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A SIMPLIFIED APPROACH TO COST-EFFECTIVE ALLOCATION OF LEARNING RESOURCES

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A Thesis

in

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ABSTRACT

MAHFUZ R. CHOUDHURY

A SIMPLIFIED APPROACH TO COST EFFECTIVE ALLOCATION OF LEARNING RESOURCES

Mathematical and Simulation models of Queueing Theory have been successfully used in industries and business organizations for cost effective allocation of their resources. Cost effective allocation of resources, requires balancing between two contradictory factors: cost of idle time of a resource, and cost of waiting time of a user. These two factors vary inversely to each other, i.e. if one increases, the other decreases.

These models can also be used in educational/training institutions for the same purpose. But these models are so sophisticated that educational administrators rarely use them in their decision making.

We have, therefore, simplified the entire process of using a mathematical queueing model to the level of the planners or administrators who are presumed to possess no formal knowledge of Queueing Theory or Operations Research.

We have produced a handy table of all the necessary queueing data which may be used for any traffic intensity in a learning/educational resource allocation problem. We have also developed a number of self-explanatory forms and procedures which may be used to calculate the traffic intensity of a given problem, and to use data from the table corresponding to this traffic intensity. Thus an administrator or planner can determine firstly the cost-effective number of learning resources necessary and secondly, the optimum value of traffic intensity. This is especially needed to maintain motivation in a self-instructional learning environment when the waiting time corresponding to the cost-effective number of learning resources seems high enough to accept.

This planning procedure has been used to solve a practical problem in a training center.

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INTRODUCTION

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RESOURCE ALLOCATION AS AN EDUCATIONAL PROBLEM

INTRODUCTION

The resource allocation sector in an educational/training system draws the attention of an educational technologist to the proper allocation of the educational resources on the basis of some criterion, e.g. cost effectiveness. The resources should not be more than required, otherwise they will remain idle for a period of time. This is undesirable since they are purchased with tax-payers' (or private) money. Education and training administrators are often asked to justify the budget allocation in this sector. Equally undesirable is the provision of insufficient resources because students (and others) may waste time. This is a potential educational issue in that the students' individual learning differences and their mental set are to be recognized by allowing them to have access to learning resources as long as they need. There should be a sufficient number of resources so that a fast learner may have a resource on demand, without waiting for another to leave and a student not mentally set to learn can come back and use a resource at any time he wants.

This thesis shows that the problem of resource allocation can be effectively analysed with the systems approach. It's methods and techniques are outlined in Ackoff and Sasieni(1968). To simplify and reduce the volume of work usually necessary to analyse a system problem like a resource allocation problem, scientists have developed a number of models which are known as operation research models. These models have been tested and successfully used over a wide variety of problems in various organizations such as the Military, the Government and the public sectors. The major

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objectives of such analysis using a systems approach are two fold. Firstly, to obtain more effective and efficient control of the operating systems, and secondly to design new systems to obtain desired goals with less expenditure of human and financial resources (Ammentorp, 1969, p.1).

These major objectives of systems analysis suggest that we should attempt to use operations research models to attain these objectives, in resource allocation for an educational/training system (cf Mitchell, 1975).

Unfortunately educational administrators do not find any simpler approach to deal with operation research models which often seem to them fairly difficult. As a result, they hardly use these models in their decision making. One area that might benefit is the provision of capital intensive self-instructional facilities. Planning such facilities is a common task of the educational technologist.

It is, therefore, one of the responsibilities of an educational technologist to assist the administrators in choosing the best model to a given problem and manipulating the model so as to derive alternative ways of achieving the objective of the problem.

An educational technologist can assist an educational administrator in this sector of resource allocation in two ways: one way is to do all the work

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of analysing himself; the other way is to develop handy tables, forms and simple procedures, so that an educational administrator can easily analyse such a problem without any formal training for this purpose. This second way is adopted in various industries and organizations, where scientists and engineers have developed tables and forms which are used to solve specific problems by the practising engineers and technologists. In either case, a simple procedure must be developed.

Before such a method could be developed, we must remember that effective analysis of any system problem requires the use of an appropriate tool/model to the specific problem concerned (Ammentorp, 1969, p. 1). With this point in mind, operations research specialists have classified all the system problems into approximately eight groups (Gillett,1976).And to deal with each class of problems, they have to develop specific models.

In order to decide which of the operations research models suits best to resource allocation problems in an educational/training system, we must know what a resource allocation problem is all about.

Queueing Theory

A resource allocation problem arises when an educational administrator wants to know how many resources (human or non-human) are necessary to permit a given set of students/trainees to successfully complete a curriculum/training program, yet keeping the total cost involved to a minimum. The resources in this case may be audiovisual equipment, laboratory equipment, helping staff, etc.

Many of these items are very costly; naturally they are found limited in number in an educational/ training institution. For this reason, it is observed that pupils have to wait often in a queue for a long time in order to use them. A long queue is usually undesirable because firstly, long queues cost money due to loss of time, especially waiting in a queue on the part of the pupils who are paid or whose earning capacity is lost (Hubbard, 1972); secondly, a long queue is psychologically unfavourable because it de-motivates pupils to learn (Redfearn, 1973). On the other hand, costly items usually should not remain idle; if they do so, then their idle period is considered to be a loss of their capacity to serve. Ideally, we might want students to spend little or no time waiting for access to educational resources. In practice money for such resources is scarce and resources restrictions produce delays.

Generally speaking, queueing problems have two identifiable as well as important key concepts: waiters and servers. Whenever man or material waits in a queue to use a resource (human or non-human) the idle entity is termed a waiter. Since resources serve the waiters they are called accordingly servers. With these two key words, one can identify a huge number of such problems in one's every day life. For example, a telephone booth where people wait in queue to use it; a cash counter of a post office, a supermarket, a ticket counter in a theaterhall, etc., where people wait in a queue to be served. On the other hand a fire fighting service represents idle resources waiting to respond instantly to a request for service.

These problems are classified as waiting line or queueing problems in Operations Research, and are analysed with a specially developed model which is well known as Queueing Theory Model. Queueing Theory falls under the general heading of stochastic or probabilistic model, because the arrival process of the waiters can be described by their probability distribution of time between successful arrivals. Queueing model can be classified into various types (Appendix A). The theoretical aspects of queueing problems may be better understood if conceptualized with three major interrelated components: input, process, and output. In the case of queueing problems in an educational/training system, the input may be the pupils or trainees arriving at a resource center to use a resource. The process is the act of service by a

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resource (e.g. video tape player) and the output is the pupils departing from the resource center after being served (or in other words, a pupil departs after he has used a resource).

In this case of self-instructional modules, random arrival of pupils to use a module is expected (Mitchell, 1976b). We can assume that arrival pattern of the pupils is completely random (though in practice this may not be so). We also can assume that whoever arrives first is served first.

Arrival Pattern

We have already identified two key concepts in a queueing system: waiters and servers. Waiters are those (human or non-human) who arrive at a center of servers (e.g. learning resources) and then wait in a queue in order to use one of the servers. Though the users (waiters) arrive at a resources center at random, yet their arrival pattern as a function of time can be described with a statistical distribution as

$$f(t) = \lambda e^{-\lambda t}, \quad t > 0$$ (cf Gue & Thomas, 1968; Taha, 1971 & Wagner, 1970)

which states that the arrival pattern follows a negative exponential distribution. The probability (P) of the number of pupils (n) arriving in an interval of time (t) can be determined with a formula of statistical distribution which is known as Poissons Law which is stated as:

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$$Pn(t) = \frac{(\lambda t)^n}{n!} \times e^{-\lambda t} \quad ; \text{for } n = 0, 1, 2, \ldots$$

where λ is the rate of arriving of the pupils (cf Kaufmann, 1968).

Service Pattern

Again the users (waiters) are permitted to use a learning resource (server) as long as they need. In other words, the servicing time of a server varies depending on the time taken by each of the users, yet experimentally it is found that the service pattern of a server can be described as a function of time, which is stated mathematically as

$$g(t) = \mu e^{-\mu t}$$ (cf. Cue & Thomas, 1968; Tana, 1971 & Wagner, 1970)

which states that service time follows a negative exponential distribution, where μ is the service rate per unit of time that the server is busy. The mean service rate is $1/\mu$.

With the two statistical distributions, one for arrival pattern and the other for service pattern, operation research specialists have developed a specific type of mathematical model, well known as M/M/S:FIFO (Appendix B). Where the first M stands for arrival time distribution as stated earlier, and the second M stands for service time distribution which is also stated earlier, S stands for the number of parallel servers (resources) available, and FIFO states the serving policy as "First in, First Out", in other words, whoever comes first is served first.

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This model is representative of resource allocation problems in any self-instructional system whether the arrival pattern is completely random, and more than one identical servers (resources) exist. It is likely to be applicable even when assumption of randomness is violated.

By manipulating this model we can calculate:

a) Loss of time on the part of a user while waiting in a queue.

b) Loss of time on the part of a resource being idle.

The objective function of a resource allocation problem in a self-instructional system is to find the optimum number of resources for which the total cost of waiting and idle time is minimum.

But the mathematical formulas given in the model M/M/S:FIFO to calculate waiting time and idle time, are very complex and difficult (Appendix B).

At this stage one might advocate the use of a simulation model. A simulation model is also difficult in the sense that it consumes considerable amounts of time on the part of the analyst as well as computer time. In both the cases, e.g. to use a mathematical model or a simulation model, one has to have proper training and enough spare time to deal with these models which often require the use of computers. Again to use a computer, one has to have proper training. Thus Wilson (1977) is one of a small number of educational technologists possessing the necessary skill. She has analysed a Bell Canada training system, in Montreal, for optimum requirements of its resources. In her study, she has used two methods, analytic and computer simulation. These approaches are time consuming. Moreover, they require the users to possess formal training. But educational administrators are rarely found to possess prerequisites, whereas they badly need quantitative data to make decisions on cost effective allocation of educational/ training resources.

The Problem

Can we develop an alternative way of solving resource allocation problems (eg. queueing problems) with respect to optimization of the cost of lost time due to a pupil waiting in a queue to use a resource, and the resource being idle for a period of time, without the user's going through all the difficult jobs of manipulating a mathematical queueing model or spending much time in running a queue simulation model in a computer? The alternative way to be developed should be reliable enough to justify the rejection of a mathematical or simulation model.

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The Operational Aspects of the Problem

I) A computer program will be developed using the mathematical formulas of a multichannel queueing model of the type M/M/S:FIFO (where first M stands for arrival pattern which follows a negative exponential distribution as a function of time; the second M states the service time pattern which follow a negative exponential distribution as a function of time; S states that there are at least more than one server serving in parellel; and FIFO states that in this queueing model, the arrivals are served in the order of their arrival, e.g. whoever comes first is served first), to produce a table of the following data corresponding to a wide range of traffic intensities:

a) Number of feasible servers under each traffic intensity.

b) Corresponding to each feasible number of servers the following data will be printed:

1) Probability that each server is busy.

2) Probability that a server is idle (the cost of idle time is proportional to this probability).

3) Queue length (waiting time of a pupil can be calculated by dividing the queue length with the arrival rate of the pupils).

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4) Total number of the pupils in the system which includes both the pupils in the queue and the pupils in service e.g. the pupils engaged in using the available resources (total time a pupil spends in the system is determined by dividing the total pupils in the system with the arrival rate of the pupils).

II) The validity of the computer program to be developed will be obtained by comparing its output data with that of Wagner who has calculated probability of a service station being busy when a station is comprised of multiple servers in parallel. He has calculated these probabilities corresponding to traffic intensities ranging from .5 to 10. The computer program is intended to produce queueing data for traffic intensities ranging from .5 to 50. Therefore, to accept the program as valid as well as its extended data, its data for the range of traffic intensities from .5 to 10 must be exactly same (at least to the third decimal) to those produced by Wagner for the same range of traffic intensities.

III) Two procedural forms may be developed, one for the calculation of traffic intensity of a specific resource allocation problem existing in a self-instructional system, and the other will use the data from the table corresponding to the calculated traffic intensity so as to determine which of the feasible number of servers (resources) will lead to minimum total cost of waiting time and idle time.

RELEVANT LITERATURE REVIEW

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APPLICATIONS OF QUEUEING THEORY TO RESOURCES ALLOCATION

Relevant literature pertaining to the development of a Simplified Approach to queueing problems, which is the subject of this thesis is scarce and seldom adequate to build a strong foundation for the proposed approach. Yet a few studies are available which are relevant at least at the beginning stage of the approach to be developed..

Edie (1954) has given a detail treatment of waiting problems arising in various man made systems ie: telephone, business, transportation, etc. Referring to a telephone system, he tries to give a simple description of a waiting problem e.g. if there is one telephone trunk and if there are a number of calls at a particular time, then one call will occupy the trunk and the other calls will wait as long as the trunk is busy. If the number of trunks is increased, the possibility of the capacity of trunks being idle for a period of time increases, which is undesirable to the telephone company because providing extra capacity is sometimes very costly.

Waiting problems, therefore, require the balancing between waiting time and excess system capacity.

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Edie's suggestion for consideration of the frequency of breakdown of a server in case of balancing a waiting problem is important in order to maintain a good service.

The important aspects of this paper are firstly that it has established the implications as well as the significance of operations research approach to waiting problems over other approaches (e.g.the method of averages) where the element of variation was always neglected. Operations research gives this element due importance and is more much reliable than those adopted formerly. Secondly, the operation research approach reveals a significant aspect of waiting problems, namely that the efficiency of co-operating channels is greater when the number of channels is increased. Here by co-operating channels is meant a group of channels in parallel serving a common stream of traffic. Referring to the telephone field, he wants to clarify this as when a long distance call is put through within an average delay of fifteen seconds, a circuit can be utilized only 15% of the time available in the busy hour, being useful only nine minutes out of sixty minutes, where as two circuits in multiple providing the same average delay of fifteen seconds, can be utilized 35% of the busy hour, being useful forty two minutes out of one hundred and twenty minutes. From this case of doubling the number of circuits, we can see that the traffic carrying capacity has been increased over four times.

Edie (1954), Wagner (1970) and other show that a very useful tool in dealing with arrival variation is the Poissons distribution which states the random pattern of arrival distribution. Whether or not an actual arriving pattern of a given waiting problem fits this theoretical random distribution can be tested by two ways: a) by plotting frequency distribution of actual observations of arrivals during each interval of time and plotting on the same paper the theoretical frequencies taken from a table of Poisson distribution, b) by a more exact method of comparison than the graphical one, namely the chi-square test. Using chi-square for the number of arrivals of each interval, the observed (actual) frequency and the theoretical frequency (from a table of Poisson distribution) are determined and a comparison is made between the two distributions as to how well they fit together, in other words as to how well the actual frequency distribution fits with the theoretical random distribution curve (Poisson distribution). The more the two distributions are close together, the more the actual distribution tends to random pattern of arrivals. This is important because most of the waiting problems are assumed to be a perfect random

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arrival pattern of distribution with a greater number of observations of arrivals.

Edie's paper is important in my research study in the following ways: 1) It shows the importance of OR in analysing a system problem such as a waiting problem; 2) it stresses the importance of balancing between waiting time and idle time of a server; 3) it suggests that we consider the frequency of breakdown of a server to maintain a good service while balancing a waiting problem; 4) it shows that when the number of servers is increased forming a group to serve a common stream of traffic in co-operation then the efficiency of the co-operating channels increases; and 5) it suggests that waiting problems in general follow a theoretical random distribution known as Poisson distribution.

Kaufmann (1968) says quite correctly that the mathematical formula to calculate queueing data for a multi-channel queueing model is very complicated, so he has shown the use of a graphical chart, from where one can calculate the values for $\mu \bar{t}_f$ (rate of service (μ) multiplied by waiting time ($\bar{t}_f$)) following the crossing points of the number of servers and the traffic intensity ($\lambda/(\mu s)$). Here λ is the rate of arrivals, μ is the rate of service, and s is the number of servers. He has shown with example how to solve a waiting problem with this chart so as to determine the optimum number of servers, for which the total cost of waiting time and idle time of the servers will be minimum.

The main drawbacks of his approach are: 1) He has used the method of average in determining the idle time of the servers, thus he has neglected the important element of a waiting problem, which is the variability (Edie, 1954, p. 6); 2) There is every possibility that one having poor mathematical aptitude will read inaccurate data from the graph, where in many cases he needs to interpolate so as to have a reading of the data he wants, (since the span between the two curves of traffic intensities are not the same the method of interpolation does not yield reliable data); 3) The factor, $\lambda/(\mu s)$ that he has used for traffic intensities indicates that the author has assumed each of the servers operates independently of the other, in such case the time one expends in the system is twice as much as one expends if the servers were operating in a single station serving a common stream of traffic (Wagner, 1970, p. 479, & Gillett, 1976. p. 470-473). Edie ((1954, p. 6) says, in this case, that there is a significant aspect of waiting problems, that is the greater efficiency of co-operating channels as the number of channels is increased. Edie has shown with examples that by only doubling the number of circuits of a telephone system, the traffic carrying capacity has been increased over four times.

The above mentioned drawbacks of Kaufmann's approach have important implications for the development of the simplified approach which is the aim of my study.

In an article Mitchell (1976) has shown the calculations of three representative queueing problems that are often found in learning resource centers. His objective in solving these problems is to show that analytical approach may be easily adopted to calculate queueing data which are very essential when the question of allocation of an optimum number of educational resources arises. Such a question is vital in planning a learning resources center, because this center usually is expected to function smoothly at minimum cost. In some of the calculations Mitchell has used the Table of Po (Plane and Kochenberger, 1972) which states the

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probability that there is no customer in the system during a particular period of time. By using the values of Po in the available analytical formulas, (Taha, 1971; Wagner, 1972) Mitchell has calculated queueing data for those problems.

In addition, Mitchell has shown a short cut approach for rapid calculations of queueing data without using any table. But he found that there is a difference between his shortcut approach and other approaches using either Po table or Redfearn's Graph of Estimation of Waiting Time. He suggests that if the cost factor is not important, his shortcut approach is advantageous over other approaches where much time is involved in the process of calculation for queueing data. Moreover, he admits that accurate calculation of queueing data needs messy calculations which often need computers. The intent of this thesis is to demonstrate that a simple procedure can be developed.

In regard to determination of an optimum number of servers, he says this is the number of servers which will produce minimum total cost per minute of service and per minute of waiting. This is a common though not necessarily universal judgement. (e.g. in time of war military training may ignore cost and minimize time of trainees).

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In another part of the article, he says that a modular or self-instruction system, produces a complex queueing system in the form of a network, which is comprised of many queues in parallel as well as sequential form. This is because a modular instruction system permits branching, self-pacing, cycling back to attain mastery of modules. He reoommends that such a system can be broken down into simpler components with available queueing models, usually a multi-channel queueing model is most suitable.

The central objective of this article of Mitchell is to develop an easier approach in solving queueing problems because queueing problems often exist in learning resource centers, but the available methods seem to be complex enough to most of the educational administrators. He found that such a method could be developed but is not accurate enough to deal with cost factor of a queueing process.

Being encouraged by this line of thinking, this research investigates the feasibility of developing a more accurate as well as simpler approach.

In another article, Mitchell (1976) studied the scope of Operations Research in planning individualized instruction. In his opinion, individualized systems of instruction have become very popular. But this has created a problem for educational managers in respect of proper management of learning resources. This is because in an individualized system of instruction, students are supposed to have free access to learning resources without undue delay. The system of learning resources should be so designed and managed that it responds to the factors: a) average time interval between successive students beginning a module; b) average time spent on a module; c) probability distributions associated with arrivals and departures; d) sequencing of modules.

Misallocation of educational resources in an individualized system of instruction creates the following problems:

a) Idle and costly facilities.

b) Queues to gain access to resources.

c) Inability of instructional material production units to cope with demands.

If systems analysis approach including operations research models, are not used, then there is every possibility that planners of these resources may provide too many instructional units which are usually very

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expensive, or may provide too few which will cause inconvenience, and discontention on the part of the users because they are unable to get the instruction when ever they want to (Mitchell, 1975, 1976). These problems can be effectively dealt with if the system is analysed with the methodology of systems analysis and operations research. Mitchell agrees that these responsibilities remain with the educational technologists.

Mitchell (1976 b) described an individualized instruction system. He has described the system to make it clear what the system is all about, so that the proper analysis of it could be feasible. He says that the system may take many forms. But it can be simply defined as the method of desynchronizing students' progress through a curriculum which is designed in such a way that each student can proceed with his own pace through a sequence of learning modules. These modules are very short in practice, may be of varying length and students might leave the instructional system upon completion of one or more modules and they may return after a random time interval. If there are more pupils arriving in a particular time interval than the number of a specific module available, then some of the pupils have to wait

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in queue, usually in the order of whoever comes first is ahead of the queue line. The opposite situation might arise when the number of pupils arriving in a particular time interval is less than the number of specific modules available. In this case some of the modules will remain idle. It was said earlier that these modules might be very costly. Mitchell, in this respect, asks a question "How can we determine the size of instruction system needed to keep both capital cost and waiting time of students within acceptable limits?".

With a linear graph he has shown the flow of students through the modules of a self-instructional system. He says that for each module, we need to know: a) number of identical modules necessary; b) time allocated or estimated for each module; c) capacity of the facility i.e. how many students can be accommodated simultaneously.

Mitchell claims that this information can be obtained by considering each module as a sub-system and this sub-system can be analysed by a queueing model in order to obtain the above data. Moreover, his method is still not simplified enough for educational administrators to use easily.

The main points we obtain from the foregoing analysis now can be summarised. A self-instructional system is composed of a number of modules. These modules are so designed that students can study them all by themselves, and whenever they wish they can study the modules, which states that the arrival pattern of the students for any module is random. Since self instructional systems aim at providing the students with a module on demand without undue delay, it is often required that there should be more than one identical module available at a particular time. The analysis further reveals that a multi-channel queueing model with random arrival process and a queueing discipline of "first come, first served" will be most suitable in analysing a self-instructional system.

There is no doubt that Mitchell's work has established the importance of systems analysis in making decisions in case of proper allocation of learning resources in a self-instructional system. Wilson (1977) has extended this work.

Wilson has used two methods, analytic and computer simulation, to analyse a learning resources center (Bell Canada Training System in Montreal) to plan the media resources requirements for this center. In her analytic approach, Wilson has used Mitchell's formula for determination of the percentage utilization (U) of the service facilities (Mitchell, 1976, p. 32), and for calculation of expected student waiting time, Wilson has used Redfearn's formula along with Redfearn's graphical model of "Mean Queueing Time" (Redfearn, 1973, p. 228). She has also used Mitchell's formula for calculation of waiting time (Mitchell, 1976b, p. 32-33) along with the Po table (Plane and Kochenberger, 1972, p. 196).

In case of computer simulation, Wilson has used a single-channel queueing simulation model (McMillan & Gonzales, 1965, p. 264).

All these approaches of Wilson seem to be difficult for educational administrators to use. We like to develop a simpler approach, so that one having no formal training in these analytic and computer simulation methods, can analyse resource allocation problems and make decisions as regards optimum allocation. Moreover, Wilson's approach needs further study because she has assumed that service facilities are working independently of each other. Where as in practice the service facilities work in co-operation resulting in greater efficiency of the system as a whole.

One especially important paper is that of Redfearn (1973). He tried to develop a short cut method of solving queueing problems which arise during the design and management of programmed learning. He stressed the importance of queueing data at the design stages of self-instructional packages so that the packages will be utilized maximally subject to the queue length of the pupils waiting to use these packages being minimum. Arguing in favour of maximum utilization of learning packages and minimum queue length, Redfearn says that these two conditions are important because if the students are to stay in a queue for a considerably long time to use these materials then they would be demotivated to learn. On the other hand, the cost of self-instructional materials may be high. For this reason, administrators want materials to be utilized to a maximum, so that idle period for these materials will be minimum. But here is the dilemma, high utilization of these materials causes considerably

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long queue, which is not desirable from the psychological aspect of learning. In this case, the educational technologist wants to balance these two factors of high utilization and low queue length. Redfearn says this can be done by developing a simplified approach, thus avoiding the difficult jobs of using a pure mathematical or a simulation model.

He has, therefore, developed a table of formulas to calculate the number of students arriving during successive weeks of a program to use self-instructional packages. For a given problem, he has shown another table which may be used to determine the peak arrivals during a period of the school day. With this information he has calculated the mean arrival rate during that period of the day. Then he has produced a table where he has compared various combinations of utilization factor (traffic intensity) and service rate in terms of the waiting time that they produce.

In the above mentioned table, the effect of various combinations of traffic intensity and service rate over waiting time has been shown, here the number of servers remain constant. For the same problem he has shown in another table the effect of various combinations of traffic intensities and number of servers over the waiting times. He has also produced a graph to calculate waiting time.

This approach developed by Redfearn is of course easier than other available approaches to queueing problems. Yet I want to develop a more simplified approach than this, because the person who wants to use this approach of Redfearn needs some sort of training. He may be confused as to what number of packages is to be selected, because Redfearn has not clearly shown how to balance between the two factors, high utilization of the available instructional packages and the low queue length. In my opinion the balancing between these factors should be made with respect to a definite criterion which in this case should be associated cost of waiting time of a pupil/trainee and that of idle time of a server (instructional package). If the pupil is not paid, then perhaps his lost earning capacity should be considered, or at least his time.

In one table Redfearn has shown the effect of various combinations of traffic intensities and service rates (corresponding to the same number of server/servers) over the waiting time. In this case, too, I think, balancing should be made with respect to the associated cost of waiting time of a pupil and idle time of a server.

Redfearn admits that his approach will not give a correct solution but will give an approximate idea of the behaviour of a queueing problem at the beginning stage.

I suspect that errors would arise if one reads wrong data from his graph to determine queue length. This problem would arise if the user has low mathematical aptitude; and the method of interpolation which is required to read data does not always produce correct data, due mainly to unequal span between two curves of traffic intensities.

Because of the above-mentioned drawbacks in Redfearn's approach, I feel it necessary to develop a more simplified approach for those educational administrators who are afraid of an analytical approach, though they are badly in need of quantitative data in their decision making. Yet the approach to be developed should be accurate enough to reject his approach. But I admit that his approach has induced in me a sense of significance of such an approach and thus encouraged me to seek a more simplified approach.

DEVELOPMENT OF THE APPROACH - A FLOW CHART

[redacted]

DEVELOPMENT OF THE APPROACH

The literature review shows that there is an urgent need for a simple technique to deal with the ever increasing problem of planning and managing instructional facilities in today's educational systems. This requirement leads to the development of a self-instructional system which is characterized by Mitchell (1976b, p. 3,6) as the method of desynchronizing students' progress through a curriculum designed in such a way that each student can proceed with his own pace through a sequence of learning modules. These are very short (though they may be of varying length) and students might leave the instructional facility upon completion of one or more modules and they may return after a random time interval. In most cases students learn these modules all by themselves through the interactions with audio-visual equipment and/or printed materials through which the instructions are offered. Such instructions may be a t.v. program, a computer assisted instruction, a slide-tape instruction, etc.

From the above definition of a self-instructional system, it is clear that the foundation of such a system is the aspect of rationality. Analysis of the literature reveals that a self-instructional system is composed of a number of self-instructional modules (lessons) forming a network (Mitchell, 1976_b, p. 4-5) the number of each identical module should be sufficient to meet the demand of the students without undue delay. But if the students are permitted to arrive at random, two things may happen:

a) In some time interval, the number of students is less than the capacity of a subsystem of identical modules, naturally resulting in idling of excess systems capacity which, because not used, is considered to be a cost loss. Such a cost loss is undesirable since providing these modules (eg: if each requires a VTR) may some time be very expensive.

b) In some time interval, the number of students arriving is more than the capacity of a subsystem of identical modules. Due to this some of the students will have to wait in a queue. Some times such waiting time is too long and violates the definition of a self-instructional system. This is because firstly a long queue demotivates a student to learn (Redfearn, 1973, p. 1), and secondly, waiting time of a student is considered to be a cost loss when a student is paid in an industrial/ business training program; if a student is not paid, then his earning capacity may be considered (Hubbard, et al., 1972, p. 52), or his opportunity cost i.e. the lost opportunity to engage in some other activity) may be estimated. These two problems arising in a self-instructional system are due to the variability in students' arrival pattern and to the variability in learning time. Operations research gives due importance to this important element of variability in a queueing problem and thus proves its superiority as well as reliability over other formally used approaches such as the method of average (Edie, 1954, p. 6-9).

Those two problems demand that each subsystem must be balanced between the waiting time of the users (the students) and the cost of excess system capacity. Now the question arises, "By what criteria, and how can a system be balanced?". This question is well treated under the systems approach techniques including operations research. Operations research models are specially designed to analyse and then control a system so that the system reaches to its goal with its minimum involvement in costs.

So one criteria by which a system can be balanced is the minimum cost; and operations research models of systems approach techniques can help to deal with balancing a system. Mitchell (1976a) has given a logical as well as practicable answer to the question as to how to determine the optimum number of modules which will result in minimum system cost. He suggests that the number of instructional modules which will produce minimum total cost per minute of service and per minute of waiting can be accepted.

Now going back to the element of variability in the arrival process of a queueing/waiting problem, we must know what it looks like when the frequencies of the arrivals during the time intervals of the hours of the day when a system is in operation are plotted so that we can describe an arrival process of a queueing problem. If greater number of observations are taken, the frequency distribution of the actual observations will greatly follow a theoretical random frequency distribution curve known as poisson distribution (Edie, 1954, p. 14-15).

Whether or not a given arrival process follows the theoretical random distribution can be tested by plotting two frequency curves in the same graph paper - one for the actual frequencies for the arrival during the time intervals, and the other for the theoretical frequencies (from the table of poisson distributions) for the same arrivals during the same time intervals. Thus we can visualize how well they fit with each other. In this case we will see that there is a difference between the two curves at the beginning of the congestion, the two frequency distributions can be tested with a more accurate statistical test known as Chi-square test of fitness, Even when the difference between the two curves is fairly large, the Chi-square test result will show whether (even though we see a difference between them at the beginning of the congestion) the actual frequency distribution fits well with the poisson

[redacted]

distribution of a chance factor $P \leq .05$ (Kaufmann, 1968, p. 56 - 57 & Edie, 1954, p. 15). Therefore, with greater number of observations of the arrivals of a queueing/waiting problem, the arrival process is expected to follow a theoretical frequency distribution of a perfectly random arrival process (Edie, 1954, p. 14 - 15).

We can accurately assume (for simplifying the approach that we like to develop) that the arrival process of any waiting problem existing in self-instructional systems will obey the Poisson distribution and can be predicted by the Poisson Law of distribution (Kaufmann, 1968, p. 56-57):

$$P_n(t) = \frac{\lambda t}{n!} \cdot e^{-\lambda t}$$

which states the probability (P) of N number of arrivals in a time interval (t) is equal to the right hand factor where λ is the rate of arrival per unit of time and $n!$ is the factorial of n number of arrivals.

For generalization, the random arrival pattern as a function of time can be described with a statistical distribution as $f(t) = \lambda e^{-\lambda t}$, $t > 0$ which states that the random arrival pattern follows a negative exponential distribution.

We cannot overlook the variability existing in the servicing process (i.e. the instructional communications in, or studying of, a module). Because the pattern of departure from a learning resources center depends greatly on holding pattern of the servers (learning

[redacted]

resources) by the students, and the queue length is also affected with variable service pattern. Variability exists in students' holding time/servicing time due to their difference in their ability to learn, which has been duly recognized in the definition of a self-instructional system in that they are permitted to learn the modules at their own pace. So students' holding time/servicing time can also be described as a function of time with a statistical distribution which can be expressed mathematically as

$$g(t) = \mu e^{-\mu t}$$

which states that service time follows a negative exponential distribution, where. is the rate of service per unit of time. (Gue & Thomas, 1968; Wagner, 1970; Taha, 1971).

We can assume that the queue for any subsystem of modules should form a single line. This is because the efficiency of co-operating channels is greater when the number of channels is increased (Edie,.1965, p. 6; Gillett, 1976, p. 469). The term co-operating channels is meant to denote a group of channels in parallel serving a common stream of traffic, where the arrivals make a queue in order of their arrival (i.e. whoever comes first will be served first).

We can justify the adoption of a multichannel queueing model of the type M/M/S:FIFO. (Wagner, 1970,).

[redacted]

The first M stands for negative exponential distribution of arrivals; the second M stands for negative exponential distribution of service time; S stands for the number of servers being greater than one; and FIFO states that there is a single line of queue and the arrivals get the access to a subsystem of identical modules in the order of their arrival, that is whoever comes first is entitled to have service first.

The mathematical formulas to calculate queueing data are available (Appendix B). With these formulas, we have developed a computer program (Appendix C) to produce a table of queueing data corresponding to a range of traffic intensitites (λ/μ) from .05 to 50.0 with an increment of 0.005. To give the readers an easy understanding about the design strategy of the computer program, we have produced a flow diagram of it (Appendix C).

In planning and managing instructional facilities, these questions arise as to how many servers to select and how to select them.

Now as regards how one can use the table, we can simply state this as:

For any given queueing/waiting problem, there is an average rate of arrivals; and there is an average rate of service. The quotient of the average rate of arrivals (λ) by the average service rate (μ) is the traffic intensity.

(RHO) of the problem. Now going to the table, and corresponding to this RHO you can have the feasible number of servers (S), and then corresponding to these S you can have the probability of these servers being busy (BP), the probability of these servers being idle (IP), length of queue (QL), and the total number of arrivals in the subsystem (TNS).

The answer to "how many" is clearly defined by the objective function of a resource allocation problem in a self-functional system (stated earlier) which states that the number of servers (S) for which the combined cost of waiting time and idling time is minimum is to be selected.

Now the answer to "how to select them" can be stated simply as: calculate the combined cost of waiting time and idling time corresponding to the feasible number of S (which are taken from the table) corresponding to the calculated RHO. Cost of waiting time and cost of idling time can be calculated as follows:

a) cost of waiting time (C_{WT}) = waiting time (WT) x Cost of wages per arrival per hr. (C_W)

b) cost of idling time (C_{IT}) = Probability of idle period (IP) x Cost of providing service per hr. (C_S)

$$= IP \times C_S$$

[redacted]

At this stage we see that the use of the table of queueing data is fairly easy. Then considering the persons to use this table with no or little mathematical background, we have developed the following forms:

a) Form A for data collection.

b) Form B for calculation of traffic intensity.

c) Form C for decision making as regards:

I. The optimum number of servers/resources to select.

II. The optimum RHO.

d) An algorithmic job aid to guide the user.

The provision for determination of optimum RHO in Form C is very important because waiting time for the selected S and calculated RHO may be long enough to demotivate the students to learn (Redfearn, 1973, p. 1). Since waiting time is proportional to RHO, we may decrease the value of the calculated RHO, so as to decrease the waiting time. This can be done as: going to the table of queueing data again, corresponding to the same selected number of servers (optimum number of servers), look for the values of traffic intensity (RHO) lower than calculated RHO, and calculate the combined cost of waiting time and idling time against each lower value of RHO. Now look for

[redacted]

the value of the new RHO (lower than that calculated) which yields the lower value of waiting time as desired.

An opposite situation may also arise where queue length corresponding to the optimal number of servers (S) selected is too low. We can see from the table that queue length is inversely proportional to the probability of idle time (IP) of the servers, and vis-a-vis. So when the queue length is too low, the IP is considerably high. High IP may sometimes costs much. In this case we look for higher values of RHO corresponding to the same S selected. We then select the optimal RHO which leads to the higher waiting time as desired.

For implication of the optimum RHO when it is lower than the given calculated one, either the arrival rate (λ) is decreased or the service rate (μ) is increased proportionally and in the other case when optimum RHO is higher than the given/calculated one, either λ is increased or μ is decreased proportionally.

The design aspects of the forms can be described as: A self-instructional system is comprised of a number of lessons which can be grouped according to the type of media (M), through which the lessons are to be offered. Suppose there are M_n types of media, where $n = 1, 2, \ldots n$ and there are LG_K groups of lessons, where LG stands for lesson group, K stands for the number of groups, $K = 1, 2 \ldots K$ I_{LG_K} states the number of lessons in lesson group number K, where $I = 1, 2 \ldots I$

[redacted]

Therefore the number of lessons of a self instructional program to be processed by media type M_1 is equal to I_{LG_1}. If there are N number of students in the program length L hrs., then total population (PT) to be served by M_1 is equal to λ N x I_{LG_1}. The population (P), therefore, arriving per hr. for M_1 is equal to N x I_{LG_1}/L or

The total time (T_{M_1}) taken by N x I_{LG_1} population for media M_1 is the summation of time taken by each student for each lesson. $T_{M_1} = \sum_{s=1}^{I} \sum_{l=1}^{J} t_{sl}$. s stands for student numbering from 1 to I, and l stands for lesson numbering from 1 to J. t is the time taken by a student s for a lesson l.

The average time (T_{AM_1}) taken by each population is equal to T_{M_1}/ N x I_{LG_1}.

The number of population that can be processed or served per unit time by M_1 is equal to $1/T_{AM_1}$ or U.

Therefore the traffic intensity (RHO) is equal to

$$\frac{\lambda \text{ population/hr.}}{\mu \text{ population/hr.}} = \frac{\lambda}{\mu} \qquad \text{no dimension.}$$

Wages per student per hr (C_W) can be determined from the actual payment, or if they are not paid their earning capacity in terms of money is estimated.

[redacted]

Cost of service by each type of media/resource per hr. (C_S) is the summation of the following costs:

a) Fixed Cost (C_F) per hr. = Hardware Cost/life in hrs.

+ Software Cost/life in hr.

b) Operating cost (C_{OP}) per hr. = Cost of Electricity/hr

+ Cost of Operator/hr.

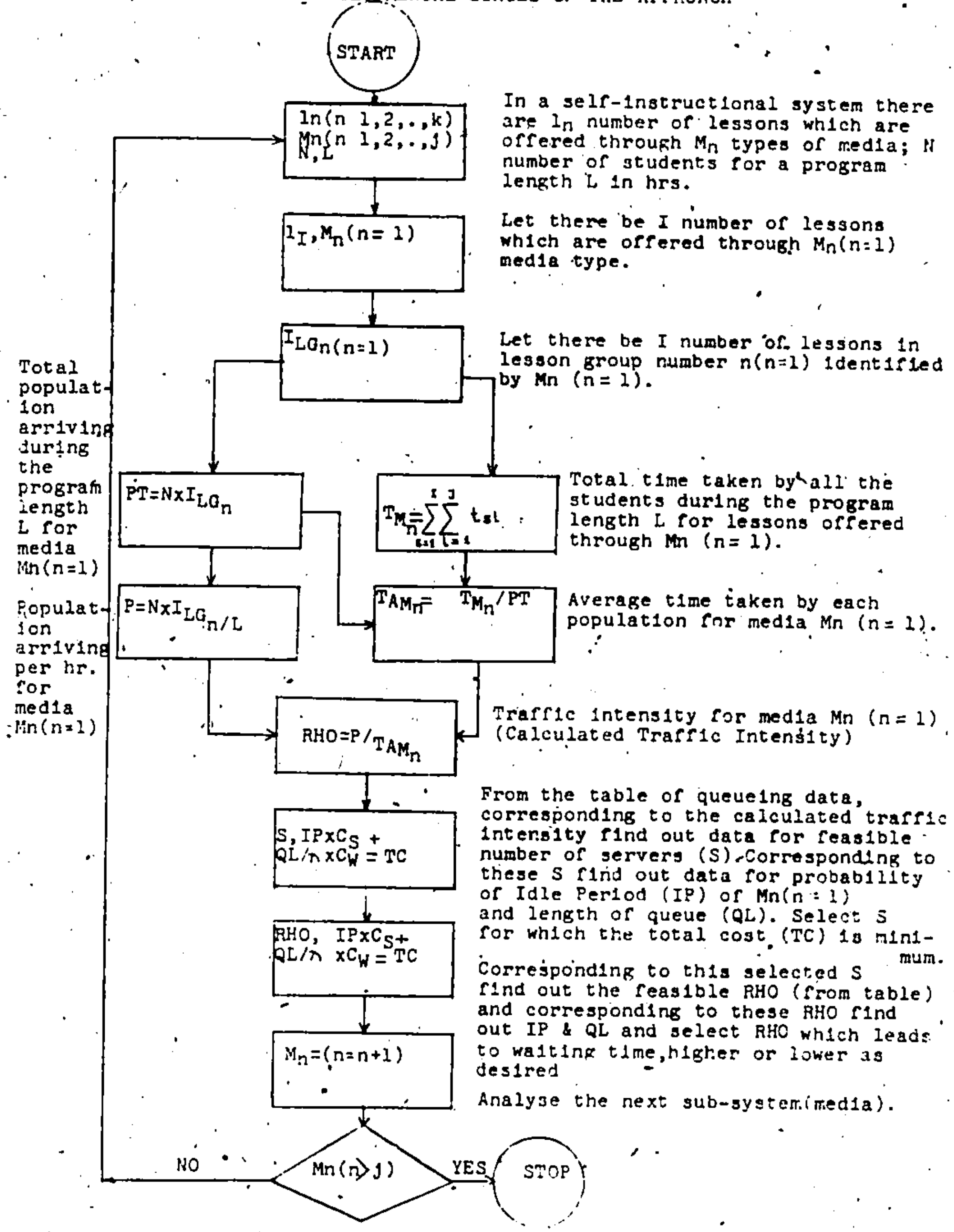
c) Maintenance cost (C_M) per hr. = Cost of spare parts/hr

+ Cost of repairman/hr.

The forms are self-explanatory, and they have been designed for analyzing an operating (existing) system as well as a new system which will be either an expansion of the existing one or an improved one based on the analysis of the operating system.

The development of the approach can be described in a flow diagram which might be easier to have quick understanding of the developmental stages of the approach.

A FLOW DIAGRAM OF THE DEVELOPMENTAL STAGES OF THE APPROACH



USER'S MANUAL

OF

PLANNING FACILITIES USING THE SIMPLIFIED APPROACH

[redacted]

STEPS TO FOLLOW TO DETERMINE COST EFFECTIVE NUMBER OF LEARNING RESOURCES (MEDIA) AND ITS CORRESPONDING OPTIMUM TRAFFIC INTENSITY:

1. Complete FORM AA to determine which of the lessons are being offered by which of the available learning resources.

2. Complete FORM AB to determine average time needed per student per lesson per media (ie: average serving time of a resource).

3. Put the information obtained from FORM AA & FORM AB into FORM A, and Complete FORM A. (This will then contain all the data for all the available learning resources.)

4. With the information from FORM A, complete FORM B for one of the available media, to calculate traffic intensity (RHO) for this particular media (learning resource).

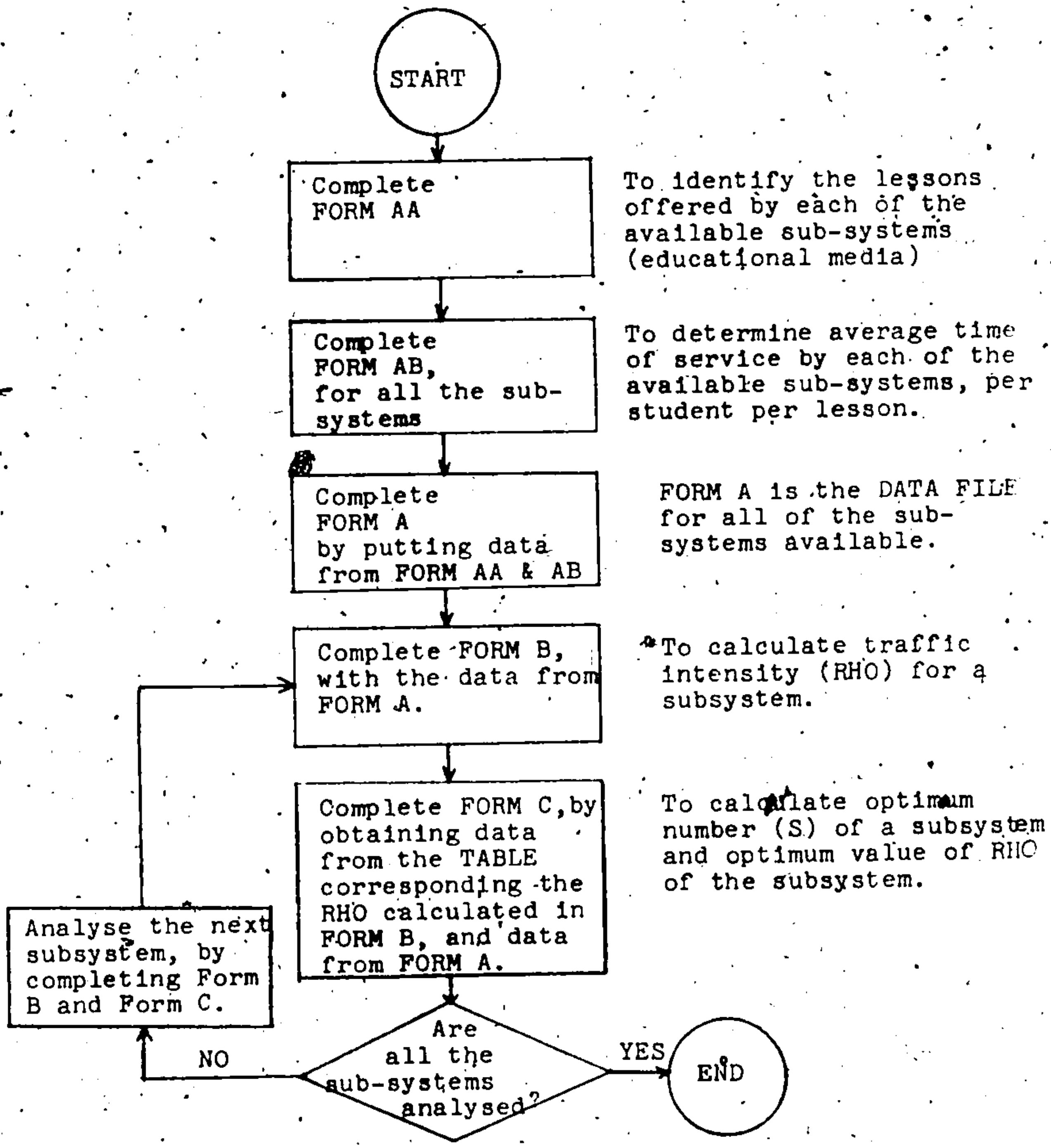
5. Obtain queueing data (as required in FORM C) from the table corresponding to the traffic intensity calculated in FORM B. Put these table data into FORM C.

6. Enter data (information) from FORM A into FORM C. Determine: a) cost of effective number of this particular learning resource (media necessary).

b) Optimum value of traffic intensity corresponding the cost optimal number of the particular learning resources selected.

7. Repeat steps 4,5 and 6 for each of the available learning resources (media).

THE APPROACH IN A FLOW CHART



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FORM AA: OPERATING/NEW SYSTEM

	TYPES OF LEARNING RESOURCES AVAILABLE							
Special No. of lessons in the program								
Total No. of lessons to be offered by each type of learning resources (I_{LG})								

[redacted] **POOR PRINT**

FORM AB

SUB-SYSTEM: ______________ OPERATING/NEW/SYSTEM

STUDENTS	TIME TAKEN BY STUDENTS FOR LESSONS																TOTAL TIME TAKEN BY EACH STUDENT FOR ALL THE LESSONS (T_A)
Total Time Taken by all Students for each lesson (T_{Mi})																	ΣT_A = ____ $T_M = \Sigma T_{Mi}$ = ____
Average Time Per Student Per Lesson (T_B) = T_{Mi}/N																	$T_M = \Sigma T_A$ = ____ $T_M^* = (\Sigma T_B) \cdot N$ = ____

N = Number of students in the program

TOTAL TIME TAKEN BY ALL STUDENTS FOR ALL LESSONS (T_M) = ______________

AVERAGE TIME OF SERVICE (T_{AM}) PER STUDENT PER LESSON = T_M/PT =

PT = (number of students) x (number of lessons) = ______

= ______________ = ______________

* NOTE: T_M may be calculated in either way depending on the availability of data.

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POOR PRINT

FORM A

FORM FOR DATA COLLECTION

Name of the Institution ________	Name of the Institution ________
OPERATING SYSTEM	NEW SYSTEM
Program length in days (PL) =	Program length in days (PL) =
Study hrs. per day (SH) =	Study hrs. per day (SH) =
Program length in hrs. (L) = PL x SH = ______ = ______	Program length in hrs. (L) = PL x SH = ______ = ______
Number of pupils in the program (N) = ______	Number of pupils in the program (N) = ______

Operating system

Types of learning resources (subsystems): to be used	Number Available
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

New system

Types of learning resources (subsystems): to be used	Number Available
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

Operating system

Number of lessons offered through each learning resource per pupil (using Form AA)

Types of learning resources:	Number of lessons (I_{LG})
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

New system

Number of lessons offered through each learning resource per pupil (using Form AA)

Types of learning resources:	Number of Lessons (I_{LG})
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

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POOR PRINT

OPERATING SYSTEM

Average time of service for each learning resource (T_{AM}), (using Form AB)

Types of learning resources	: T_{AM}
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

Wages (actual or estimated) per pupil per hr. (C_W) ______

Fixed cost of each type of learning resources:

Type	Cost of hardware Life in hr.	Cost of software Life in hr.	Fixed Cost per hr. (C_F)
a) ____	: ______	+ ______	= ______
b) ____	: ______	+ ______	= ______
c) ____	: ______	+ ______	= ______
d) ____	: ______	+ ______	= ______
e) ____	: ______	+ ______	= ______
f) ____	: ______	+ ______	= ______
g) ____	: ______	+ ______	= ______
h) ____	: ______	+ ______	= ______
i) ____	: ______	+ ______	= ______
j) ____	: ______	+ ______	= ______

NEW SYSTEM

Average time of service for each learning resource (T_{AM}), (using Form AB)

Types of learning resources	: T_{AM}
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

Wages (actual or estimated) per pupil per hr. (C_W) ______

Fixed cost of each type of learning resources:

Type	Cost of hardware Life in hr.	Cost of Software Life in hr.	Fixed Cost per hr. (C_F)
a) ____	: ______	+ ______	= ______
b) ____	: ______	+ ______	= ______
c) ____	: ______	+ ______	= ______
d) ____	: ______	+ ______	= ______
e) ____	: ______	+ ______	= ______
f) ____	: ______	+ ______	= ______
g) ____	: ______	+ ______	= ______
h) ____	: ______	+ ______	= ______
i) ____	: ______	+ ______	= ______
j) ____	: ______	+ ______	= ______

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POOR PRINT

OPERATING SYSTEM

Operating Cost of each type of learning resources

Type	Operating Cost per hr. (C_{OP})
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

Maintenance Cost of each type of learning resources

Type	Maintenance Cost per hr. (C_M)
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

NEW SYSTEM

Operating Cost of each type of learning resources

Type	Operating cost per hr. (C_{OP})
a) ______	: ______
a) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

Maintenance Cost of each type of learning resources

Type	Maintenance Cost per hr. (C_M)
a) ______	: ______
b) ______	: ______
c) ______	: ______
d) ______	: ______
e) ______	: ______
f) ______	: ______
g) ______	: ______
h) ______	: ______
i) ______	: ______
j) ______	: ______

[redacted] [POOR PRINT]

OPERATING SYSTEM

Cost of service for each type of learning resources (C_S) per hour (actual/estimated).

Type	: C_F		C_{OP}		C_M		C_S
a) ______	: __	+	____	+	__	=	__
b) ______	: __	+	____	+	__	=	__
c) ______	: __	+	____	+	__	=	__
d) ______	: __	+	____	+	__	=	__
e) ______	: __	+	____	+	__	=	__
f) ______	: __	+	____	+	__	=	__
g) ______	: __	+	____	+	__	=	__
h) ______	: __	+	____	+	__	=	__
i) ______	: __	+	____	+	__	=	__
j) ______	: __	+	____	+	__	=	__

NEW SYSTEM

Cost of service for each type of learning resources (C_S) per hour (actual/estimated).

Type	: C_F		C_{OP}		C_M		C_S
a) ______	: __	+	____	+	__	=	__
b) ______	: __	+	____	+	__	=	__
c) ______	: __	+	____	+	__	=	__
d) ______	: __	+	____	+	__	=	__
e) ______	: __	+	____	+	__	=	__
f) ______	: __	+	____	+	__	=	__
g) ______	: __	+	____	+	__	=	__
h) ______	: __	+	____	+	__	=	__
i) ______	: __	+	____	+	__	=	__
j) ______	: __	+	____	+	__	=	__

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POOR PRINT

FORM B

(CALCULATION OF TRAFFIC INTENSITY (RHO), USING FORM A)
SUBSYSTEM (IE: NAME OF THE LEARNING RESOURCE): ______________

OPERATING SYSTEM		NEW SYSTEM	
Program length in hrs. (L)	= ______	Program length in hrs. (L)	= ______
Number of pupils in the system (N)	= ______	Number of pupils in the system (N)	= ______
Number of lessons offered in the sub-system (I_{LG})	= ______	Number of lessons offered in the sub-system (I_{LG})	= ______
Total population (PT) N x I_{LG}	= ______ = ______	Total population (PT) N x I_{LG}	= ______ = ______
Population arriving per hr. (P) = PT/L	= λ = ______ = ______	Population arriving per hr. (P) = PT/L	= λ = ______ = ______
Average time of service for the sub-system (T_{AM}) in hr.	= ______	Average time of service for the sub-system (T_{AM}) in hr.	= ______
Rate of service (ie: the population that can be served by the subsystem per hr), $\mu = 1/T_{AM}$	= ______ = ______	Rate of service (ie: the population that can be served by the subsystem per hr), $\mu = 1/T_{AM}$	= ______ = ______
Traffic intensity (RHO) $P \times \frac{1}{T_{AM}}$ or λ/μ	= ______ = ______	Traffic intensity (RHO) $P \times \frac{1}{T_{AM}}$ or λ/μ	= ______ = ______

[redacted]

POOR PRINT

FORM C (FOR COST ANALYSIS AND DECISION MAKING)

SUB-SYSTEM: ______________

	OPERATING SYSTEM										NEW SYSTEM									
	Wages (Actual or estimated) per student per hour (C_W)= ______										Wages (Actual or estimated) per student per hour (C_W)= ______									
	Cost of providing service per resource per hour (C_S)= ______										Cost of providing service per resource per hour (C_S)= ______									
	Arrival rate (λ) per hour= ______										Arrival rate (λ) per hour= ______									
	Data from table for calculated traffic intensity (RHO) = ______										Data from table for calculated traffic intensity (RHO) = ______									
	Traffic Intensity	Number of Servers	Probability of Idle Time	Queue Length per hr	Waiting Time in hrs	Total Population in The System per hr.	Total Time per population in the System in hrs	Cost of Idle Time per hr. A	Cost of Waiting Time per hr. B	Total Cost per hr. TC	Traffic Intensity	Number of Servers	Probability of Idle Time	Queue Length per hr.	Waiting Time in hrs	Total Population In The System per hr.	Total Time Per population In The System in hrs.	Cost of Idle Time per hr. A	Cost of Waiting Time per hr. B	Total Cost per hr. TC
	RHO	S	IP	QL	WT = QL/λ	TNS	TNS/λ	IP x C_S	WT x C_W	A + B	RHO	S	IP	QL	WT = QL/λ	TNS	TNS/λ	IP x C_S	WT x C_W	A + B
STAGE I																				
STAGE 2																				

STAGE I: Cost against different S corresponding to the same RHO as calculated. Select S that leads to minimum total cost.

STAGE 2: Cost against lower or higher values of RHO (calculated)* corresponding to the S's selected in Stage I. Select RHO that leads to acceptable waiting time.

*Calculation of Stage 2 is necessary when the decision maker finds that queue length corresponding to the optimal servers (S) selected in Stage I [illegible] students; in this case, he looks for the lower value of RHO, or, [illegible] increased by looking for higher values of RHO in order to increase the percentage utilization of the learning resources.

[redacted]

A TABLE

OF

QUEUEING DATA FOR A MULTI CHANNEL QUEUEING MODEL

[redacted] POOR PRINT

MEANING OF THE SYMBOLS USED IN THE TABLE OF QUEUEING DATA

RHO	Traffic intensity $= \dfrac{\text{Rate of Arrivals}}{\text{Rate of Service}}$
S	Number of Servers feasible.
BP	Busy P ie: the probability that all the available servers or channels are busy. (the probability that there will be a delay).
IP	Idle P ie: the probability that all the available servers or channels are idle.
QL	Expected length of a queue.
TNS	Expected total customers (human or non-human) in a queueing system.

[redacted] **POOR PRINT**

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RF	IF	QI	TQ
.0500	1	.0500	.9500	.0026	[illegible]
.1000	1	.1000	.9000	.0111	.1111
.1500	1	.1500	.8500	.0265	.1765
.2000	1	.2000	.8000	.0500	.2500
.2000	2	.0182	.9818	.0020	.2020
.2500	1	.2500	.7500	.0833	.3333
.2500	2	.0278	.9722	.0040	.2540
.3000	1	.3000	.7000	.1286	.4286
.3000	2	.0391	.9609	.0069	.3069
.3500	1	.3500	.6500	.1885	.5385
.3500	2	.0521	.9479	.0111	.3611
.4000	1	.4000	.6000	.2667	.6667
.4000	2	.0667	.9333	.0167	.4167
.4000	3	.0082	.9918	.0013	.4013
.4500	1	.4500	.5500	.3682	.8182
.4500	2	.0827	.9173	.0240	.474[illegible]
.4500	3	.0114	.9886	.0020	.45[illegible]
.5000	1	.5000	.5000	.5000	1.0000
.5000	2	.1000	.9000	.0333	.533[illegible]
.5000	3	.0152	.9848	.0030	.5030
.5500	1	.5500	.4500	.6722	1.2[illegible]
.5500	2	.1186	.8814	.0450	.5[illegible]
.5500	3	.0196	.9804	.0044	.5[illegible]
.6000	1	.6000	.4000	.9000	1.5000
.6000	2	.1385	.8615	.0593	.65[illegible]
.6000	3	.0247	.9753	.0062	.606[illegible]
.6500	1	.6500	.3500	1.2071	1.857[illegible]
.6500	2	.1594	.8406	.0768	.72[illegible]
.6500	3	.0304	.9696	.0084	.65[illegible]
.7000	1	.7000	.3000	1.6333	2.3333
.7000	2	.1815	.8185	.0977	[illegible]
.7000	3	.0369	.9631	.0112	.711[illegible]
.7000	4	.0060	.9940	.0013	.7013
.7500	1	.7500	.2500	2.2500	3.0000
.7500	2	.2045	.7955	.1227	.87[illegible]
.7500	3	.0441	.9559	.0147	.7647
.7500	4	.0077	.9923	.0018	.751[illegible]
.8000	1	.8000	.2000	3.2000	4.0000
.8000	2	.2286	.7714	.1524	.952[illegible]
.8000	3	.0520	.9480	.0189	.8189
.8000	4	.0096	.9904	.0024	.802[illegible]
.8500	1	.8500	.1500	4.8167	5.6667
.8500	2	.2535	.7465	.1874	1.0374
.8500	3	.0607	.9393	.0240	.8740
.8500	4	.0118	.9882	.0032	.8532
.9000	1	.9000	.1000	8.1000	9.0000
.9000	2	.2793	.7207	.2285	1.1285
.9000	3	.0700	.9300	.0300	.9300
.9000	4	.0143	.9857	.0042	.9042
.9500	1	.9500	.0500	18.0500	19.0000
.9500	2	.3059	.6941	.2768	1.2268
.9500	3	.0801	.9199	.0371	.9871
.9500	4	.0172	.9828	.0054	.9554
1.0000	2	.3333	.6667	.3333	1.3333

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POOR PRINT

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
1.0000	3	.0909	.9091	.0455	1.0455
1.0000	4	.0204	.9796	.0068	1.0068
1.0500	2	.3615	.6385	.3995	1.4495
1.0500	3	.1024	.8976	.0552	1.1052
1.0500	4	.0240	.9760	.0085	1.0585
1.0500	5	.0047	.9953	.0013	1.051[illegible]
1.1000	2	.3903	.6097	.4771	1.5771
1.1000	3	.1146	.8854	.0664	1.1664
1.1000	4	.0279	.9721	.0106	1.110[illegible]
1.1000	5	.0057	.9943	.0016	1.1016
1.1500	2	.4198	.5802	.5680	1.7180
1.1500	3	.1276	.8724	.0793	1.2293
1.1500	4	.0323	.9677	.0130	1.1630
1.1500	5	.0069	.9931	.0021	1.1521
1.2000	2	.4500	.5500	.6750	1.8750
1.2000	3	.1412	.8588	.0941	1.2941
1.2000	4	.0370	.9630	.0159	1.2159
1.2000	5	.0082	.9918	.0026	1.2026
1.2500	2	.4808	.5192	.8013	2.0513
1.2500	3	.1555	.8445	.1111	1.3611
1.2500	4	.0422	.9578	.0192	1.2692
1.2500	5	.0097	.9903	.0032	1.2532
1.3000	2	.5121	.4879	.9511	2.2511
1.3000	3	.1704	.8296	.1303	1.4303
1.3000	4	.0478	.9522	.0230	1.3230
1.3000	5	.0114	.9886	.0040	1.3040
1.3500	2	.5440	.4560	1.1299	2.4299
1.3500	3	.1861	.8139	.1522	1.5022
1.3500	4	.0538	.9462	.0274	1.37[illegible]
1.3500	5	.0133	.9867	.0049	1.3549
1.4000	2	.5765	.4235	1.3451	2.7451
1.4000	3	.2024	.7976	.1771	1.5771
1.4000	4	.0603	.9397	.0325	1.4325
1.4000	5	.0153	.9847	.0060	1.4060
1.4000	6	.0034	.9966	.0010	1.4010
1.4500	2	.6094	.3906	1.6067	3.0567
1.4500	3	.2193	.7807	.2051	1.6551
1.4500	4	.0672	.9328	.0382	1.4882
1.4500	5	.0176	.9824	.0072	1.4572
1.4500	6	.0040	.9960	.0013	1.451[illegible]
1.5000	2	.6429	.3571	1.9286	3.4286
1.5000	3	.2368	.7632	.2368	1.7368
1.5000	4	.0746	.9254	.0448	1.5448
1.5000	5	.0201	.9799	.0086	1.5086
1.5000	6	.0047	.9953	.0016	1.5016
1.5500	2	.6768	.3232	2.3311	3.8811
1.5500	3	.2550	.7450	.2726	1.8226
1.5500	4	.0824	.9176	.0521	1.6021
1.5500	5	.0229	.9771	.0103	1.5603
1.5500	6	.0055	.9945	.0019	1.5519
1.6000	2	.7111	.2889	2.8444	4.4444
1.6000	3	.2738	.7262	.3129	1.9129
1.6000	4	.0907	.9093	.0605	1.6605
1.6000	5	.0259	.9741	.0122	1.6122

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POOR PRINT

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BF	TF	QL	TOS
1.6000	6	.0064	.9936	.0023	1.602[illegible]
1.6500	2	.7459	.2541	3.5163	5.166[illegible]
1.6500	3	.2932	.7068	.3583	2.008[illegible]
1.6500	4	.0995	.9005	.0698	1.7198
1.6500	5	.0291	.9709	.0144	1.6644
1.6500	6	.0074	.9926	.0028	1.6528
1.7000	2	.7811	.2189	4.4261	6.1261
1.7000	3	.3131	.6869	.4095	2.1095
1.7000	4	.1087	.8913	.0803	1.780[illegible]
1.7000	5	.0326	.9674	.0168	1.7168
1.7000	6	.0085	.9915	.0034	1.7034
1.7500	2	.8167	.1833	5.7167	7.4667
1.7500	3	.3337	.6663	.4671	2.2171
1.7500	4	.1184	.8816	.0921	1.8421
1.7500	5	.0364	.9636	.0196	1.7696
1.7500	6	.0098	.9902	.0040	1.7540
1.8000	2	.8526	.1474	7.6737	9.4737
1.8000	3	.3547	.6453	.5321	2.3321
1.8000	4	.1285	.8715	.1052	1.905[illegible]
1.8000	5	.0405	.9595	.0228	1.8228
1.8000	6	.0111	.9889	.0048	1.8048
1.8500	2	.8890	.1110	10.9639	12.8139
1.8500	3	.3764	.6236	.6055	2.4555
1.8500	4	.1392	.8608	.1198	1.9698
1.8500	5	.0448	.9552	.0263	1.8763
1.8500	6	.0126	.9874	.0056	1.8556
1.8500	7	.0035	.9965	.0011	1.8511
1.9000	2	.9256	.0744	17.587[illegible]	19.487[illegible]
1.9000	3	.3985	.6015	.6884	2.5884
1.9000	4	.1503	.8497	.1360	2.0360
1.9000	5	.0495	.9505	.0303	1.930[illegible]
1.9000	6	.0143	.9857	.0066	1.9066
1.9000	7	.0036	.9964	.0014	1.901[illegible]
1.9500	2	.9627	.0373	37.5437	39.4937
1.9500	3	.4212	.5788	.7823	2.7323
1.9500	4	.1619	.8381	.1540	2.1040
1.9500	5	.0544	.9456	.0348	1.9848
1.9500	6	.0161	.9839	.0077	1.9577
1.9500	7	.0042	.9958	.0016	1.9516
2.0000	3	.4444	.5556	.8889	2.8889
2.0000	4	.1739	.8261	.1739	2.1739
2.0000	5	.0597	.9403	.0398	2.0398
2.0000	6	.0180	.9820	.0090	2.0090
2.0000	7	.0048	.9952	.0019	2.0019
2.0500	3	.4681	.5319	1.0102	[illegible]
2.0500	4	.1864	.8136	.1960	2.2460
2.0500	5	.0653	.9347	.0454	2.0954
2.0500	6	.0201	.9799	.0104	2.0604
2.0500	7	.0055	.9945	.0023	2.05[illegible]
2.1000	3	.4923	.5077	1.1488	3.2488
2.1000	4	.1994	.8006	.2204	2.3204
2.1000	5	.0712	.9288	.0515	2.1515
2.1000	6	.0224	.9776	.0121	2.1121
2.1000	7	.0062	.9938	.0027	2.1027

[redacted] [POOR PRINT]

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RP	IF	QL	TNS
2.1500	3	.5170	.4830	1.3078	3.4578
2.1500	4	.2129	.7871	.2474	2.3974
2.1500	5	.0774	.9226	.0584	2.2208
2.1500	6	.0248	.9752	.0139	2.1639
2.1500	7	.0071	.9929	.0031	2.1531
2.2000	3	.5422	.4578	1.4909	3.6909
2.2000	4	.2268	.7732	.2772	2.4772
2.2000	5	.0839	.9161	.0659	2.2659
2.2000	6	.0275	.9725	.0159	2.2159
2.2000	7	.0080	.9920	.0037	2.2037
2.2500	3	.5678	.4322	1.7033	3.9533
2.2500	4	.2412	.7588	.3101	2.5601
2.2500	5	.0908	.9092	.0743	2.3243
2.2500	6	.0303	.9697	.0183	2.2683
2.2500	7	.0090	.9910	.0043	2.2543
2.3000	3	.5938	.4062	1.9511	4.2511
2.3000	4	.2560	.7440	.3464	2.6464
2.3000	5	.0980	.9020	.0835	2.3835
2.3000	6	.0333	.9667	.0207	2.3207
2.3000	7	.0101	.9899	.0049	2.3049
2.3000	8	.0027	.9973	.0011	2.3011
2.3500	3	.6203	.3797	2.2426	4.5926
2.3500	4	.2713	.7287	.3864	2.7364
2.3500	5	.1056	.8944	.0936	2.4436
2.3500	6	.0365	.9635	.0235	2.3735
2.3500	7	.0113	.9887	.0057	2.3557
2.3500	8	.0031	.9969	.0013	2.3513
2.4000	3	.6472	.3528	2.5888	4.9888
2.4000	4	.2870	.7130	.4306	2.8306
2.4000	5	.1135	.8865	.1048	2.5048
2.4000	6	.0400	.9600	.0266	2.4266
2.4000	7	.0126	.9874	.0065	2.4065
2.4000	8	.0035	.9965	.0015	2.4015
2.4500	3	.6745	.3255	3.0047	5.4547
2.4500	4	.3032	.6968	.4793	[illegible]
2.4500	5	.1218	.8782	.1170	2.5670
2.4500	6	.0436	.9564	.0301	2.4801
2.4500	7	.0139	.9861	.0075	2.4575
2.4500	8	.0040	.9960	.0018	2.4518
2.5000	3	.7022	.2978	3.5112	6.0112
2.5000	4	.3199	.6801	.5331	3.0331
2.5000	5	.1304	.8696	.1304	2.6304
2.5000	6	.0474	.9526	.0339	2.5339
2.5000	7	.0154	.9846	.0086	2.5086
2.5000	8	.0045	.9955	.0021	2.5021
2.5500	3	.7304	.2696	4.1388	6.6888
2.5500	4	.3369	.6631	.5925	3.1425
2.5500	5	.1393	.8607	.1450	2.6950
2.5500	6	.051[illegible]	.9485	.0381	2.5881
2.5500	7	.0171	.9829	.0098	2.5598
2.5500	8	.0051	.9949	.0024	2.5524
2.6000	3	.7589	.2411	4.9328	7.5328
2.6000	4	.3544	.6456	.6582	3.2582
2.6000	5	.1487	.8513	.1610	2.7610

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POOR PRINT

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	RL	TNS
2.6000	6	.0558	.9442	.0427	2.6427
2.6000	7	.0188	.9812	.0111	2.6111
2.6000	8	.0057	.9943	.0027	2.6027
2.6500	3	.7878	.2122	5.9647	8.6147
2.6500	4	.3723	.6277	.7309	3.3809
2.6500	5	.1583	.8417	.1785	2.8285
2.6500	6	.0604	.9396	.0478	2.6978
2.6500	7	.0207	.9793	.0126	2.6626
2.6500	8	.0064	.9936	.0032	2.6532
2.7000	3	.8171	.1829	7.3535	10.0535
2.7000	4	.3907	.6093	.8115	3.5115
2.7000	5	.1684	.8316	.1976	2.8976
2.7000	6	.0652	.9348	.0533	2.7533
2.7000	7	.0227	.9773	.0142	2.7142
2.7000	8	.0071	.9929	.0036	2.7036
2.7500	3	.8467	.1533	9.3136	12.0636
2.7500	4	.4095	.5905	.9008	3.6508
2.7500	5	.1788	.8212	.2185	2.9685
2.7500	6	.0702	.9298	.0594	2.8094
2.7500	7	.0248	.9752	.0160	2.7660
2.7500	8	.0079	.9921	.0041	2.7541
2.7500	9	.0023	.9977	.0010	2.7510
2.8000	3	.8767	.1233	12.2735	15.0735
2.8000	4	.4287	.5713	1.0002	3.8002
2.8000	5	.1895	.8105	.2412	3.0412
2.8000	6	.0755	.9245	.0660	2.8660
2.8000	7	.0271	.9729	.0180	2.8180
2.8000	8	.0088	.9912	.0047	2.8047
2.8000	9	.0026	.9974	.0012	2.8012
2.8500	3	.9070	.0930	17.2332	20.0832
2.8500	4	.4482	.5518	1.1109	3.9609
2.8500	5	.2006	.7994	.2660	3.1160
2.8500	6	.0810	.9190	.0733	2.9233
2.8500	7	.0295	.9705	.0202	2.8702
2.8500	8	.0097	.9903	.0054	2.8554
2.8500	9	.0029	.9971	.0013	2.8513
2.9000	3	.9377	.0623	27.1927	30.0927
2.9000	4	.4682	.5318	1.2345	4.1345
2.9000	5	.2121	.7879	.2929	3.1929
2.9000	6	.0868	.9132	.0812	2.9812
2.9000	7	.0320	.9680	.0227	2.9227
2.9000	8	.0107	.9893	.0061	2.9061
2.9000	9	.0032	.9968	.0015	2.9015
2.9500	3	.9687	.0313	57.1520	60.1020
2.9500	4	.4886	.5114	1.3729	4.3229
2.9500	5	.2240	.7760	.3223	3.2723
2.9500	6	.0928	.9072	.0898	3.0398
2.9500	7	.0348	.9652	.0253	2.9753
2.9500	8	.0118	.9882	.0069	2.9569
2.9500	9	.0036	.9964	.0018	2.9518
3.0000	4	.5094	.4906	1.5283	4.5283
3.0000	5	.2362	.7638	.3542	3.3542
3.0000	6	.0991	.9009	.0991	3.0991
3.0000	7	.0376	.9624	.0282	3.0282

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POOR PRINT

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RP	TP	RL	TNS
3.0000	8	.0129	.9871	.0078	3.0078
3.0000	9	.0040	.9960	.0020	3.0020
3.0500	4	.5306	.4694	1.7035	4.7535
3.0500	5	.2487	.7513	.3890	3.4390
3.0500	6	.1057	.8943	.1093	3.1593
3.0500	7	.0407	.9593	.0314	3.0814
3.0500	8	.0142	.9858	.0087	3.0587
3.0500	9	.0045	.9955	.0023	3.0523
3.1000	4	.5522	.4478	1.9019	5.0019
3.1000	5	.2616	.7384	.4269	3.5269
3.1000	6	.1126	.8874	.1203	3.2203
3.1000	7	.0439	.9561	.0349	3.1349
3.1000	8	.0155	.9845	.0098	3.1098
3.1000	9	.0050	.9950	.0026	3.1026
3.1500	4	.5741	.4259	2.1276	5.2776
3.1500	5	.2749	.7251	.4681	3.6181
3.1500	6	.1197	.8803	.1323	3.2823
3.1500	7	.0473	.9527	.0387	3.1887
3.1500	8	.0170	.9830	.0110	3.1610
3.1500	9	.0055	.9945	.0030	3.1530
3.2000	4	.5964	.4036	2.3857	5.5857
3.2000	5	.2886	.7114	.5130	3.7130
3.2000	6	.1271	.8729	.1453	3.3453
3.2000	7	.0509	.9491	.0428	3.2428
3.2000	8	.0185	.9815	.0123	3.2123
3.2000	9	.0061	.9939	.0034	3.2034
3.2500	4	.6191	.3809	2.6828	5.9328
3.2500	5	.3026	.6974	.5619	3.8119
3.2500	6	.1348	.8652	.1593	3.4093
3.2500	7	.0546	.9454	.0473	3.2973
3.2500	8	.0201	.9799	.0138	3.2638
3.2500	9	.0068	.9932	.0038	3.2538
3.2500	10	.0021	.9979	.0010	3.2510
3.3000	4	.6422	.3578	3.0273	6.3273
3.3000	5	.3169	.6831	.6152	3.9152
3.3000	6	.1427	.8573	.1745	3.4745
3.3000	7	.0585	.9415	.0522	3.3522
3.3000	8	.0219	.9781	.0153	3.3153
3.3000	9	.0074	.9926	.0043	3.3043
3.3000	10	.0023	.9977	.0011	3.3011
3.3500	4	.6656	.3344	3.4302	6.7802
3.3500	5	.3316	.6684	.6733	4.0233
3.3500	6	.1510	.8490	.1909	3.5409
3.3500	7	.0627	.9373	.0575	3.4075
3.3500	8	.0237	.9763	.0171	3.3671
3.3500	9	.0082	.9918	.0048	3.3548
3.3500	10	.0026	.9974	.0013	3.3513
3.4000	4	.6893	.3107	3.9061	7.3061
3.4000	5	.3467	.6533	.7367	4.1367
3.4000	6	.1595	.8405	.2086	3.6086
3.4000	7	.0670	.9330	.0633	3.4633
3.4000	8	.0256	.9744	.0190	3.4190
3.4000	9	.0090	.9910	.0054	3.4054
3.4000	10	.0029	.9971	.0015	3.4015

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RF	IP	QI	LNS
3.4500	4	.7134	.2866	4.4751	7.9251
3.4500	5	.3621	.6379	.8059	4.2559
3.4500	6	.1684	.8316	.2278	3.6728
3.4500	7	.0715	.9285	.0695	3.5195
3.4500	8	.0277	.9723	.0210	3.4710
3.4500	9	.0098	.9902	.0061	3.4561
3.4500	10	.0032	.9968	.0017	3.4517
3.5000	4	.7379	.2621	5.1650	8.6650
3.5000	5	.3778	.6222	.8816	4.3816
3.5000	6	.1775	.8225	.2485	3.7485
3.5000	7	.0762	.9238	.0762	3.5762
3.5000	8	.0299	.9701	.0232	3.5232
3.5000	9	.0107	.9893	.0068	3.5068
3.5000	10	.0035	.9965	.0019	3.5019
3.5500	4	.7626	.2374	6.0164	9.5664
3.5500	5	.3939	.6061	.9645	4.5145
3.5500	6	.1869	.8131	.2708	3.8208
3.5500	7	.0811	.9189	.0835	3.6335
3.5500	8	.0322	.9678	.0257	3.5757
3.5500	9	.0117	.9883	.0076	3.5576
3.5500	10	.0039	.9961	.0021	3.5521
3.6000	4	.7878	.2122	7.0898	10.6898
3.6000	5	.4104	.5896	1.0553	4.6553
3.6000	6	.1966	.8034	.2948	3.8948
3.6000	7	.0862	.91[illegible]	.0913	3.6913
3.6000	8	.0346	.9654	.0283	3.6283
3.6000	9	.0127	.9873	.0085	3.6085
3.6000	10	.0043	.9957	.0024	3.6024
3.6500	4	.8132	.1868	8.4804	12.1304
3.6500	5	.4272	.5728	1.1550	4.8050
3.6500	6	.2066	.7934	.3208	3.9708
3.6500	7	.0916	.9084	.0998	3.7498
3.6500	8	.0372	.9628	.0312	3.6812
3.6500	9	.0138	.9862	.0094	3.6594
3.6500	10	.0047	.9953	.0027	3.6527
3.7000	4	.8390	.1610	10.3471	14.0471
3.7000	5	.4443	.5557	1.2646	4.9646
3.7000	6	.2168	.7832	.3488	4.0488
3.7000	7	.0971	.9029	.1089	3.8089
3.7000	8	.0399	.9601	.0343	3.7343
3.7000	9	.0150	.9850	.0105	3.7105
3.7000	10	.0052	.9948	.0031	3.7031
3.7500	4	.8650	.1350	12.9754	16.7254
3.7500	5	.4618	.5382	1.3854	5.1354
3.7500	6	.2274	.7726	.3790	4.1290
3.7500	7	.1029	.8971	.1187	3.8687
3.7500	8	.0427	.9573	.0377	3.7877
3.7500	9	.0163	.9837	.0116	3.7616
3.7500	10	.0057	.9943	.0034	3.7534
3.8000	4	.8914	.1086	16.9370	20.7370
3.8000	5	.4796	.5204	1.5187	5.3187
3.8000	6	.2383	.7617	.4116	4.2116
3.8000	7	.1089	.8911	.1293	3.9293
3.8000	8	.0457	.9543	.0413	3.8413

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	LS
3.8000	9	.0176	.9824	.0129	3.8129
3.8000	10	.0062	.9938	.0038	3.8038
3.8000	11	.0020	.9980	.0011	3.8011
3.8500	4	.9181	.0819	23.5650	27.4150
3.8500	5	.4977	.5023	1.6663	5.5163
3.8500	6	.2495	.7505	.4467	4.2967
3.8500	7	.1151	.8849	.1407	3.9907
3.8500	8	.0488	.9512	.0453	3.8953
3.8500	9	.0190	.9810	.0142	3.8642
3.8500	10	.0068	.9932	.0043	3.8543
3.8500	11	.0023	.9977	.0012	3.8512
3.9000	4	.9451	.0549	36.8595	40.7595
3.9000	5	.5162	.4838	1.8302	5.7302
3.9000	6	.2609	.7391	.4846	4.3846
3.9000	7	.1215	.8785	.1529	4.0529
3.9000	8	.0521	.9479	.0495	3.9495
3.9000	9	.0205	.9795	.0157	3.9157
3.9000	10	.0074	.9926	.0048	3.9048
3.9000	11	.0025	.9975	.0014	3.9014
3.9500	4	.9724	.0276	76.8204	80.7704
3.9500	5	.5350	.4650	2.0126	5.9626
3.9500	6	.2727	.7273	.5254	4.4754
3.9500	7	.1282	.8718	.1660	4.1160
3.9500	8	.0555	.9445	.0541	4.0041
3.9500	9	.0221	.9779	.0173	3.9673
3.9500	10	.0081	.9919	.0053	3.9553
3.9500	11	.0027	.9973	.0015	3.9515
4.0000	5	.5541	.4459	2.2165	6.2165
4.0000	6	.2848	.7152	.5495	4.5495
4.0000	7	.1351	.8649	.1801	4.1801
4.0000	8	.0590	.9410	.0590	4.0590
4.0000	9	.0238	.9762	.0190	4.0190
4.0000	10	.0088	.9912	.0059	4.0059
4.0000	11	.0030	.9970	.0017	4.0017
4.0500	5	.5736	.4264	2.4451	6.4951
4.0500	6	.2921	.7029	.6171	4.6671
4.0500	7	.1422	.8578	.1953	4.2453
4.0500	8	.0628	.9372	.0644	4.1144
4.0500	9	.0255	.9745	.0209	4.0709
4.0500	10	.0096	.9904	.0065	4.0565
4.0500	11	.0033	.9967	.0019	4.0519
4.1000	5	.5933	.4067	2.7029	6.8029
4.1000	6	.3098	.6902	.6685	4.7685
4.1000	7	.1496	.8504	.2115	4.3115
4.1000	8	.0667	.9333	.0701	4.1701
4.1000	9	.0274	.9726	.0229	4.1229
4.1000	10	.0104	.9896	.0072	4.1072
4.1000	11	.0036	.9964	.0022	4.1022
4.1500	5	.6134	.3866	2.9948	7.1448
4.1500	6	.3227	.6773	.7240	4.8740
4.1500	7	.1572	.8428	.2289	4.3789
4.1500	8	.0707	.9293	.0762	4.2262
4.1500	9	.0293	.9707	.0251	4.1751
4.1500	10	.0112	.9888	.0080	4.1580

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RF	TF	QL	TNS
4.1500	11	.0040	.9960	.0024	4.1524
4.2000	5	.6338	.3662	3.3273	7.5273
4.2000	6	.3360	.6640	.7839	4.9839
4.2000	7	.1651	.8349	.2426	4.4426
4.2000	8	.0749	.9251	.0828	4.2828
4.2000	9	.0314	.9686	.0275	4.2275
4.2000	10	.0122	.9878	.0088	4.2088
4.2000	11	.0044	.9956	.0027	4.2027
4.2500	5	.6545	.3455	3.7083	7.9583
4.2500	6	.3495	.6505	.8488	5.0988
4.2500	7	.1731	.8269	.2676	4.5176
4.2500	8	.0793	.9207	.0899	4.3399
4.2500	9	.0336	.9664	.0300	4.2800
4.2500	10	.0131	.9869	.0097	4.2597
4.2500	11	.0048	.9952	.0030	4.2530
4.3000	5	.6755	.3245	4.1493	8.4493
4.3000	6	.3634	.6366	.9191	5.2191
4.3000	7	.1815	.8185	.2890	4.5890
4.3000	8	.0839	.9161	.0971	4.3971
4.3000	9	.0358	.9642	.0328	4.3328
4.3000	10	.0142	.9858	.0107	4.3107
4.3000	11	.0052	.9948	.0033	4.3033
4.3500	5	.6968	.3032	4.6631	9.0131
4.3500	6	.3775	.6225	.9959	5.3459
4.3500	7	.1900	.8100	.3119	4.6619
4.3500	8	.0886	.9114	.1056	4.4556
4.3500	9	.0382	.9618	.0357	4.3857
4.3500	10	.0153	.9847	.0117	4.3617
4.3500	11	.0056	.9944	.0037	4.3537
4.3500	12	.0019	.9981	.0011	4.3511
4.4000	5	.7184	.2816	5.2682	9.6682
4.4000	6	.3919	.6081	1.0778	5.4778
4.4000	7	.1988	.8012	.3365	4.7365
4.4000	8	.0935	.9065	.1143	4.5143
4.4000	9	.0407	.9593	.0389	4.4389
4.4000	10	.0164	.9836	.0129	4.4129
4.4000	11	.0061	.9939	.0041	4.4041
4.4000	12	.0021	.9979	.0012	4.4012
4.4500	5	.7403	.2597	5.9896	10.4396
4.4500	6	.4066	.5934	1.1675	5.6175
4.4500	7	.2079	.7921	.3628	4.8128
4.4500	8	.0986	.9014	.1236	4.5736
4.4500	9	.0433	.9567	.0424	4.4924
4.4500	10	.0176	.9824	.0141	4.4641
4.4500	11	.0067	.9933	.0045	4.4545
4.4500	12	.0023	.9977	.0014	4.4514
4.5000	5	.7625	.2375	6.8624	11.3624
4.5000	6	.4217	.5783	1.2650	5.7650
4.5000	7	.2172	.7828	.3910	4.8910
4.5000	8	.1039	.8961	.1336	4.6336
4.5000	9	.0460	.9540	.0460	4.5460
4.5000	10	.0189	.9811	.0155	4.5155
4.5000	11	.0072	.9928	.0050	4.5050
4.5000	12	.0026	.9974	.0015	4.5015

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
4.5500	5	.7850	.2150	7.9371	12.4871
4.5500	6	.4370	.5630	1.3711	5.9211
4.5500	7	.2268	.7732	.4212	4.9712
4.5500	8	.1094	.8906	.1442	4.6942
4.5500	9	.0489	.9511	.0500	4.6000
4.5500	10	.0203	.9797	.0169	4.5669
4.5500	11	.0078	.9922	.0055	4.5555
4.5500	12	.0028	.9972	.0017	4.5517
4.6000	5	.8078	.1922	9.2893	13.8893
4.6000	6	.4525	.5475	1.4869	6.0869
4.6000	7	.2366	.7634	.4535	5.0535
4.6000	8	.1150	.8850	.1556	4.7556
4.6000	9	.0519	.9481	.0542	4.6542
4.6000	10	.0217	.9783	.0185	4.6185
4.6000	11	.0084	.9916	.0061	4.6061
4.6000	12	.0031	.9969	.0019	4.6019
4.6500	5	.8308	.1692	11.0381	15.6881
4.6500	6	.4684	.5316	1.6135	6.2635
4.6500	7	.2466	.7534	.4881	5.1381
4.6500	8	.1208	.8792	.1677	4.8177
4.6500	9	.0550	.9450	.0588	4.7088
4.6500	10	.0232	.9768	.0202	4.6702
4.6500	11	.0091	.9909	.0067	4.6567
4.6500	12	.0033	.9967	.0021	4.6521
4.7000	5	.8542	.1458	13.3821	18.0821
4.7000	6	.4846	.5154	1.7520	6.4520
4.7000	7	.2570	.7430	.5251	5.2251
4.7000	8	.1269	.8731	.1807	4.8807
4.7000	9	.0582	.9418	.0636	4.7636
4.7000	10	.0248	.9752	.0220	4.7220
4.7000	11	.0098	.9902	.0073	4.7073
4.7000	12	.0036	.9964	.0023	4.7023
4.7500	5	.8778	.1222	16.6782	21.4282
4.7500	6	.5010	.4990	1.9039	6.6539
4.7500	7	.2675	.7325	.5648	5.3148
4.7500	8	.1331	.8669	.1946	4.9446
4.7500	9	.0616	.9384	.0688	4.8188
4.7500	10	.0265	.9735	.0240	4.7740
4.7500	11	.0106	.9894	.0080	4.7580
4.7500	12	.0039	.9961	.0026	4.7526
4.8000	5	.9017	.0983	21.6408	26.4408
4.8000	6	.5178	.4822	2.0711	6.8711
4.8000	7	.2783	.7217	.6073	5.4073
4.8000	8	.1395	.8605	.2093	5.0093
4.8000	9	.0651	.9349	.0744	4.8744
4.8000	10	.0282	.9718	.0261	4.8261
4.8000	11	.0114	.9886	.0088	4.8088
4.8000	12	.0043	.9957	.0029	4.8029
4.8500	5	.9259	.0741	29.9366	34.7866
4.8500	6	.5348	.4652	2.2554	7.1054
4.8500	7	.2894	.7106	.6529	5.5029
4.8500	8	.1462	.8538	.2251	5.0751
4.8500	9	.0687	.9313	.0803	4.9303
4.8500	10	.0301	.9699	.0283	4.8783

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BF	IF	QI	TNS
4.8500	11	.0122	.9878	.0097	4.8597
4.8500	12	.0046	.9954	.0032	4.8532
4.9000	5	.9503	.0497	46.5655	51.4655
4.9000	6	.5521	.4479	2.4593	7.3593
4.9000	7	.3007	.6993	.7017	5.6017
4.9000	8	.1530	.8470	.2418	5.1418
4.9000	9	.0725	.9275	.0867	4.9867
4.9000	10	.0320	.9680	.0307	4.9307
4.9000	11	.0131	.9869	.0106	4.9106
4.9000	12	.0050	.9950	.0035	[illegible]
4.9000	13	.0018	.9982	.0011	4.9011
4.9500	5	.9750	.0250	96.5276	101.4776
4.9500	6	.5697	.4303	2.6856	7.6356
4.9500	7	.3123	.6877	.7541	5.7041
4.9500	8	.1600	.8400	.2597	5.2097
4.9500	9	.0764	.9236	.0934	5.0434
4.9500	10	.0340	.9660	.0333	4.9833
4.9500	11	.0141	.9859	.0115	4.9615
4.9500	12	.0054	.9946	.0038	4.9538
4.9500	13	.0020	.9980	.0012	4.9512
5.0000	6	.5875	.4125	2.9376	7.9376
5.0000	7	.3241	.6759	.8104	5.8104
5.0000	8	.1673	.8327	.2786	5.2786
5.0000	9	.0805	.9195	.1006	5.1006
5.0000	10	.0361	.9639	.0361	5.0361
5.0000	11	.0151	.9849	.0126	5.0126
5.0000	12	.0059	.9941	.0042	5.0042
5.0000	13	.0021	.9979	.0013	5.0013
5.0500	6	.6056	.3944	3.2195	8.2695
5.0500	7	.3362	.6638	.8708	5.9208
5.0500	8	.1747	.8253	.2991	5.3491
5.0500	9	.0847	.9153	.1083	5.1583
5.0500	10	.0383	.9617	.0391	5.0891
5.0500	11	.0161	.9839	.0137	5.0637
5.0500	12	.0064	.9936	.0046	5.0546
5.0500	13	.0023	.9977	.0015	5.0515
5.1000	6	.6241	.3759	3.5363	8.6363
5.1000	7	.3486	.6514	.9357	6.0357
5.1000	8	.1824	.8176	.3207	5.4207
5.1000	9	.0891	.9109	.1165	5.2165
5.1000	10	.0406	.9594	.0423	5.1423
5.1000	11	.0173	.9827	.0149	5.1149
5.1000	12	.0069	.9931	.0051	5.1051
5.1000	13	.0025	.9975	.0016	5.1016
5.1500	6	.6427	.3573	3.8942	9.0442
5.1500	7	.3612	.6388	1.0054	6.1554
5.1500	8	.1902	.8098	.3437	5.4937
5.1500	9	.0936	.9064	.1252	5.2752
5.1500	10	.0430	.9570	.0457	5.1957
5.1500	11	.0184	.9816	.0162	5.1662
5.1500	12	.0074	.9926	.0055	5.1555
5.1500	13	.0028	.9972	.0018	5.1518
5.2000	6	.6617	.3383	4.3009	9.5009
5.2000	7	.3740	.6260	1.0805	6.2805

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
5.2000	8	.1983	.8017	.3683	5.5683
5.2000	9	.0983	.9017	.1345	5.3345
5.2000	10	.0455	.9545	.0493	5.2493
5.2000	11	.0197	.9803	.0176	5.2176
5.2000	12	.0079	.9921	.0061	5.2061
5.2000	13	.0030	.9970	.0020	5.2020
5.2500	6	.6809	.3191	4.7662	10.0162
5.2500	7	.3871	.6129	1.1614	6.4114
5.2500	8	.2066	.7934	.3944	5.6444
5.2500	9	.1031	.8969	.1444	5.3944
5.2500	10	.0481	.9519	.0532	5.3032
5.2500	11	.0210	.9790	.0191	5.2691
5.2500	12	.0085	.9915	.0066	5.2566
5.2500	13	.0033	.9967	.0022	5.2522
5.3000	6	.7004	.2996	5.3028	10.6028
5.3000	7	.4005	.5995	1.2486	6.5486
5.3000	8	.2151	.7849	.4222	5.7222
5.3000	9	.1081	.8919	.1549	5.4549
5.3000	10	.0508	.9492	.0573	5.3573
5.3000	11	.0223	.9777	.0207	5.3207
5.3000	12	.009[illegible]	.9908	.0072	5.3072
5.3000	13	.0035	.9965	.0024	5.3024
5.3500	6	.7201	.2799	5.9271	11.2771
5.3500	7	.4141	.5859	1.3427	6.6927
5.3500	8	.2238	.7762	.4518	5.8018
5.3500	9	.1133	.8867	.1661	5.5161
5.3500	10	.0536	.9464	.0617	5.4117
5.3500	11	.0237	.9763	.0225	5.3725
5.3500	12	.0098	.9902	.0079	5.3579
5.3500	13	.0038	.9962	.0027	5.3527
5.4000	6	.7401	.2599	6.6611	12.0611
5.4000	7	.4280	.5720	1.4444	6.8444
5.4000	8	.2327	.7673	.4833	5.8833
5.4000	9	.1186	.8814	.1779	5.5779
5.4000	10	.0566	.9434	.0664	5.4664
5.4000	11	.0252	.9748	.0243	5.4243
5.4000	12	.0105	.9895	.0086	5.4086
5.4000	13	.0041	.9959	.0029	5.4029
5.4500	6	.7604	.2396	7.5348	12.9848
5.4500	7	.4421	.5579	1.5544	7.0044
5.4500	8	.2419	.7581	.5169	5.9669
5.4500	9	.1241	.8759	.1905	5.6405
5.4500	10	.0596	.9404	.0714	5.5214
5.4500	11	.0268	.9732	.0263	5.4763
5.4500	12	.0113	.9887	.0094	5.4594
5.4500	13	.0044	.9956	.0032	5.4532
5.4500	14	.0016	.9984	.0010	5.4510
5.5000	6	.7809	.2191	8.5902	14.0902
5.5000	7	.4564	.5436	1.6736	7.1736
5.5000	8	.2512	.7488	.5527	6.0527
5.5000	9	.1298	.8702	.2039	5.7039
5.5000	10	.0628	.9372	.0767	5.5767
5.5000	11	.0284	.9716	.0284	5.5284
5.5000	12	.0121	.9879	.0102	5.5102

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
5.5000	13	.0048	.9952	.0035	5.5035
5.5000	14	.0018	.9982	.0012	5.5012
5.5500	6	.8017	.1983	9.8878	15.4378
5.5500	7	.4711	.5289	1.8030	7.3530
5.5500	8	.2608	.7392	.5908	6.1408
5.5500	9	.1356	.8644	.2181	5.7681
5.5500	10	.0661	.9339	.0824	5.6324
5.5500	11	.0301	.9699	.0307	5.5807
5.5500	12	.0129	.9871	.0111	5.5611
5.5500	13	.0052	.9948	.0038	5.5538
5.5500	14	.0019	.9981	.0013	5.5513
5.6000	6	.8228	.1772	11.5185	17.1185
5.6000	7	.4859	.5141	1.9438	7.5438
5.6000	8	.2706	.7294	.6314	6.2314
5.6000	9	.1416	.8584	.2332	5.8332
5.6000	10	.0695	.9305	.0884	5.6884
5.6000	11	.0319	.9681	.0331	5.6331
5.6000	12	.0138	.9862	.0120	5.6120
5.6000	13	.0056	.9944	.0042	5.6042
5.6000	14	.0021	.9979	.0014	5.6014
5.6500	6	.8440	.1560	13.6253	19.2753
5.6500	7	.5011	.4989	2.0970	7.7470
5.6500	8	.2806	.7194	.6747	6.3247
5.6500	9	.1478	.8522	.2492	5.8992
5.6500	10	.0730	.9270	.0948	5.7448
5.6500	11	.0338	.9662	.0357	5.6857
5.6500	12	.0147	.9853	.0130	5.6630
5.6500	13	.0060	.9940	.0046	5.6546
5.6500	14	.0023	.9977	.0015	5.6515
5.7000	6	.8656	.1344	16.4462	22.1462
5.7000	7	.5164	.4836	2.2643	7.9643
5.7000	8	.2909	.7091	.7208	6.4208
5.7000	9	.1541	.8459	.2662	5.9662
5.7000	10	.0766	.9234	.1016	5.8016
6.7000	11	.0357	.9643	.0384	5.7384
5.7000	12	.0156	.9844	.0141	5.7141
5.7000	13	.0064	.9936	.0050	5.7050
5.7000	14	.0025	.9975	.0017	5.7017
5.7500	6	.8874	.1126	20.4098	26.1598
5.7500	7	.5320	.4680	2.4474	8.1974
5.7500	8	.3013	.6987	.7701	6.5201
5.7500	9	.1606	.8394	.2842	6.0342
5.7500	10	.0804	.9196	.1088	5.8588
5.7500	11	.0378	.9622	.0414	5.7914
5.7500	12	.0166	.9834	.0153	5.7653
5.7500	13	.0069	.9931	.0055	5.7555
5.7500	14	.0027	.9973	.0019	5.7519
5.8000	6	.9094	.0906	26.3732	32.1732
5.8000	7	.5479	.4521	2.6482	8.4482
5.8000	8	.3120	.6880	.8226	6.6226
5.8000	9	.1673	.8327	.3033	6.1033
5.8000	10	.0843	.9157	.1165	5.9165
5.8000	11	.0399	.9601	.0445	5.8445
5.8000	12	.0177	.9823	.0166	5.8166

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QI	TNS
5.8000	13	.0074	.9926	.0059	5.8059
5.8000	14	.0029	.9971	.0020	5.8020
5.8500	6	.9317	.0683	36.3365	42.1865
5.8500	7	.5640	.4360	2.8692	8.7192
5.8500	8	.3229	.6771	.8786	6.7286
5.8500	9	.1742	.8258	.3236	6.1736
5.8500	10	.0884	.9116	.1246	5.9746
5.8500	11	.0421	.9579	.0478	5.8978
5.8500	12	.0188	.9812	.0179	5.8679
5.8500	13	.0079	.9921	.0065	5.8565
5.8500	14	.0031	.9969	.0022	5.8522
5.9000	6	.9542	.0458	56.2996	62.1996
5.9000	7	.5804	.4196	3.1130	9.0130
5.9000	8	.3341	.6659	.9385	6.8385
5.9000	9	.1813	.8187	.3451	6.2451
5.9000	10	.0925	.9075	.1332	6.0332
5.9000	11	.0444	.9556	.0513	5.9513
5.9000	12	.0200	.9800	.0193	5.9193
5.9000	13	.0084	.9916	.0070	5.9070
5.9000	14	.0034	.9966	.0024	5.9024
5.9500	6	.9770	.0230	116.2625	122.2125
5.9500	7	.5970	.4030	3.3829	9.3329
5.9500	8	.3454	.6546	1.0025	6.9525
5.9500	9	.1885	.8115	.3678	6.3178
5.9500	10	.0969	.9031	.1423	6.0923
5.9500	11	.0468	.9532	.0551	6.0051
5.9500	12	.0212	.9788	.0208	5.9708
5.9500	13	.0090	.9910	.0076	5.9576
5.9500	14	.0036	.9964	.0027	5.9527
6.0000	7	.6138	.3862	3.6830	9.6830
6.0000	8	.3570	.6430	1.0709	7.0709
6.0000	9	.1960	.8040	.3920	6.3920
6.0000	10	.1013	.8987	.1519	6.1519
6.0000	11	.0492	.9508	.0591	6.0591
6.0000	12	.0225	.9775	.0225	6.0225
6.0000	13	.0096	.9904	.0083	6.0083
6.0000	14	.0039	.9961	.0029	6.0029
6.0500	7	.6309	.3691	4.0180	10.0680
6.0500	8	.3688	.6312	1.1442	7.1942
6.0500	9	.2036	.7964	.4176	6.4676
6.0500	10	.1059	.8941	.1622	6.2122
6.0500	11	.0518	.9482	.0633	6.1133
6.0500	12	.0238	.9762	.0242	6.0742
6.0500	13	.0103	.9897	.0090	6.0590
6.0500	14	.0042	.9958	.0032	6.0532
6.0500	15	.0016	.9984	.0011	6.0511
6.1000	7	.6482	.3518	4.3937	10.4937
6.1000	8	.3808	.6192	1.2226	7.3226
6.1000	9	.2114	.7886	.4447	6.5447
6.1000	10	.1106	.8894	.1730	6.2730
6.1000	11	.0545	.9455	.0678	6.1678
6.1000	12	.0252	.9748	.0261	6.1261
6.1000	13	.0110	.9890	.0097	6.1097
6.1000	14	.0045	.9955	.0035	6.1035

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
6.1000	15	.0017	.9983	.0012	6.1012
6.1500	7	.6658	.3342	4.8174	10.9674
6.1500	8	.3931	.6069	1.3066	7.4566
6.1500	9	.2194	.7806	.4734	6.6234
6.1500	10	.1155	.8845	.1845	6.3345
6.1500	11	.0572	.9428	.0725	6.2225
6.1500	12	.0267	.9733	.0280	6.1780
6.1500	13	.0117	.9883	.0105	6.1605
6.1500	14	.0048	.9952	.0038	6.1538
6.1500	15	.0019	.9981	.0013	6.1513
6.2000	7	.6836	.3164	5.2981	11.4981
6.2000	8	.4055	.5945	1.3968	7.5968
6.2000	9	.2276	.7724	.5039	6.7039
6.2000	10	.1205	.8795	.1966	6.3966
6.2000	11	.0601	.9399	.0776	6.2776
6.2000	12	.0282	.9718	.0301	6.2301
6.2000	13	.0124	.9876	.0114	6.2114
6.2000	14	.0052	.9948	.0041	6.2041
6.2000	15	.0020	.9980	.0014	6.2014
6.2500	7	.7017	.2983	5.8473	12.0973
6.2500	8	.4182	.5818	1.4936	7.7436
6.2500	9	.2360	.7640	.5363	6.7863
6.2500	10	.1257	.8743	.2094	6.4594
6.2500	11	.0630	.9370	.0830	6.3330
6.2500	12	.0298	.9702	.0324	6.2824
6.2500	13	.0132	.9868	.0123	6.2623
6.2500	14	.0055	.9945	.0045	6.2545
6.2500	15	.0022	.9978	.0016	6.2516
6.3000	7	.7200	.2800	6.4796	12.7796
6.3000	8	.4311	.5689	1.5977	7.8977
6.3000	9	.2445	.7555	.5705	6.8705
6.3000	10	.1310	.8690	.2230	6.5230
6.3000	11	.0661	.9339	.0886	6.3886
6.3000	12	.0314	.9686	.0347	6.3347
6.3000	13	.0141	.9859	.0132	6.3132
6.3000	14	.0059	.9941	.0049	6.3049
6.3000	15	.0024	.9976	.0017	6.3017
6.3500	7	.7385	.2615	7.2143	13.5643
6.3500	8	.4443	.5557	1.7098	8.0598
6.3500	9	.2533	.7467	.6069	6.9569
6.3500	10	.1364	.8636	.2373	6.5873
6.3500	11	.0693	.9307	.0946	6.4446
6.3500	12	.0332	.9668	.0373	6.3873
6.3500	13	.0149	.9851	.0143	6.3643
6.3500	14	.0064	.9936	.0053	6.3553
6.3500	15	.0025	.9975	.0019	6.3519
6.4000	7	.7572	.2428	8.0771	14.4771
6.4000	8	.4576	.5424	1.8306	8.2306
6.4000	9	.2622	.7378	.6455	7.0455
6.4000	10	.1420	.8580	.2525	6.6525
6.4000	11	.0726	.9274	.1010	6.5010
6.4000	12	.0349	.9651	.0399	6.4399
6.4000	13	.0159	.9841	.0154	6.4154
6.4000	14	.0068	.9932	.0057	6.4057

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
6.4000	7	.7572	.2428	8.0771	14.4771
6.4000	8	.4576	.5424	1.8306	8.2306
6.4000	9	.2622	.7378	.6455	7.0455
6.4000	10	.1420	.8580	.2525	6.6525
6.4000	11	.0726	.9274	.1010	6.5010
6.4000	12	.0349	.9651	.0399	6.4399
6.4000	13	.0159	.9841	.0154	6.4154
6.4000	14	.0068	.9932	.0057	6.4057
6.4000	15	.0027	.9973	.0020	6.4020
6.4500	7	.7762	.2238	9.1029	15.5529
6.4500	8	.4712	.5288	1.9609	8.4109
6.4500	9	.2714	.7286	.6864	7.1364
6.4500	10	.1478	.8522	.2685	6.7185
6.4500	11	.0760	.9240	.1077	6.5577
6.4500	12	.0368	.9632	.0428	6.4928
6.4500	13	.0168	.9832	.0166	6.4666
6.4500	14	.0072	.9928	.0062	6.4562
6.4500	15	.0029	.9971	.0022	6.4522
6.5000	7	.7954	.2046	10.3406	16.8406
6.5000	8	.4850	.5150	2.1019	8.6019
6.5000	9	.2807	.7193	.7298	7.2298
6.5000	10	.1537	.8463	.2855	6.7855
6.5000	11	.0795	.9205	.1148	6.6148
6.5000	12	.0388	.9612	.0458	6.5458
6.5000	13	.0178	.9822	.0178	6.5178
6.5000	14	.0077	.9923	.0067	6.5064
6.5000	15	.0032	.9968	.0024	6.5024
6.5500	7	.8149	.1851	11.8610	18.4110
6.5500	8	.4991	.5009	2.2545	8.8045
6.5500	9	.2902	.7098	.7760	7.3260
6.5500	10	.1598	.8402	.3034	6.8534
6.5500	11	.0831	.9169	.1223	6.6723
6.5500	12	.0408	.9592	.0490	6.5990
6.5500	13	.0189	.9811	.0192	6.5692
6.5500	14	.0082	.9918	.0072	6.5572
6.5500	15	.0034	.9966	.0026	6.5526
6.6000	7	.8346	.1654	13.7701	20.3701
6.6000	8	.5133	.4867	2.4200	9.0200
6.6000	9	.3000	.7000	.8249	7.4249
6.6000	10	.1660	.8340	.3223	6.9223
6.6000	11	.0868	.9132	.1303	6.7303
6.6000	12	.0429	.9571	.0524	6.6524
6.6000	13	.0200	.9800	.0206	6.6206
6.6000	14	.0088	.9912	.0078	6.6078
6.6000	15	.0036	.9964	.0029	6.6029
6.6000	16	.0014	.9986	.0010	6.6010
6.6500	7	.8545	.1455	16.2346	22.8846
6.6500	8	.5278	.4722	2.6000	9.2500
6.6500	9	.3099	.6901	.8770	7.5270
6.6500	10	.1724	.8276	.3423	6.9923
6.6500	11	.0907	.9093	.1386	6.7886
6.6500	12	.0450	.9550	.0560	6.7060
6.6500	13	.0211	.9789	.0221	6.6721
6.6500	14	.0093	.9907	.0085	6.6585

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
6.6500	15	.0039	.9961	.0031	6.6531
6.6500	16	.0015	.9985	.0011	6.6511
6.7000	7	.8746	.1254	19.5323	26.2323
6.7000	8	.5425	.4575	2.7960	9.4960
6.7000	9	.3200	.6800	.9323	7.6323
6.7000	10	.1790	.8210	.3634	7.0634
6.7000	11	.0947	.9053	.1475	6.8475
6.7000	12	.0473	.9527	.0598	6.7598
6.7000	13	.0223	.9777	.0237	6.7237
6.7000	14	.0099	.9901	.0091	6.7091
6.7000	15	.0042	.9958	.0034	6.7034
6.7000	16	.0017	.9983	.0012	6.7012
6.7500	7	.8949	.1051	24.1631	30.9131
6.7500	8	.5574	.4426	3.0101	9.7601
6.7500	9	.3304	.6696	.9911	7.7411
6.7500	10	.1857	.8143	.3857	7.1357
6.7500	11	.0988	.9012	.1569	6.9069
6.7500	12	.0496	.9504	.0638	6.8138
6.7500	13	.0236	.9764	.0254	6.7754
6.7500	14	.0106	.9894	.0098	6.7598
6.7500	15	.0045	.9955	.0037	6.7537
6.7500	16	.0018	.9982	.0013	6.7513
6.8000	7	.9155	.0845	31.1272	37.9272
6.8000	8	.5726	.4274	3.2446	10.0446
6.8000	9	.3409	.6591	1.0536	7.8536
6.8000	10	.1926	.8074	.4092	7.2092
6.8000	11	.1030	.8970	.1667	6.9667
6.8000	12	.0521	.9479	.0681	6.8681
6.8000	13	.0249	.9751	.0273	6.8273
6.8000	14	.0112	.9888	.0106	6.8106
6.8000	15	.0048	.9952	.0040	6.8040
6.8000	16	.0019	.9981	.0014	6.8014
6.8500	7	.9363	.0637	42.7577	49.6077
6.8500	8	.5879	.4121	3.5020	10.3520
6.8500	9	.3516	.6484	1.1202	7.9702
6.8500	10	.1996	.8004	.4341	7.2841
6.8500	11	.1073	.8927	.1771	7.0271
6.8500	12	.0546	.9454	.0726	6.9226
6.8500	13	.0262	.9738	.0292	6.8792
6.8500	14	.0119	.9881	.0114	6.8614
6.8500	15	.0051	.9949	.0043	6.8543
6.8500	16	.0021	.9979	.0016	6.8516
6.9000	7	.9573	.0427	66.0548	72.9548
6.9000	8	.6035	.3965	3.7856	10.6856
6.9000	9	.3625	.6375	1.1911	8.0911
6.9000	10	.2068	.7932	.4603	7.3603
6.9000	11	.1118	.8882	.1881	7.0881
6.9000	12	.0572	.9428	.0773	6.9773
6.9000	13	.0276	.9724	.0312	6.9312
6.9000	14	.0126	.9874	.0123	6.9123
6.9000	15	.0055	.9945	.0046	6.9046
6.9000	16	.0022	.9978	.0017	6.9017
6.9500	7	.9785	.0215	136.0184	142.9684
6.9500	8	.6193	.3807	4.0992	11.0492

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
6.9500	9	.3736	.6264	1.2667	8.2167
6.9500	10	.2142	.7858	.4881	7.4381
6.9500	11	.1164	.8836	.1997	7.1497
6.9500	12	.0598	.9402	.0824	7.0324
6.9500	13	.0291	.9709	.0334	6.9834
6.9500	14	.0134	.9866	.0132	6.9632
6.9500	15	.0058	.9942	.0050	6.9550
6.9500	16	.0024	.9976	.0018	6.9518
7.0000	8	.6353	.3647	4.4472	11.4472
7.0000	9	.3849	.6151	1.3473	8.3473
7.0000	10	.2217	.7783	.5174	7.5174
7.0000	11	.1211	.8789	.2119	7.2119
7.0000	12	.0626	.9374	.0877	7.0877
7.0000	13	.0306	.9694	.0357	7.0357
7.0000	14	.0142	.9858	.0142	7.0142
7.0000	15	.0062	.9938	.0054	7.0054
7.0000	16	.0026	.9974	.0020	7.0020
7.0500	8	.6515	.3485	4.8352	11.8852
7.0500	9	.3965	.6035	1.4334	8.4834
7.0500	10	.2294	.7706	.5483	7.5983
7.0500	11	.1260	.8740	.2248	7.2748
7.0500	12	.0655	.9345	.0933	7.1433
7.0500	13	.0322	.9678	.0382	7.0882
7.0500	14	.0150	.9850	.0152	7.0652
7.0500	15	.0066	.9934	.0059	7.0559
7.0500	16	.0028	.9972	.0022	7.0522
7.1000	8	.6680	.3320	5.2697	12.3697
7.1000	9	.4082	.5918	1.5253	8.6253
7.1000	10	.2373	.7627	.5810	7.6810
7.1000	11	.1310	.8690	.2384	7.3384
7.1000	12	.0685	.9315	.0992	7.1992
7.1000	13	.0339	.9661	.0408	7.1408
7.1000	14	.0159	.9841	.0163	7.1163
7.1000	15	.0070	.9930	.0063	7.1063
7.1000	16	.0030	.9970	.0024	7.1024
7.1500	8	.6847	.3153	5.7592	12.9092
7.1500	9	.4201	.5799	1.6236	8.7736
7.1500	10	.2454	.7546	.6156	7.7656
7.1500	11	.1361	.8639	.2527	7.4027
7.1500	12	.0715	.9285	.1054	7.2554
7.1500	13	.0356	.9644	.0435	7.1935
7.1500	14	.0168	.9832	.0175	7.1675
7.1500	15	.0075	.9925	.0068	7.1568
7.1500	16	.0032	.9968	.0026	7.1526
7.2000	8	.7015	.2985	6.3138	13.5138
7.2000	9	.4322	.5678	1.7289	8.9289
7.2000	10	.2536	.7464	.6521	7.8521
7.2000	11	.1413	.8587	.2678	7.4678
7.2000	12	.0747	.9253	.1120	7.3120
7.2000	13	.0374	.9626	.0464	7.2464
7.2000	14	.0177	.9823	.0187	7.2187
7.2000	15	.0079	.9921	.0073	7.2073
7.2000	16	.0034	.9966	.0028	7.2028
7.2500	8	.7186	.2814	6.9467	14.1967

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
7.2500	9	.4445	.5555	1.8417	9.0917
7.2500	10	.2620	.7380	.6907	7.9407
7.2500	11	.1467	.8533	.2837	7.5337
7.2500	12	.0779	.9221	.1190	7.3690
7.2500	13	.0392	.9608	.0494	7.2994
7.2500	14	.0187	.9813	.0201	7.2701
7.2500	15	.0084	.9916	.0079	7.2579
7.2500	16	.0036	.9964	.0030	7.2530
7.3000	8	.7359	.2641	7.6747	14.9747
7.3000	9	.4571	.5429	1.9627	9.2627
7.3000	10	.2706	.7294	.7315	8.0315
7.3000	11	.1523	.8477	.3004	7.6004
7.3000	12	.0813	.9187	.1263	7.4263
7.3000	13	.0411	.9589	.0527	7.3527
7.3000	14	.0197	.9803	.0215	7.3215
7.3000	15	.0090	.9910	.0085	7.3085
7.3000	16	.0039	.9961	.0032	7.3032
7.3500	8	.7534	.2466	8.5197	15.8697
7.3500	9	.4698	.5302	2.0927	9.4427
7.3500	10	.2793	.7207	.7747	8.1247
7.3500	11	.1579	.8421	.3180	7.6680
7.3500	12	.0848	.9152	.1340	7.4840
7.3500	13	.0431	.9569	.0561	7.4061
7.3500	14	.0208	.9792	.0230	7.3730
7.3500	15	.0095	.9905	.0091	7.3591
7.3500	16	.0041	.9959	.0035	7.3535
7.4000	8	.7712	.2288	9.5111	16.9111
7.4000	9	.4827	.5173	2.2325	9.6325
7.4000	10	.2882	.7118	.8204	8.2204
7.4000	11	.1638	.8362	.3366	7.7366
7.4000	12	.0883	.9117	.1421	7.5421
7.4000	13	.0452	.9548	.0597	7.4597
7.4000	14	.0219	.9781	.0246	7.4246
7.4000	15	.0101	.9899	.0098	7.4098
7.4000	16	.0044	.9956	.0038	7.4038
7.4500	8	.7891	.2109	10.6888	18.1388
7.4500	9	.4958	.5042	2.3832	9.8332
7.4500	10	.2973	.7027	.8687	8.3187
7.4500	11	.1697	.8303	.3561	7.8061
7.4500	12	.0920	.9080	.1506	7.6006
7.4500	13	.0473	.9527	.0635	7.5135
7.4500	14	.0231	.9769	.0262	7.4762
7.4500	15	.0107	.9893	.0105	7.4605
7.4500	16	.0047	.9953	.0041	7.4541
7.5000	8	.8073	.1927	12.1088	19.6088
7.5000	9	.5091	.4909	2.5457	10.0457
7.5000	10	.3066	.6934	.9198	8.4198
7.5000	11	.1758	.8242	.3767	7.8767
7.5000	12	.0958	.9042	.1596	7.6596
7.5000	13	.0495	.9505	.0675	7.5675
7.5000	14	.0243	.9757	.0280	7.5280
7.5000	15	.0113	.9887	.0113	7.5113
7.5000	16	.0050	.9950	.0044	7.5044
7.5500	8	.8256	.1744	13.8518	21.4018

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QI	TNS
7.5500	9	.5227	.4773	2.7215	10.2715
7.5500	10	.3161	.6839	.9740	8.5240
7.5500	11	.1821	.8179	.3984	7.9484
7.5500	12	.0997	.9003	.1691	7.7191
7.5500	13	.0518	.9482	.0718	7.6218
7.5500	14	.0255	.9745	.0299	7.5799
7.5500	15	.0119	.9881	.0121	7.5621
7.5500	16	.0053	.9947	.0047	7.5547
7.6000	8	.8442	.1558	16.0392	23.6392
7.6000	9	.5364	.4636	2.9118	10.5118
7.6000	10	.3257	.6743	1.0314	8.6314
7.6000	11	.1884	.8116	.4212	8.0212
7.6000	12	.1037	.8963	.1791	7.7791
7.6000	13	.0542	.9458	.0762	7.6762
7.6000	14	.0268	.9732	.0319	7.6319
7.6000	15	.0126	.9874	.0130	7.6130
7.6000	16	.0056	.9944	.0051	7.6051
7.6500	8	.8629	.1371	18.8613	26.5113
7.6500	9	.5503	.4497	3.1184	10.7684
7.6500	10	.3355	.6645	1.0922	8.7422
7.6500	11	.1950	.8050	.4453	8.0953
7.6500	12	.1078	.8922	.1896	7.8396
7.6500	13	.0566	.9434	.0809	7.7309
7.6500	14	.0282	.9718	.0340	7.6840
7.6500	15	.0133	.9867	.0139	7.6639
7.6500	16	.0060	.9940	.0055	7.6555
7.7000	8	.8819	.1181	22.6357	30.3357
7.7000	9	.5644	.4356	3.3432	11.0432
7.7000	10	.3455	.6545	1.1566	8.8566
7.7000	11	.2017	.7983	.4706	8.1706
7.7000	12	.1120	.8880	.2006	7.9006
7.7000	13	.0591	.9409	.0859	7.7859
7.7000	14	.0296	.9704	.0362	7.7362
7.7000	15	.0141	.9859	.0149	7.7149
7.7000	16	.0064	.9936	.0059	7.7059
7.7500	8	.9011	.0989	27.9337	35.6837
7.7500	9	.5788	.4212	3.5883	11.3383
7.7500	10	.3556	.6444	1.2250	8.9750
7.7500	11	.2085	.7915	.4972	8.2472
7.7500	12	.1164	.8836	.2122	7.9622
7.7500	13	.0617	.9383	.0911	7.8411
7.7500	14	.0311	.9689	.0386	7.7886
7.7500	15	.0149	.9851	.0159	7.7659
7.7500	16	.0068	.9932	.0063	7.7563
7.8000	8	.9205	.0795	35.8982	43.6982
7.8000	9	.5933	.4067	3.8563	11.6563
7.8000	10	.3660	.6340	1.2976	9.0976
7.8000	11	.2155	.7845	.5253	8.3253
7.8000	12	.1208	.8792	.2244	8.0244
7.8000	13	.0644	.9356	.0966	7.8966
7.8000	14	.0326	.9674	.0410	7.8410
7.8000	[illegible]	.0157	.9843	.0170	7.8170
7.8000	16	.0072	.9928	.0068	7.8068
7.8500	8	.9401	.0599	49.1960	57.0460

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	RL	TNS
7.8500	9	.6080	.3920	4.1502	12.0002
7.8500	10	.3765	.6235	1.3747	9.2247
7.8500	11	.2226	.7774	.5548	8.4048
7.8500	12	.1254	.8746	.2372	8.0872
7.8500	13	.0672	.9328	.1024	7.9524
7.8500	14	.0342	.9658	.0436	7.8936
7.8500	15	.0165	.9835	.0182	7.8682
7.8500	16	.0076	.9924	.0073	7.8573
7.9000	8	.9598	.0402	75.8269	83.7269
7.9000	9	.6229	.3771	4.4736	12.3736
7.9000	10	.3872	.6128	1.4567	9.3567
7.9000	11	.2299	.7701	.5859	8.4859
7.9000	12	.1301	.8699	.2507	8.1507
7.9000	13	.0700	.9300	.1085	8.0085
7.9000	14	.0358	.9642	.0464	7.9464
7.9000	15	.0174	.9826	.0194	7.9194
7.9000	16	.0081	.9919	.0079	7.9079
7.9500	8	.9798	.0202	155.7910	163.7410
7.9500	9	.6380	.3620	4.8307	12.7807
7.9500	10	.3981	.6019	1.5439	9.4939
7.9500	11	.2374	.7626	.6187	8.5687
7.9500	12	.1349	.8651	.2648	8.2148
7.9500	13	.0730	.9270	.1149	8.0649
7.9500	14	.0375	.9625	.0493	7.9993
7.9500	15	.0183	.9817	.0207	7.9707
7.9500	16	.0085	.9915	.0084	7.9584
8.0000	9	.6533	.3467	5.2266	13.2266
8.0000	10	.4092	.5908	1.6367	9.6367
8.0000	11	.2450	.7550	.6532	8.6532
8.0000	12	.1398	.8602	.2797	8.2797
8.0000	13	.0760	.9240	.1216	8.1216
8.0000	14	.0393	.9607	.0524	8.0524
8.0000	15	.0193	.9807	.0221	8.0221
8.0000	16	.0090	.9910	.0090	8.0090
8.0500	9	.6688	.3312	5.6675	13.7175
8.0500	10	.4204	.5796	1.7356	9.7856
8.0500	11	.2527	.7473	.6896	8.7396
8.0500	12	.1449	.8551	.2953	8.3453
8.0500	13	.0791	.9209	.1287	8.1787
8.0500	14	.0411	.9589	.0556	8.1056
8.0500	15	.0203	.9797	.0235	8.0735
8.0500	16	.0095	.9905	.0097	8.0597
8.1000	9	.6845	.3155	6.1608	14.2608
8.1000	10	.4319	.5681	1.8411	9.9411
8.1000	11	.2606	.7394	.7279	8.8279
8.1000	12	.1501	.8499	.3117	8.4117
8.1000	13	.0823	.9177	.1361	8.2361
8.1000	14	.0430	.9570	.0590	8.1590
8.1000	15	.0213	.9787	.0251	8.1251
8.1000	16	.0101	.9899	.0103	8.1103
8.1500	9	.7004	.2996	6.7159	14.8659
8.1500	10	.4435	.5565	1.9537	10.1037
8.1500	11	.2687	.7313	.7684	8.9184
8.1500	12	.1554	.8446	.3290	8.4790

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	ENS
8.1500	13	.0856	.9144	.1439	8.2939
8.1500	14	.0449	.9551	.0626	8.2126
8.1500	15	.0224	.9776	.0267	8.1767
8.1500	16	.0106	.9894	.0111	8.1611
8.2000	9	.7165	.2835	7.3444	15.5444
8.2000	10	.4553	.5447	2.0740	10.2740
8.2000	11	.2769	.7231	.8110	9.0110
8.2000	12	.1608	.8392	.3471	8.5471
8.2000	13	.0890	.9110	.1521	8.3521
8.2000	14	.0469	.9531	.0664	8.2664
8.2000	15	.0235	.9765	.0284	8.2284
8.2000	16	.0112	.9888	.0118	8.2118
8.2500	9	.7328	.2672	8.0609	16.3109
8.2500	10	.4672	.5328	2.2027	10.4527
8.2500	11	.2853	.7147	.8559	9.1059
8.2500	12	.1664	.8336	.3661	8.6161
8.2500	13	.0925	.9075	.1607	8.4107
8.2500	14	.0490	.9510	.0703	8.3203
8.2500	15	.0247	.9753	.0302	8.2802
8.2500	16	.0119	.9881	.0126	8.2626
8.3000	9	.7493	.2507	8.8845	17.1845
8.3000	10	.4794	.5206	2.3406	10.6406
8.3000	11	.2938	.7062	.9033	9.2033
8.3000	12	.1721	.8279	.3861	8.6861
8.3000	13	.0961	.9039	.1698	8.4698
8.3000	14	.0512	.9488	.0745	8.3745
8.3000	15	.0259	.9741	.0321	8.3321
8.3000	16	.0125	.9875	.0135	8.3135
8.3500	9	.7660	.2340	9.8397	18.1897
8.3500	10	.4917	.5083	2.4885	10.8385
8.3500	11	.3025	.6975	.9533	9.3033
8.3500	12	.1779	.8221	.4070	8.7570
8.3500	13	.0998	.9002	.1793	8.5293
8.3500	14	.0534	.9466	.0789	8.4289
8.3500	15	.0272	.9728	.0341	8.3841
8.3500	16	.0132	.9868	.0144	8.3644
8.4000	9	.7828	.2172	10.9597	19.3597
8.4000	10	.5043	.4957	2.6474	11.0474
8.4000	11	.3114	.6886	1.0061	9.4061
8.4000	12	.1839	.8161	.4291	8.8291
8.4000	13	.1036	.8964	.1893	8.5893
8.4000	14	.0557	.9443	.0835	8.4835
8.4000	15	.0285	.9715	.0363	8.4363
8.4000	16	.0139	.9861	.0153	8.4153
8.4500	9	.7999	.2001	12.2893	20.7393
8.4500	10	.5170	.4830	2.8183	11.2683
8.4500	11	.3204	.6796	1.0618	9.5118
8.4500	12	.1900	.8100	.4522	8.9022
8.4500	13	.1075	.8925	.1997	8.6497
8.4500	14	.0580	.9420	.0884	8.5384
8.4500	15	.0298	.9702	.0385	8.4885
8.4500	16	.0146	.9854	.0164	8.4664
8.5000	9	.8171	.1829	13.8914	22.3914
8.5000	10	.5299	.4701	3.0025	11.5025

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MULTI-CHANNEL QUEUING TABLE DATA

RHO	S	BP	IP	QL	TNS
8.5000	11	.3296	.6704	1.1207	9.6207
8.5000	12	.1962	.8038	.4765	8.9765
8.5000	13	.1115	.8885	.2107	8.7107
8.5000	14	.0605	.9395	.0935	8.5935
8.5000	15	.0312	.9688	.0409	8.5409
8.5000	16	.0154	.9846	.0174	8.5174
8.5500	9	.8346	.1654	15.8571	24.4071
8.5500	10	.5429	.4571	3.2014	11.7514
8.5500	11	.3390	.6610	1.1829	9.7329
8.5500	12	.2026	.7974	.5020	9.0520
8.5500	13	.1156	.8844	.2222	8.7722
8.5500	14	.0630	.9370	.0988	8.6488
8.5500	15	.0327	.9673	.0433	8.5933
8.5500	16	.0162	.9838	.0186	8.5686
8.6000	9	.8522	.1478	18.3226	26.9226
8.6000	10	.5562	.4438	3.4166	12.0166
8.6000	11	.3485	.6515	1.2487	9.8487
8.6000	12	.2091	.7909	.5288	9.1288
8.6000	13	.1199	.8801	.2343	8.8343
8.6000	14	.0656	.9344	.1044	8.7044
8.6000	15	.0342	.9658	.0460	8.6460
8.6000	16	.0170	.9830	.0198	8.6198
8.6500	9	.8700	.1300	21.5023	30.1523
8.6500	10	.5696	.4304	3.6498	12.2998
8.6500	11	.3581	.6419	1.3183	9.9683
8.6500	12	.2157	.7843	.5569	9.2069
8.6500	13	.1242	.8758	.2469	8.8969
8.6500	14	.0682	.9318	.1103	8.7603
8.6500	15	.0358	.9643	.0487	8.69[illegible]
8.6500	16	.0179	.9821	.0210	8.6710
8.7000	9	.8880	.1120	25.7532	34.4532
8.7000	10	.5832	.4168	3.9032	12.6032
8.7000	11	.3680	.6320	1.3919	10.0919
8.7000	12	.2225	.7775	.5865	9.2865
8.7000	13	.1286	.8714	.2602	8.9602
8.7000	14	.0710	.9290	.1165	8.8165
8.7000	15	.0374	.9626	.0516	8.7516
8.7000	16	.0188	.9812	.0224	8.7224
8.7500	9	.9062	.0938	31.7183	40.4683
8.7500	10	.5970	.4030	4.1792	12.9292
8.7500	11	.3780	.6220	1.4699	10.2199
8.7500	12	.2294	.7706	.6175	9.3675
8.7500	13	.1331	.8669	.2741	9.0241
8.7500	14	.0738	.9262	.1230	8.8730
8.7500	15	.0390	.9610	.0546	8.8046
8.7500	16	.0197	.9803	.0238	8.7738
8.8000	9	.9246	.0754	40.6832	49.4832
8.8000	10	.6110	.3890	4.4807	13.2807
8.8000	11	.3881	.6119	1.5526	10.3526
8.8000	12	.2364	.7636	.6502	9.4502
8.8000	13	.1378	.8622	.2887	9.0887
8.8000	14	.0767	.9233	.1298	8.9298
8.8000	15	.0408	.9592	.0578	8.8578
8.8000	16	.0207	.9793	.0252	8.8252

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RP	TP	QL	TNS
8.8500	9	.9432	.0568	55.6481	64.4981
8.8500	10	.6252	.3748	4.8111	13.6611
8.8500	11	.3985	.6015	1.6403	10.4903
8.8500	12	.2436	.7564	.6844	9.5344
8.8500	13	.1425	.8575	.3040	9.1540
8.8500	14	.0797	.9203	.1370	8.9870
8.8500	15	.0425	.9575	.0612	8.9112
8.8500	16	.0217	.9783	.0268	8.8768
8.9000	9	.9619	.0381	85.6127	94.5127
8.9000	10	.6395	.3605	5.1742	14.0742
8.9000	11	.4090	.5910	1.7333	10.6333
8.9000	12	.2509	.7491	.7205	9.6205
8.9000	13	.1474	.8526	.3200	9.2200
8.9000	14	.0828	.9172	.1444	9.0444
8.9000	15	.0444	.9556	.0647	8.9647
8.9000	16	.0227	.9773	.0285	8.9285
8.9500	9	.9809	.0191	175.5773	184.5273
8.9500	10	.6540	.3460	5.5748	14.5248
8.9500	11	.4196	.5804	1.8321	10.7821
8.9500	12	.2584	.7416	.7583	9.7083
8.9500	13	.1524	.8476	.3368	9.2868
8.9500	14	.0859	.9141	.1523	9.1023
8.9500	15	.0463	.9537	.0685	9.0185
8.9500	16	.0238	.9762	.0302	8.9802
9.0000	10	.6687	.3313	6.0186	15.0186
9.0000	11	.4305	.5695	1.9371	10.9371
9.0000	12	.2660	.7340	.7981	9.7981
9.0000	13	.1575	.8425	.3544	9.3544
9.0000	14	.0892	.9108	.1605	9.1605
9.0000	15	.0482	.9518	.0724	9.0724
9.0000	16	.0249	.9751	.0320	9.0320
9.0500	10	.6836	.3164	6.5123	15.5623
9.0500	11	.4415	.5585	2.0489	11.0989
9.0500	12	.2738	.7262	.8399	9.8899
9.0500	13	.1627	.8373	.3728	9.4228
9.0500	14	.0925	.9075	.1691	9.2191
9.0500	15	.0503	.9497	.0764	9.1264
9.0500	16	.0261	.9739	.0339	9.0839
9.1000	10	.6987	.3013	7.0644	16.1644
9.1000	11	.4526	.5474	2.1678	11.2678
9.1000	12	.2817	.7183	.8840	9.9840
9.1000	13	.1681	.8319	.3921	9.4921
9.1000	14	.0959	.9041	.1782	9.2782
9.1000	15	.0523	.9477	.0807	9.1807
9.1000	16	.0273	.9727	.0360	9.1360
9.1500	10	.7139	.2861	7.6851	16.8351
9.1500	11	.4640	.5360	2.2947	11.4447
9.1500	12	.2897	.7103	.9302	10.0802
9.1500	13	.1735	.8265	.4124	9.5624
9.1500	14	.0994	.9006	.1876	9.3376
9.1500	15	.0545	.9455	.0852	9.2352
9.1500	16	.0285	.9715	.0381	9.1881
9.2000	10	.7293	.2707	8.3873	17.5873
9.2000	11	.4755	.5245	2.4801	11.6301

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RF	IF	QL	TNS
9.2000	12	.2979	.7021	.9790	10.1790
9.2000	13	.1791	.8209	.4336	9.6336
9.2000	14	.1031	.8969	.1975	9.3975
9.2000	15	.0567	.9433	.0899	9.2899
9.2000	16	.0298	.9702	.0403	9.2403
9.2500	10	.7449	.2551	9.1875	18.4375
9.2500	11	.4871	.5129	2.5747	11.8247
9.2500	12	.3063	.6937	1.0302	10.2802
9.2500	13	.1848	.8152	.4558	9.7058
9.2500	14	.1067	.8933	.2079	9.4579
9.2500	15	.0590	.9410	.0949	9.3449
9.2500	16	.0312	.9688	.0427	9.2927
9.3000	10	.7607	.2393	10.1066	19.4066
9.3000	11	.4989	.5011	2.7295	12.0295
9.3000	12	.3148	.6852	1.0842	10.3842
9.3000	13	.1906	.8094	.4790	9.7790
9.3000	14	.1105	.8895	.2187	9.5187
9.3000	15	.0613	.9387	.1001	9.4001
9.3000	16	.0325	.9675	.0452	9.3452
9.3500	10	.7767	.2233	11.1720	20.5220
9.3500	11	.5109	.4891	2.8953	12.2453
9.3500	12	.3234	.6766	1.1411	10.4911
9.3500	13	.1965	.8035	.5034	9.8534
9.3500	14	.1144	.8856	.2301	9.5801
9.3500	15	.0638	.9362	.1055	9.4555
9.3500	16	.0340	.9660	.0478	9.3978
9.4000	10	.7928	.2072	12.4204	21.8204
9.4000	11	.5231	.4769	3.0732	12.4732
9.4000	12	.3322	.6678	1.2010	10.6010
9.4000	13	.2026	.7974	.5290	9.9290
9.4000	14	.1184	.8816	.2420	9.6420
9.4000	15	.0662	.9338	.1112	9.5112
9.4000	16	.0354	.9646	.0505	9.4505
9.4500	10	.8091	.1909	13.9018	23.3518
9.4500	11	.5354	.4646	3.2644	12.7144
9.4500	12	.3411	.6589	1.2642	10.7142
9.4500	13	.2088	.7912	.5557	10.0057
9.4500	14	.1225	.8775	.2544	9.7044
9.4500	15	.0688	.9312	.1172	9.5672
9.4500	16	.0370	.9630	.0533	9.5033
9.5000	10	.8256	.1744	15.6861	25.1861
9.5000	11	.5479	.4521	3.4703	12.9703
9.5000	12	.3502	.6498	1.3308	10.8308
9.5000	13	.2151	.7849	.5838	10.0838
9.5000	14	.1267	.8733	.2674	9.7674
9.5000	15	.0714	.9286	.1234	9.6234
9.5000	16	.0386	.9614	.0563	9.5563
9.5500	10	.8422	.1578	17.8743	27.4243
9.5500	11	.5606	.4394	3.6922	13.2422
9.5500	12	.3595	.6405	1.4011	10.9511
9.5500	13	.2215	.7785	.6132	10.1632
9.5500	14	.1310	.8690	.2810	9.8310
9.5500	15	.0742	.9258	.1299	9.6799
9.5500	16	.0402	.9598	.0595	9.6095

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
9.6000	10	.8591	.1409	20.6179	30.2179
9.6000	11	.5734	.4266	3.9321	13.5321
9.6000	12	.3688	.6312	1.4754	11.0754
9.6000	13	.2281	.7719	.6440	10.2440
9.6000	14	.1353	.8647	.2953	9.8953
9.6000	15	.0769	.9231	.1368	9.7368
9.6000	16	.0419	.9581	.0628	9.6628
9.6500	10	.8761	.1239	24.1551	33.8051
9.6500	11	.5864	.4136	4.1919	13.8419
9.6500	12	.3784	.6216	1.5538	11.2038
9.6500	13	.2348	.7652	.6763	10.3263
9.6500	14	.1398	.8602	.3102	9.9602
9.6500	15	.0798	.9202	.1439	9.7939
9.6500	16	.0436	.9564	.0663	9.7163
9.7000	10	.8933	.1067	28.8825	38.5825
9.7000	11	.5996	.4004	4.4740	14.1740
9.7000	12	.3881	.6119	1.6366	11.3366
9.7000	13	.2416	.7584	.7101	10.4101
9.7000	14	.1444	.8556	.3257	10.0257
9.7000	15	.0827	.9173	.1514	9.8514
9.7000	16	.0454	.9546	.0699	9.7699
9.7500	10	.9106	.0894	35.5146	45.2646
9.7500	11	.6129	.3871	4.7809	14.5309
9.7500	12	.3979	.6021	1.7243	11.4743
9.7500	13	.2485	.7515	.7456	10.4956
9.7500	14	.1491	.8509	.3420	10.0920
9.7500	15	.0857	.9143	.1592	9.9092
9.7500	16	.0472	.9528	.0737	9.823[illegible]
9.8000	10	.9282	.0718	45.4799	55.2799
9.8000	11	.6264	.3736	5.1159	14.9159
9.8000	12	.4079	.5921	1.8170	11.6170
9.8000	13	.2556	.7444	.7829	10.5829
9.8000	14	.1539	.8461	.3591	10.1591
9.8000	15	.0888	.9112	.1674	9.9674
9.8000	16	.0491	.9509	.0777	9.8777
9.8500	10	.9459	.0541	62.1117	71.9617
9.8500	11	.6401	.3599	5.4827	15.3327
9.8500	12	.4180	.5820	1.9152	11.7652
9.8500	13	.2628	.7372	.8219	10.6719
9.8500	14	.1588	.8412	.3769	10.2269
9.8500	15	.0920	.9080	.1760	10.0260
9.8500	16	.0511	.9489	.0818	9.9318
9.9000	10	.9637	.0363	95.4101	105.3101
9.9000	11	.6539	.3461	5.8855	15.7855
9.9000	12	.4283	.5717	2.0193	11.9193
9.9000	13	.2702	.7298	.8628	10.7628
9.9000	14	.1638	.8362	.3955	10.2955
9.9000	15	.0953	.9047	.1849	10.0849
9.9000	16	.0531	.9469	.0862	9.9862
9.9500	10	.9818	.0182	195.3750	205.3250
9.9500	11	.6679	.3321	6.3296	16.2796
9.9500	12	.4388	.5612	2.1297	12.0797
9.9500	13	.2777	.7223	.9058	10.8558
9.9500	14	.1689	.8311	.4150	10.3650

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RP	TP	QL	TNS
9.9500	15	.0986	.9014	.1943	10.1443
9.9500	16	.0552	.9448	.0908	10.0408
10.0000	11	.6821	.3179	6.8212	16.8212
10.0000	12	.4494	.5506	2.2469	12.2469
10.0000	13	.2853	.7147	.9509	10.9509
10.0000	14	.1741	.8259	.4353	10.4353
10.0000	15	.1020	.8980	.2041	10.2041
10.0000	16	.0573	.9427	.0956	10.0956
10.0500	11	.6965	.3035	7.3677	17.4177
10.0500	12	.4601	.5399	2.3715	12.4215
10.0500	13	.2930	.7070	.9982	11.0482
10.0500	14	.1795	.8205	.4566	10.5066
10.0500	15	.1056	.8944	.2143	10.2643
10.0500	16	.0595	.9405	.1006	10.1506
10.1000	11	.7110	.2890	7.9785	18.0785
10.1000	12	.4711	.5289	2.5040	12.6040
10.1000	13	.3009	.6991	1.0479	11.1479
10.1000	14	.1849	.8151	.4789	10.5789
10.1000	15	.1091	.8909	.2250	10.3250
10.1000	16	.0618	.9382	.1058	10.2058
10.1500	11	.7256	.2744	8.6648	18.8148
10.1500	12	.4821	.5179	2.6451	12.7951
10.1500	13	.3089	.6911	1.1001	11.2501
10.1500	14	.1905	.8095	.5022	10.6522
10.1500	15	.1128	.8872	.2361	10.3861
10.1500	16	.0641	.9359	.1113	10.2613
10.2000	11	.7405	.2595	9.4408	19.6408
10.2000	12	.4933	.5067	2.7956	12.9956
10.2000	13	.3171	.6829	1.1550	11.3550
10.2000	14	.1961	.8039	.5265	10.7265
10.2000	15	.1166	.8834	.2478	10.4478
10.2000	16	.0665	.9335	.1170	10.3170
10.2500	11	.7555	.2445	10.3245	20.5745
10.2500	12	.5047	.4953	2.9562	13.2062
10.2500	13	.3253	.6747	1.2127	11.4627
10.2500	14	.2019	.7981	.5519	10.8019
10.2500	15	.1205	.8795	.2600	10.5100
10.2500	16	.0690	.9310	.1230	10.3730
10.3000	11	.7706	.2294	11.3390	21.6390
10.3000	12	.5162	.4838	3.1278	13.4278
10.3000	13	.3338	.6662	1.2733	11.5733
10.3000	14	.2078	.7922	.5786	10.8786
10.3000	15	.1244	.8756	.2727	10.5727
10.3000	16	.0715	.9285	.1292	10.4292
10.3500	11	.7859	.2141	12.5146	22.8646
10.3500	12	.5279	.4721	3.3115	13.6615
10.3500	13	.3423	.6577	1.3370	11.6870
10.3500	14	.2138	.7862	.6064	10.9564
10.3500	15	.1285	.8715	.2859	10.6359
10.3500	16	.0741	.9259	.1358	10.4858
10.4000	11	.8014	.1986	13.8915	24.2915
10.4000	12	.5398	.4602	3.5084	13.9084
10.4000	13	.3510	.6490	1.4041	11.8041
10.4000	14	.2200	.7800	.6355	11.0355

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RP	IP	QL	TNS
10.4000	15	.1326	.8674	.2998	10.6998
10.4000	16	.0768	.9232	.1426	10.5426
10.4500	11	.8171	.1829	15.5247	25.9747
10.4500	12	.5518	.4482	3.7199	14.1699
10.4500	13	.3599	.6401	1.4748	11.9248
10.4500	14	.2262	.7738	.6659	11.1159
10.4500	15	.1368	.8632	.3143	10.7643
10.4500	16	.0795	.9205	.1497	10.5997
10.5000	11	.8329	.1671	17.4910	27.9910
10.5000	12	.5639	.4361	3.9473	14.4473
10.5000	13	.3688	.6312	1.5492	12.0492
10.5000	14	.2326	.7674	.6978	11.1978
10.5000	15	.1412	.8588	.3294	10.8294
10.5000	16	.0823	.9177	.1572	10.6572
10.5500	11	.8489	.1511	19.9017	30.4517
10.5500	12	.5762	.4238	4.1924	14.7424
10.5500	13	.3780	.6220	1.6276	12.1776
10.5500	14	.2391	.7609	.7311	11.2811
10.5500	15	.1456	.8544	.3451	10.8951
10.5500	16	.0852	.9148	.1649	10.7149
10.6000	11	.8650	.1350	22.9234	33.5234
10.6000	12	.5887	.4113	4.4570	15.0570
10.6000	13	.3872	.6128	1.7102	12.3102
10.6000	14	.2457	.7543	.7660	11.3660
10.6000	15	.1501	.8499	.3616	10.9616
10.6000	16	.0882	.9118	.1730	10.7730
10.6500	11	.8813	.1187	26.8179	37.4679
10.6500	12	.6013	.3987	4.7434	15.3934
10.6500	13	.3966	.6034	1.7974	12.4474
10.6500	14	.2524	.7476	.8024	11.4524
10.6500	15	.1547	.8453	.3787	11.0287
10.6500	16	.0912	.9088	.1815	10.8315
10.7000	11	.8978	.1022	32.0219	42.7219
10.7000	12	.6140	.3860	5.0540	15.7540
10.7000	13	.4062	.5938	1.8895	12.5895
10.7000	14	.2593	.7407	.8406	11.5406
10.7000	15	.1594	.8406	.3967	11.0967
10.7000	16	.0943	.9057	.1903	10.8903
10.7500	11	.9144	.0856	39.3209	50.0709
10.7500	12	.6270	.3730	5.3919	16.1419
10.7500	13	.4158	.5842	1.9868	~~12.7368~~
10.7500	14	.2662	.7338	.8806	11.6306
10.7500	15	.1642	.8358	.4154	11.1654
10.7500	16	.0975	.9025	.1996	10.9496
10.8000	11	.9312	.0688	50.2865	61.0865
10.8000	12	.6400	.3600	5.7604	16.5604
10.8000	13	.4257	.5743	2.0896	12.8896
10.8000	14	.2733	.7267	.9224	11.7224
10.8000	15	.1691	.8309	.4349	11.2349
10.8000	16	.1007	.8993	.2092	11.0092
10.8500	11	.9482	.0518	68.5853	79.4353
10.8500	12	.6533	.3467	6.1635	17.0135
10.8500	13	.4356	.5644	2.1983	13.0483
10.8500	14	.2805	.7195	.9663	11.8163

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	TP	QL	TNS
10.8500	11	.9482	.0518	68.5853	79.4353
10.8500	12	.6533	.3467	6.1635	17.0135
10.8500	13	.4356	.5644	2.1983	13.0483
10.8500	14	.2805	.7195	.9663	11.8163
10.8500	15	.1741	.8259	.4553	11.3053
10.8500	16	.1041	.8959	.2192	11.0692
10.9000	11	.9653	.0347	105.2173	116.1173
10.9000	12	.6667	.3333	6.6060	17.5060
10.9000	13	.4457	.5543	2.3135	13.2135
10.9000	14	.2879	.7121	1.0122	11.9122
10.9000	15	.1793	.8207	.4766	11.3766
10.9000	16	.1075	.8925	.2297	11.1297
10.9500	11	.9826	.0174	215.1825	226.1325
10.9500	12	.6802	.3198	7.0936	18.0436
10.9500	13	.4560	.5440	2.4355	13.3855
10.9500	14	.2953	.7047	1.0603	12.0103
10.9500	15	.1845	.8155	.4988	11.4488
10.9500	16	.1110	.8890	.2406	11.1906
11.0000	12	.6939	.3061	7.6329	18.6329
11.0000	13	.4664	.5336	2.5650	13.5650
11.0000	14	.3029	.6971	1.1107	12.1107
11.0000	15	.1898	.8102	.5219	11.5219
11.0000	16	.1145	.8855	.2520	11.2520
11.0500	12	.7078	.2922	8.2323	19.2823
11.0500	13	.4769	.5231	2.7024	13.7524
11.0500	14	.3106	.6894	1.1636	12.2136
11.0500	15	.1952	.8048	.5461	11.5961
11.0500	16	.1182	.8818	.2639	11.3139
11.1000	12	.7218	.2782	8.9017	20.0017
11.1000	13	.4876	.5124	2.8484	13.9484
11.1000	14	.3185	.6815	1.2190	12.3190
11.1000	15	.2008	.7992	.5714	11.6714
11.1000	16	.1219	.8781	.2762	11.3762
11.1500	12	.7359	.2641	9.6535	20.8035
11.1500	13	.4984	.5016	3.0038	14.1538
11.1500	14	.3264	.6736	1.2771	12.4271
11.1500	15	.2064	.7936	.5977	11.7477
11.1500	16	.1258	.8742	.2891	11.4391
11.2000	12	.7502	.2498	10.5033	21.7033
11.2000	13	.5094	.4906	3.1693	14.3693
11.2000	14	.3345	.6655	1.3381	12.5381
11.2000	15	.2121	.7879	.6252	11.8252
11.2000	16	.1297	.8703	.3026	11.5026
11.2500	12	.7647	.2353	11.4705	22.7205
11.2500	13	.5205	.4795	3.3458	14.5958
11.2500	14	.3428	.6572	1.4022	12.6522
11.2500	15	.2180	.7820	.6540	11.9040
11.2500	16	.1337	.8663	.3166	11.5666
11.3000	12	.7793	.2207	12.5805	23.8805
11.3000	13	.5317	.4683	3.5343	14.8343
11.3000	14	.3511	.6489	1.4694	12.7694
11.3000	15	.2239	.7761	.6840	11.9840
11.3000	16	.1378	.8622	.3312	11.6312
11.3500	12	.7941	.2059	13.8662	25.2162

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
11.3500	13	.5431	.4569	3.7359	15.0859
11.3500	14	.3596	.6404	1.5401	12.8901
11.3500	15	.2300	.7700	.7153	12.0653
11.3500	16	.1419	.8581	.3464	11.6964
11.4000	12	.8090	.1910	15.3715	26.7715
11.4000	13	.5546	.4454	3.9518	15.3518
11.4000	14	.3682	.6318	1.6144	13.0144
11.4000	15	.2362	.7638	.7480	12.1480
11.4000	16	.1462	.8538	.3623	11.7623
11.4500	12	.8241	.1759	17.1564	28.6064
11.4500	13	.5663	.4337	4.1835	15.6335
11.4500	14	.3769	.6231	1.6925	13.1425
11.4500	15	.2425	.7575	.7821	12.2321
11.4500	16	.1505	.8495	.3788	11.8288
11.5000	12	.8393	.1607	19.3048	30.8048
11.5000	13	.5782	.4218	4.4325	15.9325
11.5000	14	.3858	.6142	1.7746	13.2746
11.5000	15	.2489	.7511	.8178	12.3178
11.5000	16	.1550	.8450	.3961	11.8961
11.5500	12	.8547	.1453	21.9379	33.4879
11.5500	13	.5901	.4099	4.7007	16.2507
11.5500	14	.3948	.6052	1.8611	13.4111
11.5500	15	.2554	.7446	.8551	12.4051
11.5500	16	.1595	.8405	.4140	11.9640
11.6000	12	.8703	.1297	25.2376	36.8376
11.6000	13	.6022	.3978	4.9900	16.5900
11.6000	14	.4039	.5961	1.9523	13.5523
11.6000	15	.2620	.7380	.8940	12.4940
11.6000	16	.1641	.8359	.4327	12.0327
11.6500	12	.8860	.1140	29.4895	41.1395
11.6500	13	.6145	.3855	5.3030	16.9530
11.6500	14	.4132	.5868	2.0483	13.6983
11.6500	15	.2688	.7312	.9347	12.5847
11.6500	16	.1689	.8311	.4522	12.1022
11.7000	12	.9018	.0982	35.1699	46.8699
11.7000	13	.6269	.3731	5.6422	17.3422
11.7000	14	.4226	.5774	2.1496	13.8496
11.7000	15	.2756	.7244	.9772	12.6772
11.7000	16	.1737	.8263	.4726	12.1726
11.7500	12	.9178	.0822	43.1359	54.8859
11.7500	13	.6395	.3605	6.0110	17.7610
11.7500	14	.4321	.5679	2.2565	14.0065
11.7500	15	.2826	.7174	1.0217	12.7717
11.7500	16	.1786	.8214	.4937	12.2437
11.8000	12	[illegible]339	.0661	55.1017	66.9017
11.8000	13	[illegible]522	.3478	6.4129	18.2129
11.8000	14	.4417	.5583	2.3694	14.1694
11.8000	15	.2897	.7103	1.0682	12.8682
11.8000	16	.1836	.8164	.5158	12.3158
11.8500	12	.9502	.0498	75.0675	86.9175
11.8500	13	.6650	.3350	6.8524	18.7024
11.8500	14	.4515	.5485	2.4887	14.3387
11.8500	15	.2969	.7031	1.1169	12.9669
11.8500	16	.1887	.8113	.5388	12.3888

[redacted] **POOR PRINT**

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
11.9000	12	.9667	.0333	115.0331	126.9331
11.9000	13	.6780	.3220	7.3346	19.2346
11.9000	14	.4615	.5385	2.6149	14.5149
11.9000	15	.3042	.6958	1.1677	13.0677
11.9000	16	.1939	.8061	.5627	12.4627
11.9500	12	.9833	.0167	234.9986	246.9486
11.9500	13	.6911	.3089	7.8655	19.8155
11.9500	14	.4715	.5285	2.7486	14.6986
11.9500	15	.3116	.6884	1.2210	13.1710
11.9500	16	.1992	.8008	.5877	12.5377
12.0000	13	.7044	.2956	8.4527	20.4527
12.0000	14	.4817	.5183	2.8902	14.8902
12.0000	15	.3192	.6808	1.2768	13.2768
12.0000	16	.2046	.7954	.6137	12.6137
12.0500	13	.7178	.2822	9.1048	21.1548
12.0500	14	.4920	.5080	3.0405	15.0905
12.0500	15	.3269	.6731	1.3351	13.3851
12.0500	16	.2101	.7899	.6408	12.6908
12.1000	13	.7314	.2686	9.8328	21.9328
12.1000	14	.5025	.4975	3.2000	15.3000
12.1000	15	.3347	.6653	1.3963	13.4963
12.1000	16	.2157	.7843	.6691	12.7691
12.1500	13	.7451	.2549	10.6502	22.8002
12.1500	14	.5131	.4869	3.3697	15.5197
12.1500	15	.3426	.6574	1.4604	13.6104
12.1500	16	.2214	.7786	.6986	12.8486
12.2000	13	.7589	.2411	11.5736	23.7736
12.2000	14	.5238	.4762	3.5502	15.7502
12.2000	15	.3506	.6494	1.5276	13.7276
12.2000	16	.2272	.7728	.7293	12.9293
12.2500	13	.7729	.2271	12.6244	24.8744
12.2500	14	.5347	.4653	3.7426	15.9926
12.2500	15	.3587	.6413	1.5980	13.8480
12.2500	16	.2331	.7669	.7613	13.0113
12.3000	13	.7871	.2129	13.8298	26.1298
[illegible]	14	.5457	.4543	3.9480	16.2480
[illegible]	15	.3670	.6330	1.6719	13.9719
[illegible]	16	.2391	.7609	.7947	13.0947
[illegible]	13	.8013	.1987	15.2255	27.5755
[illegible]	14	.5568	.4432	4.1675	16.5175
12.3500	15	.3754	.6246	1.7495	14.0995
12.3500	16	.2452	.7548	.8295	13.1795
12.4000	13	.8158	.1842	16.8592	29.2592
12.4000	14	.5681	.4319	4.4024	16.8024
12.4000	15	.3839	.6161	1.8310	14.2310
12.4000	16	.2514	.7486	.8658	13.2658
12.4500	13	.8303	.1697	18.7959	31.2459
12.4500	14	.5795	.4205	4.6543	17.1043
12.4500	15	.3925	.6075	1.9165	14.3665
12.4500	16	.2577	.7423	.9037	13.3537
12.5000	13	.8451	.1549	21.1263	33.6263
12.5000	14	.5910	.4090	4.9249	17.4249
12.5000	15	.4013	.5987	2.0065	14.5065
12.5000	16	.2641	.7359	.9432	13.4432

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
12.5500	13	.8599	.1401	23.9818	36.5318
12.5500	14	.6027	.3973	5.2161	17.7661
12.5500	15	.4102	.5898	2.1011	14.6511
12.5500	16	.2706	.7294	.9845	13.5345
12.6000	13	.8749	.1251	27.5595	40.1595
12.6000	14	.6145	.3855	5.5302	18.1302
12.6000	15	.4192	.5808	2.2007	14.8007
12.6000	16	.2773	.7227	1.0275	13.6275
12.6500	13	.8900	.1100	32.1688	44.8188
12.6500	14	.6264	.3736	5.8697	18.5197
12.6500	15	.4283	.5717	2.3056	14.9556
12.6500	16	.2840	.7160	1.0724	13.7224
12.7000	13	.9053	.0947	38.3256	51.0256
12.7000	14	.6385	.3615	6.2375	18.9375
12.7000	15	.4376	.5624	2.4161	15.1161
12.7000	16	.2909	.7091	1.1194	13.8194
12.7500	13	.9208	.0792	46.9584	59.7084
12.7500	14	.6507	.3493	6.6371	19.3871
12.7500	15	.4469	.5531	2.5326	15.2826
12.7500	16	.2978	.7022	1.1684	13.9184
12.8000	13	.9363	.0637	59.9245	72.7245
12.8000	14	.6630	.3370	7.0725	19.8725
12.8000	15	.4564	.5436	2.6556	15.4556
12.8000	16	.3049	.6951	1.2195	14.0195
12.8500	13	.9520	.0480	81.5571	94.4071
12.8500	14	.6755	.3245	7.5483	20.3983
12.8500	15	.4661	.5339	2.7855	15.6355
12.8500	16	.3121	.6879	1.2730	14.1230
12.9000	13	.9679	.0321	124.8563	137.7563
12.9000	14	.6882	.3118	8.0702	20.9702
12.9000	15	.4758	.5242	2.9228	15.8228
12.9000	16	.3193	.6807	1.3289	14.2289
12.9500	13	.9839	.0161	254.8220	267.7720
12.9500	14	.7009	.2991	8.6445	21.5945
12.9500	15	.4857	.5143	3.0681	16.0181
12.9500	16	.3267	.6733	1.3873	14.3373
13.0000	14	.7138	.2862	9.2794	22.2794
13.0000	15	.4957	.5043	3.2219	16.2219
13.0000	16	.3343	.6657	1.4484	14.4484
13.0500	14	.7268	.2732	9.9843	23.0343
13.0500	15	.5058	.4942	3.3850	16.4350
13.0500	16	.3419	.6581	1.5124	14.5624
13.1000	14	.7400	.2600	10.7710	23.8710
13.1000	15	.5161	.4839	3.5581	16.6581
13.1000	16	.3496	.6504	1.5793	14.6793
13.1500	14	.7533	.2467	11.6539	24.8039
13.1500	15	.5264	.4736	3.7420	16.8920
13.1500	16	.3575	.6425	1.6493	14.7993
13.2000	14	.7667	.2333	12.6510	25.8510
13.2000	15	.5369	.4631	3.9376	17.1376
13.2000	16	.3654	.6346	1.7227	14.9227
13.2500	14	.7803	.2197	13.7852	27.0352
13.2500	15	.5476	.4524	4.1459	17.3959
13.2500	16	.3735	.6265	1.7996	15.0496

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
13.3000	14	.7940	.2060	15.0860	28.3860
13.3000	15	.5583	.4417	4.3681	17.6681
13.3000	16	.3817	.6183	1.8801	15.1801
13.3500	14	.8078	.1922	16.5918	29.9418
13.3500	15	.5692	.4308	4.6054	17.9554
13.3500	16	.3900	.6100	1.9646	15.3146
13.4000	14	.8218	.1782	18.3539	31.7539
13.4000	15	.5802	.4198	4.8594	18.2594
13.4000	16	.3984	.6016	2.0533	15.4533
13.4500	14	.8359	.1641	20.4422	33.8922
13.4500	15	.5914	.4086	5.1315	18.5815
13.4500	16	.4069	.5931	2.1464	15.5964
13.5000	14	.8502	.1498	22.9546	36.4546
13.5000	15	.6026	.3974	5.4237	18.9237
13.5000	16	.4156	.5844	2.2441	15.7441
13.5500	14	.8646	.1354	26.0326	39.5826
13.5500	15	.6140	.3860	5.7379	19.2879
13.5500	16	.4243	.5757	2.3469	15.8969
13.6000	14	.8791	.1209	29.8882	43.4882
13.6000	15	.6255	.3745	6.0767	19.6767
13.6000	16	.4332	.5668	2.4549	16.0549
13.6500	14	.8937	.1063	34.8548	48.5048
13.6500	15	.6372	.3628	6.4427	20.0927
13.6500	16	.4422	.5578	2.5686	16.2186
13.7000	14	.9085	.0915	41.4880	55.1880
13.7000	15	.6490	.3510	6.8392	20.5392
13.7000	16	.4513	.5487	2.6884	16.3884
13.7500	14	.9234	.0766	50.7877	64.5377
13.7500	15	.6609	.3391	7.2696	21.0196
13.7500	16	.4606	.5394	2.8145	16.5645
13.8000	14	.9385	.0615	64.7540	78.5540
13.8000	15	.6729	.3271	7.7384	21.5384
13.8000	16	.4699	.5301	2.9476	16.7476
13.8500	14	.9536	.0464	88.0535	101.9035
13.8500	15	.6851	.3149	8.2506	22.1006
13.8500	16	.4794	.5206	3.0881	16.9381
13.9000	14	.9690	.0310	134.6862	148.5862
13.9000	15	.6974	.3026	8.8121	22.7121
13.9000	16	.4890	.5110	3.2364	17.1364
13.9500	14	.9844	.0156	274.6521	288.6021
13.9500	15	.7098	.2902	9.4299	23.3799
13.9500	16	.4987	.5013	3.3933	17.3433
14.0000	15	.7223	.2777	10.1125	24.1125
14.0000	16	.5085	.4915	3.5594	17.5594
14.0500	15	.7350	.2650	10.8701	24.9201
14.0500	16	.5184	.4816	3.7353	17.7853
14.1000	15	.7478	.2522	11.7154	25.8154
14.1000	16	.5285	.4715	3.9219	18.0219
14.1500	15	.7607	.2393	12.6637	26.8137
14.1500	16	.5387	.4613	4.1200	18.2700
14.2000	15	.7738	.2262	13.7345	27.9345
14.2000	16	.5490	.4510	4.3307	18.5307
14.2500	15	.7870	.2130	14.9522	29.2022
14.2500	16	.5594	.4406	4.5549	18.8049

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
14.3000	15	.8003	.1997	16.3484	30.6484
14.3000	16	.5699	.4301	4.7939	19.0939
14.3500	15	.8137	.1863	17.9642	32.3142
14.3500	16	.5806	.4194	5.0492	19.3992
14.4000	15	.8273	.1727	19.8547	34.2547
14.4000	16	.5913	.4087	5.3221	19.7221
14.4500	15	.8410	.1590	22.0946	36.5446
14.4500	16	.6022	.3978	5.6144	20.0644
14.5000	15	.8548	.1452	24.7891	39.2891
14.5000	16	.6133	.3867	5.9282	20.4282
14.5500	15	.8687	.1313	28.0894	42.6394
14.5500	16	.6244	.3756	6.2655	20.8155
14.6000	15	.8828	.1172	32.2230	46.8230
14.6000	16	.6357	.3643	6.6290	21.2290
14.6500	15	.8970	.1030	37.5469	52.1969
14.6500	16	.6470	.3530	7.0215	21.6715
14.7000	15	.9114	.0886	44.6564	59.3564
14.7000	16	.6585	.3415	7.4465	22.1465
14.7500	15	.9258	.0742	54.6230	69.3730
14.7500	16	.6702	.3298	7.9078	22.6578
14.8000	15	.9404	.0596	69.5895	84.3895
14.8000	16	.6819	.3181	8.4101	23.2101
14.8500	15	.9551	.0449	94.5558	109.4058
14.8500	16	.6938	.3062	8.9586	23.8086
14.9000	15	.9699	.0301	144.5220	159.4220
14.9000	16	.7057	.2943	9.5596	24.4596
14.9500	15	.9849	.0151	294.4882	309.4382
14.9500	16	.7178	.2822	10.2208	25.1708
15.0000	16	.7301	.2699	10.9511	25.9511
15.0500	16	.7424	.2576	11.7615	26.8115
15.1000	16	.7549	.2451	12.6654	27.7654
15.1500	16	.7675	.2325	13.6792	28.8292
15.2000	16	.7802	.2198	14.8237	30.0237
15.2500	16	.7930	.2070	16.1248	31.3748
15.3000	16	.8060	.1940	17.6164	32.9164
15.3500	16	.8191	.1809	19.3422	34.6922
15.4000	16	.8322	.1678	21.3610	36.7610
15.4500	16	.8456	.1544	23.7526	39.2026
15.5000	16	.8590	.1410	26.6290	42.1290
15.5500	16	.8726	.1274	30.1517	45.7017
15.6000	16	.8862	.1138	34.5632	50.1632
15.6500	16	.9000	.1000	40.2444	55.8944
15.7000	16	.9140	.0860	47.8303	63.5303
15.7000	17	.9058	.0942	10.9390	26.6390
15.7500	16	.9280	.0720	58.4637	74.2137
15.7500	17	.9101	.0899	11.4672	27.2172
15.8000	16	.9422	.0578	74.4303	90.2303
15.8000	17	.9143	.0857	12.0389	27.8389
15.8500	16	.9564	.0436	101.0635	116.9135
15.8500	17	.9185	.0815	12.6599	28.5099
15.9000	16	.9708	.0292	154.3632	170.2632
15.9000	17	.9227	.0773	13.3368	29.2368
15.9500	16	.9854	.0146	314.3295	330.2795
15.9500	17	.9267	.0733	14.0777	30.0277

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
16.0000	17	.9308	.0692	14.8922	30.8922
16.0500	17	.9347	.0653	15.7919	31.8419
16.1000	17	.9386	.0614	16.7910	32.8910
16.1500	17	.9425	.0575	17.9070	34.0570
16.2000	17	.9463	.0537	19.1619	35.3619
16.2500	17	.9500	.0500	20.5834	36.8334
16.3000	17	.9537	.0463	22.2073	38.5073
16.3500	17	.9573	.0427	24.0803	40.4303
16.4000	17	.9609	.0391	26.2645	42.6645
16.4500	17	.9644	.0356	28.8450	45.2950
16.5000	17	.9679	.0321	31.9407	48.4407
16.5500	17	.9713	.0287	35.7232	52.2732
16.6000	17	.9747	.0253	40.4501	57.0501
16.6000	18	.9729	.0271	11.5356	28.1356
16.6500	17	.9780	.0220	46.5261	63.1761
16.6500	18	.9740	.0260	12.0132	28.6632
16.7000	17	.9813	.0187	54.6260	71.3260
16.7000	18	.9752	.0248	12.5275	29.2275
16.7500	17	.9845	.0155	65.9639	82.7139
16.7500	18	.9763	.0237	13.0827	29.8327
16.8000	17	.9877	.0123	82.9685	99.7685
16.8000	18	.9774	.0226	13.6841	30.4841
16.8500	17	.9909	.0091	111.3063	128.1563
16.8500	18	.9785	.0215	14.3376	31.1876
16.9000	17	.9939	.0061	167.9775	184.8775
16.9000	18	.9796	.0204	15.0504	31.9504
16.9500	17	.9970	.0030	337.9820	354.9320
16.9500	18	.9807	.0193	15.8309	32.7809
17.0000	18	.9817	.0183	16.6894	33.6894
17.0500	18	.9828	.0172	17.6380	34.6880
17.1000	18	.9838	.0162	18.6919	35.7919
17.1500	18	.9848	.0152	19.8696	37.0196
17.2000	18	.9858	.0142	21.1943	38.3943
17.2500	18	.9868	.0132	22.6955	39.9455
17.3000	18	.9877	.0123	24.4110	41.7110
17.3500	18	.9887	.0113	26.3902	43.7402
17.4000	18	.9896	.0104	28.6990	46.0990
17.4500	18	.9905	.0095	31.4274	48.8774
17.5000	18	.9915	.0085	34.7012	52.2012
17.5500	18	.9924	.0076	38.7023	56.2523
17.6000	18	.9933	.0067	43.7034	61.3034
17.6500	18	.9941	.0059	50.1330	67.7830
17.7000	18	.9950	.0050	58.7055	76.4055
17.7500	18	.9959	.0041	70.7065	88.4565
17.8000	18	.9967	.0033	88.7075	106.5075
17.8500	18	.9976	.0024	118.7085	136.5585
17.9000	18	.9984	.0016	178.7095	196.6095
17.9500	18	.9992	.0008	358.7105	376.6605
17.9500	19	.9991	.0009	17.0798	35.0298
17.9500	20	.9864	.0136	8.6370	26.5870
18.0000	19	.9991	.0009	17.9845	35.9845
18.0000	20	.9868	.0132	8.8809	26.8809
18.0500	19	.9992	.0008	18.9846	37.0346
18.0500	20	.9871	.0129	9.1373	27.1873

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
18.1000	19	.9992	.0008	20.0957	38.1957
18.1000	20	.9875	.0125	9.4072	27.5072
18.1500	19	.9993	.0007	21.3375	39.4875
18.1500	20	.9879	.0121	9.6916	27.8416
18.2000	19	.9993	.0007	22.7346	40.9346
18.2000	20	.9882	.0118	9.9919	28.1919
18.2500	19	.9994	.0006	24.3180	42.5680
18.2500	20	.9886	.0114	10.3093	28.5593
18.3000	19	.9994	.0006	26.1275	44.4275
18.3000	20	.9889	.0111	10.6454	28.9454
18.3500	19	.9995	.0005	28.2155	46.5655
18.3500	20	.9893	.0107	11.0019	29.3519
18.4000	19	.9995	.0005	30.6514	49.0514
18.4000	20	.9896	.0104	11.3806	29.7806
18.4500	19	.9995	.0005	33.5302	51.9802
18.4500	20	.9900	.0100	11.7838	30.2338
18.5000	19	.9996	.0004	36.9848	55.4848
18.5000	20	.9903	.0097	12.2139	30.7139
18.5500	19	.9996	.0004	41.2070	59.7570
18.5500	20	.9907	.0093	12.6736	31.2236
18.6000	19	.9997	.0003	46.4848	65.0848
18.6000	20	.9910	.0090	13.1662	31.7662
18.6500	19	.9997	.0003	53.2705	71.9205
18.6500	20	.9913	.0087	13.6953	32.3453
18.7000	19	.9998	.0002	62.3182	81.0182
18.7000	20	.9917	.0083	14.2650	32.9650
18.7500	19	.9998	.0002	74.9848	93.7348
18.7500	20	.9920	.0080	14.8804	33.6304
18.8000	19	.9998	.0002	93.9849	112.7849
18.8000	20	.9924	.0076	15.5470	34.3470
18.8500	19	.9999	.0001	125.6516	144.5016
18.8500	20	.9927	.0073	16.2716	35.1216
18.8500	21	.9926	.0074	8.7029	27.5529
18.8500	22	.9875	.0125	5.9093	24.7593
18.9000	19	.9999	.0001	188.9849	207.8849
18.9000	20	.9930	.0070	17.0621	35.9621
18.9000	21	.9928	.0072	8.9355	27.8355
18.9000	22	.9877	.0123	6.0219	24.9219
18.9500	19	1.0000	.0000	378.9849	397.9349
18.9500	20	.9934	.0066	17.9279	36.8779
18.9500	21	.9930	.0070	9.1794	28.1294
18.9500	22	.9880	.0120	6.1383	25.0883
19.0000	20	.9937	.0063	18.8802	37.8802
19.0000	21	.9932	.0068	9.4355	28.4355
19.0000	22	.9882	.0118	6.2585	25.2585
19.0500	20	.9940	.0060	19.9328	38.9828
19.0500	21	.9934	.0066	9.7048	28.7548
19.0500	22	.9884	.0116	6.3828	25.4328
19.1000	20	.9944	.0056	21.1024	40.2024
19.1000	21	.9936	.0064	9.9882	29.0882
19.1000	22	.9886	.0114	6.5113	25.6113
19.1500	20	.9947	.0053	22.4095	41.5595
19.1500	21	.9938	.0062	10.2869	29.4369
19.1500	22	.9889	.0111	6.6444	25.7944

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
19.2000	20	.9950	.0050	23.8801	43.0801
19.2000	21	.9940	.0060	10.6022	29.8022
19.2000	22	.9891	.0109	6.7823	25.9823
19.2500	20	.9953	.0047	25.5467	44.7967
19.2500	21	.9941	.0059	10.9355	30.1855
19.2500	22	.9893	.0107	6.9251	26.1751
19.3000	20	.9956	.0044	27.4515	46.7515
19.3000	21	.9943	.0057	11.2885	30.5885
19.3000	22	.9895	.0105	7.0733	26.3733
19.3500	20	.9960	.0040	29.6492	48.9992
19.3500	21	.9945	.0055	11.6628	31.0128
19.3500	22	.9897	.0103	7.2270	26.5770
19.4000	20	.9963	.0037	32.2133	51.6133
19.4000	21	.9947	.0053	12.0606	31.4606
19.4000	22	.9900	.0100	7.3867	26.7867
19.4500	20	.9966	.0034	35.2436	54.6936
19.4500	21	.9949	.0051	12.4840	31.9340
19.4500	22	.9902	.0098	7.5526	27.0026
19.5000	20	.9969	.0031	38.8799	58.3799
19.5000	21	.9950	.0050	12.9356	32.4356
19.5000	22	.9904	.0096	7.7251	27.2251
19.5500	20	.9972	.0028	43.3243	62.8743
19.5500	21	.9952	.0048	13.4184	32.9684
19.5500	22	.9906	.0094	7.9047	27.4547
19.6000	20	.9975	.0025	48.8798	68.4798
19.6000	21	.9954	.0046	13.9356	33.5356
19.6000	22	.9908	.0092	8.0918	27.6918
19.6500	20	.9979	.0021	56.0227	75.6727
19.6500	21	.9956	.0044	14.4912	34.1412
19.6500	22	.9910	.0090	8.2868	27.9368
19.7000	20	.9982	.0018	65.5464	85.2464
19.7000	21	.9958	.0042	15.0895	34.7895
19.7000	22	.9913	.0087	8.4903	28.1903
19.7500	20	.9985	.0015	78.8797	98.6297
19.7500	21	.9959	.0041	15.7356	35.4856
19.7500	22	.9915	.0085	8.7029	28.4529
19.8000	20	.9988	.0012	98.8797	118.6797
19.8000	21	.9961	.0039	16.4356	36.2356
19.8000	22	.9917	.0083	8.9251	28.7251
19.8500	20	.9991	.0009	132.2130	152.0630
19.8500	21	.9963	.0037	17.1965	37.0465
19.8500	22	.9919	.0081	9.1577	29.0077
19.9000	20	.9994	.0006	198.8797	218.7797
19.9000	21	.9964	.0036	18.0265	37.9265
19.9000	22	.9921	.0079	9.4013	29.3013
19.9500	20	.9997	.0003	398.8796	418.8296
19.9500	21	.9966	.0034	18.9356	38.8856
19.9500	22	.9923	.0077	9.6568	29.6068
20.0000	21	.9968	.0032	19.9357	39.9357
20.0000	22	.9925	.0075	9.9251	29.9251
20.0500	21	.9970	.0030	21.0409	41.0909
20.0500	22	.9927	.0073	10.2071	30.2571
20.1000	21	.9971	.0029	22.2690	42.3690
20.1000	22	.9929	.0071	10.5040	30.6040

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
20.1500	21	.9973	.0027	23.6416	43.7916
20.1500	22	.9931	.0069	10.8170	30.9670
20.2000	21	.9975	.0025	25.1857	45.3857
20.2000	22	.9933	.0067	11.1473	31.3473
20.2500	21	.9976	.0024	26.9357	47.1857
20.2500	22	.9935	.0065	11.4965	31.7465
20.3000	21	.9978	.0022	28.9357	49.2357
20.3000	22	.9937	.0063	11.8663	32.1663
20.3500	21	.9979	.0021	31.2434	51.5934
20.3500	22	.9939	.0061	12.2584	32.6084
20.4000	21	.9981	.0019	33.9357	54.3357
20.4000	22	.9941	.0059	12.6751	33.0751
20.4500	21	.9983	.0017	37.1175	57.5675
20.4500	22	.9943	.0057	13.1186	33.5686
20.5000	21	.9984	.0016	40.9357	61.4357
20.5000	22	.9945	.0055	13.5917	34.0917
20.5500	21	.9986	.0014	45.6024	66.1524
20.5500	22	.9947	.0053	14.0975	34.6475
20.6000	21	.9988	.0012	51.4357	72.0357
20.6000	22	.9949	.0051	14.6394	35.2394
20.6500	21	.9989	.0011	58.9357	79.5857
20.6500	22	.9951	.0049	15.2214	35.8714
20.7000	21	.9991	.0009	68.9357	89.6357
20.7000	22	.9953	.0047	15.8481	36.5481
20.7500	21	.9992	.0008	82.9358	103.6858
20.7500	22	.9955	.0045	16.5251	37.2751
20.8000	21	.9994	.0006	103.9358	124.7358
20.8000	22	.9957	.0043	17.2584	38.0584
20.8500	21	.9995	.0005	138.9358	159.7858
20.8500	22	.9959	.0041	18.0555	38.9055
20.9000	21	.9997	.0003	208.9358	229.8358
20.9000	22	.9961	.0039	18.9251	39.8251
20.9500	21	.9998	.0002	418.9358	439.8858
20.9500	22	.9962	.0038	19.8774	40.8274
21.0000	21	1.0000	0.0000	*6366.0000	*6386.0000
21.0000	22	.9964	.0036	20.9250	41.9250
21.0500	22	.9966	.0034	22.0829	43.1329
21.1000	22	.9968	.0032	23.3695	44.4695
21.1500	22	.9970	.0030	24.8074	45.9574
21.2000	22	.9972	.0028	26.4250	47.6250
21.2500	22	.9974	.0026	28.2584	49.5084
21.3000	22	.9975	.0025	30.3536	51.6536
21.3500	22	.9977	.0023	32.7712	54.1212
21.3500	23	.9977	.0023	12.9091	34.2591
21.3500	24	.9911	.0089	7.9850	29.3350
21.4000	22	.9979	.0021	35.5917	56.9917
21.4000	23	.9977	.0023	13.3447	34.7447
21.4000	24	.9913	.0087	8.1591	29.5591
21.4500	22	.9981	.0019	38.9250	60.3750
21.4500	23	.9978	.0022	13.8084	35.2584
21.4500	24	.9915	.0085	8.3401	29.7901
21.5000	22	.9983	.0017	42.9250	64.4250
21.5000	23	.9979	.0021	14.3031	35.8031
21.5000	24	.9917	.0083	8.5284	30.0284

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
21.5500	22	.9984	.0016	47.8139	69.3639
21.5500	23	.9980	.0020	14.8318	36.3818
21.5500	24	.9919	.0081	8.7243	30.2743
21.6000	22	.9986	.0014	53.9250	75.5250
21.6000	23	.9980	.0020	15.3983	36.9983
21.6000	24	.9920	.0080	8.9283	30.5283
21.6500	22	.9988	.0012	61.7822	83.4322
21.6500	23	.9981	.0019	16.0068	37.6568
21.6500	24	.9922	.0078	9.1411	30.7911
21.7000	22	.9990	.0010	72.2584	93.9584
21.7000	23	.9982	.0018	16.6620	38.3620
21.7000	24	.9924	.0076	9.3631	31.0631
21.7500	22	.9991	.0009	86.9250	108.6750
21.7500	23	.9983	.0017	17.3697	39.1197
21.7500	24	.9926	.0074	9.5950	31.3450
21.8000	22	.9993	.0007	108.9250	130.7250
21.8000	23	.9983	.0017	18.1364	39.9364
21.8000	24	.9928	.0072	9.8374	31.6374
21.8500	22	.9995	.0005	145.5917	167.4417
21.8500	23	.9984	.0016	18.9697	40.8197
21.8500	24	.9929	.0071	10.0911	31.9411
21.9000	22	.9997	.0003	218.9250	240.8250
21.9000	23	.9985	.0015	19.8788	41.7788
21.9000	24	.9931	.0069	10.3569	32.2569
21.9500	22	.9998	.0002	438.9250	460.8750
21.9500	23	.9986	.0014	20.8745	42.8245
21.9500	24	.9933	.0067	10.6356	32.5856
22.0000	22	1.0000	0.0000	*8574.0000	*8595.0000
22.0000	23	.9986	.0014	21.9698	43.9698
22.0000	24	.9935	.0065	10.9283	32.9283
22.0500	23	.9987	.0013	23.1803	45.2303
22.0500	24	.9937	.0063	11.2360	33.2860
22.1000	23	.9988	.0012	24.5253	46.6253
22.1000	24	.9938	.0062	11.5598	33.6598
22.1500	23	.9988	.0012	26.0286	48.1786
22.1500	24	.9940	.0060	11.9012	34.0512
22.2000	23	.9989	.0011	27.7198	49.9198
22.2000	24	.9942	.0058	12.2616	34.4616
22.2500	23	.9990	.0010	29.6364	51.8864
22.2500	24	.9944	.0056	12.6425	34.8925
22.3000	23	.9991	.0009	31.8269	54.1269
22.3000	24	.9945	.0055	13.0459	35.3459
22.3500	23	.9991	.0009	34.3544	56.7044
22.3500	24	.9947	.0053	13.4737	35.8237
22.4000	23	.9992	.0008	37.3031	59.7031
22.4000	24	.9949	.0051	13.9282	36.3282
22.4500	23	.9993	.0007	40.7880	63.2380
22.4500	24	.9950	.0050	14.4121	36.8621
22.5000	23	.9993	.0007	44.9698	67.4698
22.5000	24	.9952	.0048	14.9282	37.4282
22.5500	23	.9994	.0006	50.0809	72.6309
22.5500	24	.9954	.0046	15.4799	38.0299
22.6000	23	.9995	.0005	56.4698	79.0698
22.6000	24	.9956	.0044	16.0711	38.6711

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
22.6500	23	.9995	.0005	64.6841	87.3341
22.6500	24	.9957	.0043	16.7060	39.3560
22.7000	23	.9996	.0004	75.6365	98.3365
22.7000	24	.9959	.0041	17.3897	40.0897
22.7500	23	.9997	.0003	90.9698	113.7198
22.7500	24	.9961	.0039	18.1282	40.8782
22.8000	23	.9997	.0003	113.9698	136.7698
22.8000	24	.9962	.0038	18.9282	41.7282
22.8500	23	.9998	.0002	152.3031	175.1531
22.8500	24	.9964	.0036	19.7977	42.6477
22.9000	23	.9999	.0001	228.9698	251.8698
22.9000	24	.9965	.0035	20.7463	43.6463
22.9500	23	.9999	.0001	458.9698	481.9198
22.9500	24	.9967	.0033	21.7853	44.7353
23.0000	23	1.0000	0.0000	*0782.0000	*0804.0000
23.0000	24	.9969	.0031	22.9281	45.9281
23.0500	24	.9970	.0030	24.1913	47.2413
23.0500	25	.9970	.0030	11.7848	34.8348
23.0500	26	.9931	.0069	7.7599	30.8099
23.1000	24	.9972	.0028	25.5948	48.6948
23.1000	25	.9971	.0029	12.1222	35.2222
23.1000	26	.9933	.0067	7.9119	31.0119
23.1500	24	.9974	.0026	27.1634	50.3134
23.1500	25	.9971	.0029	12.4778	35.6278
23.1500	26	.9934	.0066	8.0692	31.2192
23.2000	24	.9975	.0025	28.9281	52.1281
23.2000	25	.9972	.0028	12.8532	36.0532
23.2000	26	.9935	.0065	8.2321	31.4321
23.2500	24	.9977	.0023	30.9281	54.1781
23.2500	25	.9973	.0027	13.2500	36.5000
23.2500	26	.9937	.0063	8.4009	31.6509
23.3000	24	.9978	.0022	33.2138	56.5138
23.3000	25	.9974	.0026	13.6702	36.9702
23.3000	26	.9938	.0062	8.5760	31.8760
23.3500	24	.9980	.0020	35.8512	59.2012
23.3500	25	.9975	.0025	14.1158	37.4658
23.3500	26	.9939	.0061	8.7577	32.1077
23.4000	24	.9982	.0018	38.9281	62.3281
23.4000	25	.9976	.0024	14.5893	37.9893
23.4000	26	.9940	.0060	8.9463	32.3463
23.4500	24	.9983	.0017	42.5644	66.0144
23.4500	25	.9976	.0024	15.0933	38.5433
23.4500	26	.9942	.0058	9.1424	32.5924
23.5000	24	.9985	.0015	46.9281	70.4281
23.5000	25	.9977	.0023	15.6310	39.1310
23.5000	26	.9943	.0057	9.3463	32.8463
23.5500	24	.9986	.0014	52.2614	75.8114
23.5500	25	.9978	.0022	16.2057	39.7557
23.5500	26	.9944	.0056	9.5586	33.1086
23.6000	24	.9988	.0012	58.9281	82.5281
23.6000	25	.9979	.0021	16.8214	40.4214
23.6000	26	.9945	.0055	9.7797	33.3797
23.6500	24	.9989	.0011	67.4995	91.1495
23.6500	25	.9980	.0020	17.4828	41.1328

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
23.6500	26	.9947	.0053	10.0102	33.6602
23.7000	24	.9991	.0009	78.9280	102.6280
23.7000	25	.9980	.0020	18.1951	41.8951
23.7000	26	.9948	.0052	10.2507	33.9507
23.7500	24	.9992	.0008	94.9280	118.6780
23.7500	25	.9981	.0019	18.9643	42.7143
23.7500	26	.9949	.0051	10.5019	34.2519
23.8000	24	.9994	.0006	118.9280	142.7280
23.8000	25	.9982	.0018	19.7976	43.5976
23.8000	26	.9950	.0050	10.7645	34.5645
23.8500	24	.9995	.0005	158.9280	182.7780
23.8500	25	.9983	.0017	20.7034	44.5534
23.8500	26	.9952	.0048	11.0393	34.8893
23.9000	24	.9997	.0003	238.9280	262.8280
23.9000	25	.9984	.0016	21.6916	45.5916
23.9000	26	.9953	.0047	11.3273	35.2273
23.9500	24	.9998	.0002	478.9280	502.8780
23.9500	25	.9984	.0016	22.7738	46.7238
23.9500	26	.9954	.0046	11.6292	35.5792
24.0000	24	1.0000	0.0000	*2990.0000	*3013.0000
24.0000	25	.9985	.0015	23.9643	47.9643
24.0000	26	.9955	.0045	11.9463	35.9463
24.0500	25	.9986	.0014	25.2801	49.3301
24.0500	26	.9956	.0044	12.2796	36.3296
24.1000	25	.9987	.0013	26.7421	50.8421
24.1000	26	.9958	.0042	12.6305	36.7305
24.1500	25	.9987	.0013	28.3761	52.5261
24.1500	26	.9959	.0041	13.0004	37.1504
24.2000	25	.9988	.0012	30.2143	54.4143
24.2000	26	.9960	.0040	13.3908	37.5908
24.2500	25	.9989	.0011	32.2977	56.5477
24.2500	26	.9961	.0039	13.8034	38.0534
24.3000	25	.9990	.0010	34.6786	58.9786
24.3000	26	.9962	.0038	14.2404	38.5404
24.3500	25	.9990	.0010	37.4259	61.7759
24.3500	26	.9964	.0036	14.7039	39.0539
24.4000	25	.9991	.0009	40.6310	65.0310
24.4000	26	.9965	.0035	15.1963	39.5963
24.4500	25	.9992	.0008	44.4189	68.8689
24.4500	26	.9966	.0034	15.7205	40.1705
24.5000	25	.9993	.0007	48.9643	73.4643
24.5000	26	.9967	.0033	16.2796	40.7796
24.5500	25	.9993	.0007	54.5199	79.0699
24.5500	26	.9968	.0032	16.8773	41.4273
24.6000	25	.9994	.0006	61.4643	86.0643
24.6000	26	.9969	.0031	17.5177	42.1177
24.6500	25	.9995	.0005	70.3929	95.0429
24.6500	26	.9971	.0029	18.2055	42.8555
24.7000	25	.9996	.0004	82.2977	106.9977
24.7000	26	.9972	.0028	18.9463	43.6463
24.7500	25	.9996	.0004	98.9644	123.7144
24.7500	26	.9973	.0027	19.7463	44.4963
24.8000	25	.9997	.0003	123.9644	148.7644
24.8000	26	.9974	.0026	20.6129	45.4129

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
24.8500	25	.9998	.0002	165.6310	190.4810
24.8500	26	.9975	.0025	21.5550	46.4050
24.9000	25	.9999	.0001	248.9644	273.8644
24.9000	26	.9976	.0024	22.5826	47.4826
24.9500	25	.9999	.0001	498.9644	523.9144
24.9500	26	.9977	.0023	23.7082	48.6582
25.0000	26	.9979	.0021	24.9463	49.9463
25.0500	26	.9980	.0020	26.3147	51.3647
25.1000	26	.9981	.0019	27.8352	52.9352
25.1500	26	.9982	.0018	29.5345	54.6845
25.2000	26	.9983	.0017	31.4463	56.6463
25.2500	26	.9984	.0016	33.6129	58.8629
25.3000	26	.9985	.0015	36.0891	61.3891
25.3500	26	.9986	.0014	38.9463	64.2963
25.4000	26	.9987	.0013	42.2796	67.6796
25.4500	26	.9988	.0012	46.2190	71.6690
25.5000	26	.9989	.0011	50.9463	76.4463
25.5500	26	.9991	.0009	56.7240	82.2740
25.6000	26	.9992	.0008	63.9462	89.5462
25.6500	26	.9993	.0007	73.2320	98.8820
25.7000	26	.9994	.0006	85.6129	111.3129
25.7500	26	.9995	.0005	102.9462	128.6962
25.8000	26	.9996	.0004	128.9462	154.7462
25.8500	26	.9997	.0003	172.2796	198.1296
25.8500	27	.9997	.0003	22.4710	48.3210
25.8500	28	.9857	.0143	11.8518	37.7018
25.9000	26	.9998	.0002	258.9462	284.8462
25.9000	27	.9997	.0003	23.5382	49.4382
25.9000	28	.9861	.0139	12.1618	38.0618
25.9500	26	.9999	.0001	518.9462	544.8962
25.9500	27	.9997	.0003	24.7071	50.6571
25.9500	28	.9864	.0136	12.4870	38.4370
26.0000	27	.9997	.0003	25.9928	51.9928
26.0000	28	.9868	.0132	12.8284	38.8284
26.0500	27	.9997	.0003	27.4138	53.4638
26.0500	28	.9872	.0128	13.1873	39.2373
26.1000	27	.9998	.0002	28.9928	55.0928
26.1000	28	.9875	.0125	13.5651	39.6651
26.1500	27	.9998	.0002	30.7575	56.9075
26.1500	28	.9878	.0122	13.9634	40.1134
26.2000	27	.9998	.0002	32.7428	58.9428
26.2000	28	.9882	.0118	14.3837	40.5837
26.2500	27	.9998	.0002	34.9928	61.2428
26.2500	28	.9885	.0115	14.8281	41.0781
26.3000	27	.9998	.0002	37.5642	63.8642
26.3000	28	.9889	.0111	15.2986	41.5986
26.3500	27	.9998	.0002	40.5312	66.8812
26.3500	28	.9892	.0108	15.7977	42.1477
26.4000	27	.9998	.0002	43.9928	70.3928
26.4000	28	.9896	.0104	16.3279	42.7279
26.4500	27	.9998	.0002	48.0837	74.5337
26.4500	28	.9899	.0101	16.8924	43.3424
26.5000	27	.9999	.0001	52.9928	79.4928
26.5000	28	.9903	.0097	17.4945	43.9945

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
26.5500	27	.9999	.0001	58.9928	85.5428
26.5500	28	.9906	.0094	18.1381	44.6881
26.6000	27	.9999	.0001	66.4928	93.0928
26.6000	28	.9909	.0091	18.8277	45.4277
26.6500	27	.9999	.0001	76.1356	102.7856
26.6500	28	.9913	.0087	19.5684	46.2184
26.7000	27	.9999	.0001	88.9928	115.6928
26.7000	28	.9916	.0084	20.3661	47.0661
26.7500	27	.9999	.0001	106.9928	133.7428
26.7500	28	.9919	.0081	21.2275	47.9775
26.8000	27	.9999	.0001	133.9928	160.7928
26.8000	28	.9923	.0077	22.1608	48.9608
26.8500	27	1.0000	.0000	178.9928	205.8428
26.8500	28	.9926	.0074	23.1753	50.0253
26.9000	27	1.0000	.0000	268.9928	295.8928
26.9000	28	.9929	.0071	24.2819	51.1819
26.9500	27	1.0000	.0000	538.9928	565.9428
26.9500	28	.9933	.0067	25.4940	52.4440
27.0000	27	1.0000	0.0000	*9614.0000	*9640.0000
27.0000	28	.9936	.0064	26.8273	53.8273
27.0500	28	.9939	.0061	28.3009	55.3509
27.1000	28	.9943	.0057	29.9383	57.0383
27.1500	28	.9946	.0054	31.7683	58.9183
27.2000	28	.9949	.0051	33.8270	61.0270
27.2500	28	.9952	.0048	36.1603	63.4103
27.3000	28	.9956	.0044	38.8269	66.1269
27.3500	28	.9959	.0041	41.9038	69.2538
27.4000	28	.9962	.0038	45.4935	72.8935
27.4500	28	.9965	.0035	49.7359	77.1859
27.5000	28	.9968	.0032	54.8267	82.3267
27.5500	28	.9972	.0028	61.0489	88.5989
27.6000	28	.9975	.0025	68.8266	96.4266
27.6500	28	.9978	.0022	78.8266	106.4766
27.7000	28	.9981	.0019	92.1598	119.8598
27.7500	28	.9984	.0016	110.8265	138.5765
27.8000	28	.9988	.0012	138.8264	166.6264
27.8500	28	.9991	.0009	185.4930	213.3430
27.9000	28	.9994	.0006	278.8263	306.7263
27.9500	28	.9997	.0003	558.8263	586.7763
27.9500	29	.9996	.0004	26.6094	54.5594
27.9500	30	.9882	.0118	13.4733	41.4233
28.0000	28	1.0000	0.0000	*1822.0000	*1849.0000
28.0000	29	.9997	.0003	27.9904	55.9904
28.0000	30	.9885	.0115	13.8391	41.8391
28.0500	29	.9997	.0003	29.5167	57.5667
28.0500	30	.9888	.0112	14.2237	42.2737
28.1000	29	.9997	.0003	31.2126	59.3126
28.1000	30	.9891	.0109	14.6285	42.7285
28.1500	29	.9997	.0003	33.1080	61.2580
28.1500	30	.9894	.0106	15.0552	43.2052
28.2000	29	.9997	.0003	35.2404	63.4404
28.2000	30	.9897	.0103	15.5056	43.7056
28.2500	29	.9997	.0003	37.6570	65.9070
28.2500	30	.9900	.0100	15.9818	44.2318

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
28.3000	29	.9998	.0002	40.4190	68.7190
28.3000	30	.9903	.0097	16.4859	44.7859
28.3500	29	.9998	.0002	43.6058	71.9558
28.3500	30	.9906	.0094	17.0206	45.3706
28.4000	29	.9998	.0002	47.3237	75.7237
28.4000	30	.9909	.0091	17.5888	45.9888
28.4500	29	.9998	.0002	51.7177	80.1677
28.4500	30	.9912	.0088	18.1936	46.6436
28.5000	29	.9998	.0002	56.9904	85.4904
28.5000	30	.9915	.0085	18.8387	47.3387
28.5500	29	.9998	.0002	63.4348	91.9848
28.5500	30	.9918	.0082	19.5283	48.0783
28.6000	29	.9999	.0001	71.4904	100.0904
28.6000	30	.9921	.0079	20.2672	48.8672
28.6500	29	.9999	.0001	81.8475	110.4975
28.6500	30	.9924	.0076	21.0608	49.7108
28.7000	29	.9999	.0001	95.6571	124.3571
28.7000	30	.9927	.0073	21.9154	50.6154
28.7500	29	.9999	.0001	114.9904	143.7404
28.7500	30	.9930	.0070	22.8385	51.5885
28.8000	29	.9999	.0001	143.9904	172.7904
28.8000	30	.9933	.0067	23.8384	52.6384
28.8500	29	1.0000	.0000	192.3237	221.1737
28.8500	30	.9936	.0064	24.9253	53.7753
28.9000	29	1.0000	.0000	288.9904	317.8904
28.9000	30	.9938	.0062	26.1110	55.0110
28.9500	29	1.0000	.0000	578.9904	607.9404
28.9500	30	.9941	.0059	27.4097	56.3597
29.0000	29	1.0000	0.0000	*4030.0000	*4058.0000
29.0000	30	.9944	.0056	28.8382	57.8382
29.0500	30	.9947	.0053	30.4171	59.4671
29.1000	30	.9950	.0050	32.1715	61.2715
29.1500	30	.9953	.0047	34.1322	63.2822
29.2000	30	.9956	.0044	36.3381	65.5381
29.2500	30	.9958	.0042	38.8380	68.0880
29.3000	30	.9961	.0039	41.6951	70.9951
29.3500	30	.9964	.0036	44.9918	74.3418
29.4000	30	.9967	.0033	48.8379	78.2379
29.4500	30	.9970	.0030	53.3833	82.8333
29.5000	30	.9973	.0027	58.8378	88.3378
29.5500	30	.9975	.0025	65.5044	95.0544
29.6000	30	.9978	.0022	73.8377	103.4377
29.6500	30	.9981	.0019	84.5520	114.2020
29.7000	30	.9984	.0016	98.8376	128.5376
29.7500	30	.9986	.0014	118.8376	148.5876
29.8000	30	.9989	.0011	148.8375	178.6375
29.8000	31	.9988	.0012	24.8032	54.6032
29.8000	32	.9978	.0022	13.5153	43.3153
29.8000	33	.9957	.0043	9.2725	39.0725
29.8500	30	.9992	.0008	198.8375	228.6875
29.8500	31	.9988	.0012	25.9264	55.7764
29.8500	32	.9978	.0022	13.8535	43.7035
29.8500	33	.9958	.0042	9.4362	39.2862
29.9000	30	.9995	.0005	298.8375	328.7375

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
29.9000	31	.9989	.0011	27.1517	57.0517
29.9000	32	.9979	.0021	14.2079	44.1079
29.9000	33	.9959	.0041	9.6052	39.5052
29.9500	30	.9997	.0003	598.8374	628.7874
29.9500	31	.9989	.0011	28.4937	58.4437
29.9500	32	.9979	.0021	14.5796	44.5296
29.9500	33	.9959	.0041	9.7797	39.7297
30.0000	30	1.0000	.0000	*6237.0000	*6266.0000
30.0000	31	.9990	.0010	29.9699	59.9699
30.0000	32	.9980	.0020	14.9698	44.9698
30.0000	33	.9960	.0040	9.9600	39.9600
30.0500	31	.9990	.0010	31.6014	61.6514
30.0500	32	.9980	.0020	15.3801	45.4301
30.0500	33	.9961	.0039	10.1464	40.1964
30.1000	31	.9991	.0009	33.4143	63.5143
30.1000	32	.9981	.0019	15.8119	45.9119
30.1000	33	.9961	.0039	10.3393	40.4393
30.1500	31	.9992	.0008	35.4405	65.5905
30.1500	32	.9981	.0019	16.2671	46.4171
30.1500	33	.9962	.0038	10.5389	40.6889
30.2000	31	.9992	.0008	37.7199	67.9199
30.2000	32	.9982	.0018	16.7476	46.9476
30.2000	33	.9963	.0037	10.7457	40.9457
30.2500	31	.9993	.0007	40.3032	70.5532
30.2500	32	.9983	.0017	17.2555	47.5055
30.2500	33	.9964	.0036	10.9600	41.2100
30.3000	31	.9993	.0007	43.2556	73.5556
30.3000	32	.9983	.0017	17.7933	48.0933
30.3000	33	.9964	.0036	11.1822	41.4822
30.3500	31	.9994	.0006	46.6622	77.0122
30.3500	32	.9984	.0016	18.3638	48.7138
30.3500	33	.9965	.0035	11.4128	41.7628
30.4000	31	.9994	.0006	50.6366	81.0366
30.4000	32	.9984	.0016	18.9698	49.3698
30.4000	33	.9966	.0034	11.6523	42.0523
30.4500	31	.9995	.0005	55.3335	85.7835
30.4500	32	.9985	.0015	19.6150	50.0650
30.4500	33	.9966	.0034	11.9012	42.3512
30.5000	31	.9995	.0005	60.9699	91.4699
30.5000	32	.9985	.0015	20.3032	50.8032
30.5000	33	.9967	.0033	12.1600	42.6600
30.5500	31	.9996	.0004	67.8588	98.4088
30.5500	32	.9986	.0014	21.0388	51.5888
30.5500	33	.9968	.0032	12.4294	42.9794
30.6000	31	.9996	.0004	76.4699	107.0699
30.6000	32	.9986	.0014	21.8270	52.4270
30.6000	33	.9969	.0031	12.7100	43.3100
30.6500	31	.9997	.0003	87.5414	118.1914
30.6500	32	.9987	.0013	22.6735	53.3235
30.6500	33	.9969	.0031	13.0025	43.6525
30.7000	31	.9997	.0003	102.3033	133.0033
30.7000	32	.9987	.0013	23.5852	54.2852
30.7000	33	.9970	.0030	13.3078	44.0078
30.7500	31	.9998	.0002	122.9699	153.7199

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
30.7500	31	.9998	.0002	122.9699	153.7199
30.7500	32	.9988	.0012	24.5698	55.3198
30.7500	33	.9971	.0029	13.6267	44.3767
30.8000	31	.9998	.0002	153.9699	184.7699
30.8000	32	.9988	.0012	25.6365	56.4365
30.8000	33	.9971	.0029	13.9600	44.7600
30.8500	31	.9999	.0001	205.6366	236.4866
30.8500	32	.9989	.0011	26.7959	57.6459
30.8500	33	.9972	.0028	14.3088	45.1588
30.9000	31	.9999	.0001	308.9700	339.8700
30.9000	32	.9989	.0011	28.0607	58.9607
30.9000	33	.9973	.0027	14.6743	45.5743
30.9500	31	1.0000	.0000	618.9700	649.9200
30.9500	32	.9990	.0010	29.4460	60.3960
30.9500	33	.9973	.0027	15.0575	46.0075
31.0000	32	.9990	.0010	30.9698	61.9698
31.0000	33	.9974	.0026	15.4600	46.4600
31.0500	32	.9991	.0009	32.6540	63.7040
31.0500	33	.9975	.0025	15.8831	46.9331
31.1000	32	.9991	.0009	34.5254	65.6254
31.1000	33	.9976	.0024	16.3284	47.4284
31.1500	32	.9992	.0008	36.6169	67.7669
31.1500	33	.9976	.0024	16.7978	47.9478
31.2000	32	.9992	.0008	38.9698	70.1698
31.2000	33	.9977	.0023	17.2933	48.4933
31.2500	32	.9993	.0007	41.6365	72.8865
31.2500	33	.9978	.0022	17.8171	49.0671
31.3000	32	.9993	.0007	44.6841	75.9841
31.3000	33	.9978	.0022	18.3717	49.6717
31.3500	32	.9994	.0006	48.2006	79.5506
31.3500	33	.9979	.0021	18.9600	50.3100
31.4000	32	.9994	.0006	52.3032	83.7032
31.4000	33	.9980	.0020	19.5850	50.9850
31.4500	32	.9995	.0005	57.1516	88.6016
31.4500	33	.9980	.0020	20.2503	51.7003
31.5000	32	.9995	.0005	62.9698	94.4698
31.5000	33	.9981	.0019	20.9600	52.4600
31.5500	32	.9996	.0004	70.0809	101.6309
31.5500	33	.9982	.0018	21.7186	53.2686
31.6000	32	.9996	.0004	78.9698	110.5698
31.6000	33	.9982	.0018	22.5314	54.1314
31.6500	32	.9997	.0003	90.3984	122.0484
31.6500	33	.9983	.0017	23.4044	55.0544
31.7000	32	.9997	.0003	105.6365	137.3365
31.7000	33	.9984	.0016	24.3446	56.0446
31.7500	32	.9998	.0002	126.9698	158.7198
31.7500	33	.9984	.0016	25.3600	57.1100
31.8000	32	.9998	.0002	158.9698	190.7698
31.8000	33	.9985	.0015	26.4600	58.2600
31.8500	32	.9999	.0001	212.3032	244.1532
31.8500	33	.9986	.0014	27.6556	59.5056
31.8500	34	.9986	.0014	14.7925	46.6425
31.8500	35	.9961	.0039	10.0719	41.9219
31.9000	32	.9999	.0001	318.9698	350.8698

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
31.9000	33	.9986	.0014	28.9600	60.8600
31.9000	34	.9986	.0014	15.1690	47.0690
31.9000	35	.9962	.0038	10.2511	42.1511
31.9500	32	1.0000	.0000	638.9698	670.9198
31.9500	33	.9987	.0013	30.3885	62.3385
31.9500	34	.9986	.0014	15.5639	47.5139
31.9500	35	.9963	.0037	10.4362	42.3862
32.0000	33	.9987	.0013	31.9600	63.9600
32.0000	34	.9987	.0013	15.9785	47.9785
32.0000	35	.9963	.0037	10.6274	42.6274
32.0500	33	.9988	.0012	33.6968	65.7468
32.0500	34	.9987	.0013	16.4144	48.4644
32.0500	35	.9964	.0036	10.8252	42.8752
32.1000	33	.9989	.0011	35.6266	67.7266
32.1000	34	.9987	.0013	16.8733	48.9733
32.1000	35	.9965	.0035	11.0297	43.1297
32.1500	33	.9989	.0011	37.7835	69.9335
32.1500	34	.9988	.0012	17.3569	49.5069
32.1500	35	.9965	.0035	11.2415	43.3915
32.2000	33	.9990	.0010	40.2100	72.4100
32.2000	34	.9988	.0012	17.8674	50.0674
32.2000	35	.9966	.0034	11.4608	43.6608
32.2500	33	.9991	.0009	42.9600	75.2100
32.2500	34	.9988	.0012	18.4071	50.6571
32.2500	35	.9967	.0033	11.6880	43.9380
32.3000	33	.9991	.0009	46.1028	78.4028
32.3000	34	.9989	.0011	18.9785	51.2785
32.3000	35	.9967	.0033	11.9237	44.2237
32.3500	33	.9992	.0008	49.7292	82.0792
32.3500	34	.9989	.0011	19.5846	51.9346
32.3500	35	.9968	.0032	12.1683	44.5183
32.4000	33	.9993	.0007	53.9600	86.3600
32.4000	34	.9989	.0011	20.2285	52.6285
32.4000	35	.9969	.0031	12.4223	44.8223
32.4500	33	.9993	.0007	58.9600	91.4100
32.4500	34	.9990	.0010	20.9140	53.3640
32.4500	35	.9969	.0031	12.6863	45.1363
32.5000	33	.9994	.0006	64.9600	97.4600
32.5000	34	.9990	.0010	21.6452	54.1452
32.5000	35	.9970	.0030	12.9608	45.4608
32.5500	33	.9994	.0006	72.2933	104.8433
32.5500	34	.9990	.0010	22.4268	54.9768
32.5500	35	.9970	.0030	13.2465	45.7965
32.6000	33	.9995	.0005	81.4600	114.0600
32.6000	34	.9991	.0009	23.2642	55.8642
32.6000	35	.9971	.0029	13.5441	46.1441
32.6500	33	.9996	.0004	93.2457	125.8957
32.6500	34	.9991	.0009	24.1637	56.8137
32.6500	35	.9972	.0028	13.8544	46.5044
32.7000	33	.9996	.0004	108.9600	141.6600
32.7000	34	.9991	.0009	25.1324	57.8324
32.7000	35	.9972	.0028	14.1782	46.8782
32.7500	33	.9997	.0003	130.9600	163.7100
32.7500	34	.9992	.0008	26.1785	58.9285

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
32.7500	33	.9997	.0003	130.9600	163.7100
32.7500	34	.9992	.0008	26.1785	58.9285
32.7500	35	.9973	.0027	14.5163	47.2663
32.8000	33	.9998	.0002	163.9600	196.7600
32.8000	34	.9992	.0008	27.3119	60.1119
32.8000	35	.9974	.0026	14.8698	47.6698
32.8500	33	.9998	.0002	218.9600	251.8100
32.8500	34	.9992	.0008	28.5438	61.3938
32.8500	35	.9974	.0026	15.2398	48.0898
32.9000	33	.9999	.0001	328.9600	361.8600
32.9000	34	.9993	.0007	29.8876	62.7876
32.9000	35	.9975	.0025	15.6274	48.5274
32.9500	33	.9999	.0001	658.9600	691.9100
32.9500	34	.9993	.0007	31.3595	64.3095
32.9500	35	.9976	.0024	16.0339	48.9839
33.0000	34	.9993	.0007	32.9785	65.9785
33.0000	35	.9976	.0024	16.4608	49.4608
33.0500	34	.9994	.0006	34.7680	67.8180
33.0500	35	.9977	.0023	16.9095	49.9595
33.1000	34	.9994	.0006	36.7563	69.8563
33.1000	35	.9977	.0023	17.3818	50.4818
33.1500	34	.9994	.0006	38.9785	72.1285
33.1500	35	.9978	.0022	17.8797	51.0297
33.2000	34	.9995	.0005	41.4785	74.6785
33.2000	35	.9979	.0021	18.4052	51.6052
33.2500	34	.9995	.0005	44.3119	77.5619
33.2500	35	.9979	.0021	18.9607	52.2107
33.3000	34	.9995	.0005	47.5500	80.8500
33.3000	35	.9980	.0020	19.5490	52.8490
33.3500	34	.9996	.0004	51.2862	84.6362
33.3500	35	.9981	.0019	20.1729	53.5229
33.4000	34	.9996	.0004	55.6452	89.0452
33.4000	35	.9981	.0019	20.8357	54.2357
33.4500	34	.9996	.0004	60.7967	94.2467
33.4500	35	.9982	.0018	21.5414	54.9914
33.5000	34	.9997	.0003	66.9785	100.4785
33.5000	35	.9982	.0018	22.2941	55.7941
33.5500	34	.9997	.0003	74.5341	108.0841
33.5500	35	.9983	.0017	23.0987	56.6487
33.6000	34	.9997	.0003	83.9785	117.5785
33.6000	35	.9984	.0016	23.9607	57.5607
33.6000	36	.9984	.0016	13.97[illegible]0	47.5770
33.6000	37	.9960	.0040	9.8431	43.4431
33.6500	34	.9998	.0002	96.1214	129.7714
33.6500	35	.9984	.0016	24.8867	58.5367
33.6500	36	.9984	.0016	14.2961	47.9461
33.6500	37	.9961	.0039	10.0055	43.6555
33.7000	34	.9998	.0002	112.3119	146.0119
33.7000	35	.9985	.0015	25.8838	59.5838
33.7000	36	.9984	.0016	14.6291	48.3291
33.7000	37	.9962	.0038	10.1729	43.8729
33.7500	34	.9998	.0002	134.9785	168.7285
33.7500	35	.9985	.0015	26.9607	60.7107
33.7500	36	.9985	.0015	14.9770	48.7270

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
33.7500	37	.9962	.0038	10.3454	44.0954
33.8000	34	.9999	.0001	168.9785	202.7785
33.8000	35	.9986	.0014	28.1274	61.9274
33.8000	36	.9985	.0015	15.3406	49.1406
33.8000	37	.9963	.0037	10.5232	44.3232
33.8500	34	.9999	.0001	225.6452	259.4952
33.8500	35	.9987	.0013	29.3955	63.2455
33.8500	36	.9985	.0015	15.7212	49.5712
33.8500	37	.9963	.0037	10.7068	44.5568
33.9000	34	.9999	.0001	338.9785	372.8785
33.9000	35	.9987	.0013	30.7789	64.6789
33.9000	36	.9986	.0014	16.1198	50.0198
33.9000	37	.9964	.0036	10.8962	44.7962
33.9500	34	1.0000	.0000	678.9785	712.9285
33.9500	35	.9988	.0012	32.2941	66.2441
33.9500	36	.9986	.0014	16.5379	50.4879
33.9500	37	.9965	.0035	11.0919	45.0419
34.0000	35	.9988	.0012	33.9607	67.9607
34.0000	36	.9986	.0014	16.9770	50.9770
34.0000	37	.9965	.0035	11.2941	45.2941
34.0500	35	.9989	.0011	35.8028	69.8528
34.0500	36	.9987	.0013	17.4385	51.4885
34.0500	37	.9966	.0034	11.5031	45.5531
34.1000	35	.9990	.0010	37.8496	71.9496
34.1000	36	.9987	.0013	17.9243	52.0243
34.1000	37	.9967	.0033	11.7194	45.8194
34.1500	35	.9990	.0010	40.1372	74.2872
34.1500	36	.9988	.0012	18.4364	52.5864
34.1500	37	.9967	.0033	11.9432	46.0932
34.2000	35	.9991	.0009	42.7107	76.9107
34.2000	36	.9988	.0012	18.9770	53.1770
34.2000	37	.9968	.0032	12.1750	46.3750
34.2500	35	.9991	.0009	45.6274	79.8774
34.2500	36	.9988	.0012	19.5484	53.7984
34.2500	37	.9968	.0032	12.4153	46.6653
34.3000	35	.9992	.0008	48.9607	83.2607
34.3000	36	.9989	.0011	20.1534	54.4534
34.3000	37	.9969	.0031	12.6644	46.9644
34.3500	35	.9993	.0007	52.8069	87.1569
34.3500	36	.9989	.0011	20.7952	55.1452
34.3500	37	.9970	.0030	12.9230	47.2730
34.4000	35	.9993	.0007	57.2941	91.6941
34.4000	36	.9989	.0011	21.4770	55.8770
34.4000	37	.9970	.0030	13.1915	47.5915
34.4500	35	.9994	.0006	62.5971	97.0471
34.4500	36	.9990	.0010	22.2028	56.6528
34.4500	37	.9971	.0029	13.4705	47.9205
34.5000	35	.9994	.0006	68.9607	103.4607
34.5000	36	.9990	.0010	22.9770	57.4770
34.5000	37	.9972	.0028	13.7607	48.2607
34.5500	35	.9995	.0005	76.7385	111.2885
34.5500	36	.9990	.0010	23.8046	58.3546
34.5500	37	.9972	.0028	14.0628	48.6128
34.6000	35	.9995	.0005	86.4607	121.0607

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	RP	IP	QL	TNS
34.6000	35	.9995	.0005	86.4607	121.0607
34.6000	36	.9991	.0009	24.6913	59.2913
34.6000	37	.9973	.0027	14.3774	48.9774
34.6500	35	.9996	.0004	98.9607	133.6107
34.6500	36	.9991	.0009	25.6436	60.2936
34.6500	37	.9973	.0027	14.7054	49.3554
34.7000	35	.9997	.0003	115.6274	150.3274
34.7000	36	.9991	.0009	26.6693	61.3693
34.7000	37	.9974	.0026	15.0477	49.7477
34.7500	35	.9997	.0003	138.9607	173.7107
34.7500	36	.9992	.0008	27.7770	62.5270
34.7500	37	.9975	.0025	15.4052	50.1552
34.8000	35	.9998	.0002	173.9607	208.7607
34.8000	36	.9992	.0008	28.9770	63.7770
34.8000	37	.9975	.0025	15.7789	50.5789
34.8000	38	.9975	.0025	10.8478	45.6478
34.8500	35	.9998	.0002	232.2940	267.1440
34.8500	36	.9992	.0008	30.2813	65.1313
34.8500	37	.9976	.0024	16.1700	51.0200
34.8500	38	.9975	.0025	11.0363	45.8863
34.9000	35	.9999	.0001	348.9607	383.8607
34.9000	36	.9993	.0007	31.7043	66.6043
34.9000	37	.9976	.0024	16.5798	51.4798
34.9000	38	.9976	.0024	11.2309	46.1309
34.9500	35	.9999	.0001	698.9607	733.9107
34.9500	36	.9993	.0007	33.2627	68.2127
34.9500	37	.9977	.0023	17.0095	51.9595
34.9500	38	.9976	.0024	11.4319	46.3819
35.0000	35	1.0000	0.0000	*8638.0000	*8672.0000
35.0000	36	.9993	.0007	34.9770	69.9770
35.0000	37	.9978	.0022	17.4607	52.4607
35.0000	38	.9977	.0023	11.6395	46.6395
35.0500	36	.9994	.0006	36.8717	71.9217
35.0500	37	.9978	.0022	17.9351	52.9851
35.0500	38	.9977	.0023	11.8542	46.9042
35.1000	36	.9994	.0006	38.9770	74.0770
35.1000	37	.9979	.0021	18.4344	53.5344
35.1000	38	.9978	.0022	12.0763	47.1763
35.1500	36	.9994	.0006	41.3299	76.4799
35.1500	37	.9979	.0021	18.9607	54.1107
35.1500	38	.9978	.0022	12.3062	47.4562
35.2000	36	.9995	.0005	43.9770	79.1770
35.2000	37	.9980	.0020	19.5163	54.7163
35.2000	38	.9978	.0022	12.5443	47.7443
35.2500	36	.9995	.0005	46.9770	82.2270
35.2500	37	.9980	.0020	20.1036	55.3536
35.2500	38	.9979	.0021	12.7910	48.0410
35.3000	36	.9995	.0005	50.4056	85.7056
35.3000	37	.9981	.0019	20.7254	56.0254
35.3000	38	.9979	.0021	13.0469	48.3469
35.3500	36	.9996	.0004	54.3616	89.7116
35.3500	37	.9982	.0018	21.3850	56.7350
35.3500	38	.9980	.0020	13.3125	48.6625
35.4000	36	.9996	.0004	58.9770	94.3770

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
35.4000	37	.9982	.0018	22.0857	57.4857
35.4000	38	.9980	.0020	13.5882	48.9882
35.4500	36	.9996	.0004	64.4315	99.8815
35.4500	37	.9983	.0017	22.8317	58.2817
35.4500	38	.9980	.0020	13.8748	49.3248
35.5000	36	.9997	.0003	70.9770	106.4770
35.5000	37	.9983	.0017	23.6274	59.1274
35.5000	38	.9981	.0019	14.1728	49.6728
35.5500	36	.9997	.0003	78.9770	114.5270
35.5500	37	.9984	.0016	24.4780	60.0280
35.5500	38	.9981	.0019	14.4830	50.0330
35.5500	39	.9981	.0019	10.2850	45.8350
35.6000	36	.9997	.0003	88.9770	124.5770
35.6000	37	.9985	.0015	25.3893	60.9893
35.6000	38	.9982	.0018	14.8062	50.4062
35.6000	39	.9982	.0018	10.4513	46.0513
35.6500	36	.9998	.0002	101.8341	137.4841
35.6500	37	.9985	.0015	26.3681	62.0181
35.6500	38	.9982	.0018	15.1431	50.7931
35.6500	39	.9982	.0018	10.6225	46.2725
35.7000	36	.9998	.0002	118.9770	154.6770
35.7000	37	.9986	.0014	27.4222	63.1222
35.7000	38	.9983	.0017	15.4946	51.1946
35.7000	39	.9982	.0018	10.7989	46.4989
35.7500	36	.9998	.0002	142.9770	178.7270
35.7500	37	.9986	.0014	28.5607	64.3107
35.7500	38	.9983	.0017	15.8617	51.6117
35.7500	39	.9982	.0018	10.9807	46.7307
35.8000	36	.9999	.0001	178.9770	214.7770
35.8000	37	.9987	.0013	29.7940	65.5940
35.8000	38	.9983	.0017	16.2456	52.0456
35.8000	39	.9983	.0017	11.1682	46.9682
35.8500	36	.9999	.0001	238.9770	274.8270
35.8500	37	.9987	.0013	31.1346	66.9846
35.8500	38	.9984	.0016	16.6473	52.4973
35.8500	39	.9983	.0017	11.3616	47.2116
35.9000	36	.9999	.0001	358.9770	394.8770
35.9000	37	.9988	.0012	32.5971	68.4971
35.9000	38	.9984	.0016	17.0681	52.9681
35.9000	39	.9983	.0017	11.5613	47.4613
35.9500	36	1.0000	.0000	718.9770	754.9270
35.9500	37	.9989	.0011	34.1988	70.1488
35.9500	38	.9985	.0015	17.5094	53.4594
35.9500	39	.9984	.0016	11.7676	47.7176
36.0000	36	1.0000	.0000	*9741.0000	*9776.0000
36.0000	37	.9989	.0011	35.9607	71.9607
36.0000	38	.9985	.0015	17.9728	53.9728
36.0000	39	.9984	.0016	11.9807	47.9807
36.0500	37	.9990	.0010	37.9081	73.9581
36.0500	38	.9985	.0015	18.4600	54.5100
36.0500	39	.9984	.0016	12.2010	48.2510
36.1000	37	.9990	.0010	40.0718	76.1718
36.1000	38	.9986	.0014	18.9728	55.0728
36.1000	39	.9984	.0016	12.4290	48.5290

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
36.1500	37	.9991	.0009	42.4901	78.6401
36.1500	38	.9986	.0014	19.5134	55.6634
36.1500	39	.9985	.0015	12.6649	48.8149
36.2000	37	.9991	.0009	45.2107	81.4107
36.2000	38	.9986	.0014	20.0840	56.2840
36.2000	39	.9985	.0015	12.9092	49.1092
36.2500	37	.9992	.0008	48.2940	84.5440
36.2500	38	.9987	.0013	20.6871	56.9371
36.2500	39	.9985	.0015	13.1625	49.4125
36.3000	37	.9992	.0008	51.8178	88.1178
36.3000	38	.9987	.0013	21.3258	57.6258
36.3000	39	.9986	.0014	13.4251	49.7251
36.3500	37	.9993	.0007	55.8838	92.2338
36.3500	38	.9988	.0012	22.0032	58.3532
36.3500	39	.9986	.0014	13.6977	50.0477
36.4000	37	.9994	.0006	60.6274	97.0274
36.4000	38	.9988	.0012	22.7229	59.1229
36.4000	39	.9986	.0014	13.9807	50.3807
36.4500	37	.9994	.0006	66.2334	102.6834
36.4500	38	.9988	.0012	23.4890	59.9390
36.4500	39	.9986	.0014	14.2748	50.7248
36.5000	37	.9995	.0005	72.9607	109.4607
36.5000	38	.9989	.0011	24.3062	60.8062
36.5000	39	.9987	.0013	14.5807	51.0807
36.5500	37	.9995	.0005	81.1829	117.7329
36.5500	38	.9989	.0011	25.1797	61.7297
36.5500	39	.9987	.0013	14.8990	51.4490
36.6000	37	.9996	.0004	91.4607	128.0607
36.6000	38	.9990	.0010	26.1157	62.7157
36.6000	39	.9987	.0013	15.2307	51.8307
36.6500	37	.9996	.0004	104.6750	141.3250
36.6500	38	.9990	.0010	27.1210	63.7710
36.6500	39	.9988	.0012	15.5764	52.2264
36.7000	37	.9997	.0003	122.2940	158.9940
36.7000	38	.9990	.0010	28.2036	64.9036
36.7000	39	.9988	.0012	15.9372	52.6372
36.7500	37	.9997	.0003	146.9607	183.7107
36.7500	38	.9991	.0009	29.3729	66.1229
36.7500	39	.9988	.0012	16.3140	53.0640
36.8000	37	.9998	.0002	183.9607	220.7607
36.8000	38	.9991	.0009	30.6395	67.4395
36.8000	39	.9988	.0012	16.7080	53.5080
36.8500	37	.9998	.0002	245.6274	282.4774
36.8500	38	.9992	.0008	32.0163	68.8663
36.8500	39	.9989	.0011	17.1202	53.9702
36.9000	37	.9999	.0001	368.9607	405.8607
36.9000	38	.9992	.0008	33.5183	70.4183
36.9000	39	.9989	.0011	17.5521	54.4521
36.9500	37	.9999	.0001	738.9607	775.9107
36.9500	38	.9992	.0008	35.1633	72.1133
36.9500	39	.9989	.0011	18.0051	54.9551
37.0000	37	1.0000	0.0000	*0846:0000	*0882.0000
37.0000	38	.9993	.0007	36.9729	73.9729
37.0000	39	.9990	.0010	18.4807	55.4807

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
37.0500	38	.9993	.0007	38.9729	76.0229
37.0500	39	.9990	.0010	18.9807	56.0307
37.1000	38	.9993	.0007	41.1951	78.2951
37.1000	39	.9990	.0010	19.5070	56.6070
37.1500	38	.9994	.0006	43.6787	80.8287
37.1500	39	.9990	.0010	20.0618	57.2118
37.2000	38	.9994	.0006	46.4729	83.6729
37.2000	39	.9991	.0009	20.6473	57.8473
37.2500	38	.9995	.0005	49.6395	86.8895
37.2500	39	.9991	.0009	21.2664	58.5164
37.3000	38	.9995	.0005	53.2586	90.5586
37.3000	39	.9991	.0009	21.9219	59.2219
37.3500	38	.9995	.0005	57.4344	94.7844
37.3500	39	.9991	.0009	22.6170	59.9670
37.4000	38	.9996	.0004	62.3062	99.7062
37.4000	39	.9992	.0008	23.3557	60.7557
37.4500	38	.9996	.0004	68.0638	105.5138
37.4500	39	.9992	.0008	24.1420	61.5920
37.5000	38	.9996	.0004	74.9729	112.4729
37.5000	39	.9992	.0008	24.9807	62.4807
37.5500	38	.9997	.0003	83.4173	120.9673
37.5500	39	.9993	.0007	25.8772	63.4272
37.6000	38	.9997	.0003	93.9729	131.5729
37.6000	39	.9993	.0007	26.8378	64.4378
37.6500	38	.9997	.0003	107.5443	145.1943
37.6500	39	.9993	.0007	27.8696	65.5196
37.7000	38	.9998	.0002	125.6395	163.3395
37.7000	39	.9993	.0007	28.9807	66.6807
37.7500	38	.9998	.0002	150.9729	188.7229
37.7500	39	.9994	.0006	30.1807	67.9307
37.8000	38	.9999	.0001	188.9729	226.7729
37.8000	39	.9994	.0006	31.4807	69.2807
37.8500	38	.9999	.0001	252.3062	290.1562
37.8500	39	.9994	.0006	32.8937	70.7437
37.9000	38	.9999	.0001	378.9729	416.8729
37.9000	39	.9994	.0006	34.4352	72.3352
37.9500	38	1.0000	.0000	758.9729	796.9229
37.9500	39	.9995	.0005	36.1235	74.0735
38.0000	38	1.0000	0.0000	*1950.0000	*1987.0000
38.0000	39	.9995	.0005	37.9807	75.9807
38.0500	39	.9995	.0005	40.0333	78.0833
38.1000	39	.9995	.0005	42.3140	80.4140
38.1500	39	.9996	.0004	44.8630	83.0130
38.2000	39	.9996	.0004	47.7307	85.9307
38.2500	39	.9996	.0004	50.9807	89.2307
38.3000	39	.9996	.0004	54.6950	92.9950
38.3500	39	.9997	.0003	58.9807	97.3307
38.4000	39	.9997	.0003	63.9807	102.3807
38.4500	39	.9997	.0003	69.8898	108.3398
38.5000	39	.9997	.0003	76.9807	115.4807
38.5500	39	.9998	.0002	85.6474	124.1974
38.6000	39	.9998	.0002	96.4807	135.0807
38.6500	39	.9998	.0002	110.4093	149.0593
38.6500	40	.9998	.0002	28.6245	67.2745

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
38.6500	39	.9998	.0002	110.4093	149.0593
38.6500	40	.9998	.0002	28.6245	67.2745
38.6500	41	.9902	.0098	16.2857	54.9357
38.7000	39	.9999	.0001	128.9807	167.6807
38.7000	40	.9998	.0002	29.7641	68.4641
38.7000	41	.9904	.0096	16.6649	55.3649
38.7500	39	.9999	.0001	154.9807	193.7307
38.7500	40	.9998	.0002	30.9949	69.7449
38.7500	41	.9906	.0094	17.0610	55.8110
38.8000	39	.9999	.0001	193.9807	232.7807
38.8000	40	.9998	.0002	32.3282	71.1282
38.8000	41	.9909	.0091	17.4751	56.2751
38.8500	39	.9999	.0001	258.9807	297.8307
38.8500	40	.9998	.0002	33.7775	72.6275
38.8500	41	.9911	.0089	17.9085	56.7585
38.9000	39	1.0000	.0000	388.9807	427.8807
38.9000	40	.9999	.0001	35.3585	74.2585
38.9000	41	.9913	.0087	18.3625	57.2625
38.9500	39	1.0000	.0000	778.9807	817.9307
38.9500	40	.9999	.0001	37.0901	76.0401
38.9500	41	.9915	.0085	18.8386	57.7886
39.0000	40	.9999	.0001	38.9949	77.9949
39.0000	41	.9917	.0083	19.3386	58.3386
39.0500	40	.9999	.0001	41.1002	80.1502
39.0500	41	.9919	.0081	19.8642	58.9142
39.1000	40	.9999	.0001	43.4394	82.5394
39.1000	41	.9922	.0078	20.4175	59.5175
39.1500	40	.9999	.0001	46.0537	85.2037
39.1500	41	.9924	.0076	21.0007	60.1507
39.2000	40	.9999	.0001	48.9949	88.1949
39.2000	41	.9926	.0074	21.6163	60.8163
39.2500	40	.9999	.0001	52.3282	91.5782
39.2500	41	.9928	.0072	22.2670	61.5170
39.3000	40	.9999	.0001	56.1378	95.4378
39.3000	41	.9930	.0070	22.9561	62.2561
39.3500	40	.9999	.0001	60.5334	99.8834
39.3500	41	.9932	.0068	23.6869	63.0369
39.4000	40	.9999	.0001	65.6616	105.0616
39.4000	41	.9934	.0066	24.4633	63.8633
39.4500	40	.9999	.0001	71.7222	111.1722
39.4500	41	.9936	.0064	25.2899	64.7399
39.5000	40	.9999	.0001	78.9949	118.4949
39.5000	41	.9939	.0061	26.1716	65.6716
39.5500	40	.9999	.0001	87.8838	127.4338
39.5500	41	.9941	.0059	27.1141	66.6641
39.6000	40	.9999	.0001	98.9949	138.5949
39.6000	41	.9943	.0057	28.1239	67.7239
39.6500	40	1.0000	.0000	113.2806	152.9306
39.6500	41	.9945	.0055	29.2085	68.8585
39.7000	40	1.0000	.0000	132.3282	172.0282
39.7000	41	.9947	.0053	30.3766	70.0766
39.7500	40	1.0000	.0000	158.9949	198.7449
39.7500	41	.9949	.0051	31.6381	71.3881
39.8000	40	1.0000	.0000	198.9949	238.7949

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
39.8000	40	1.0000	.0000	198.9949	238.7949
39.8000	41	.9951	.0049	33.0047	72.8047
39.8500	40	1.0000	.0000	265.6616	305.5116
39.8500	41	.9953	.0047	34.4902	74.3402
39.9000	40	1.0000	.0000	398.9949	438.8949
39.9000	41	.9955	.0045	36.1107	76.0107
39.9500	40	1.0000	.0000	798.9949	838.9449
39.9500	41	.9957	.0043	37.8856	77.8356
40.0000	40	1.0000	0.0000	*4158.0000	*4197.0000
40.0000	41	.9959	.0041	39.8379	79.8379
40.0500	41	.9962	.0038	41.9958	82.0458
40.1000	41	.9964	.0036	44.3934	84.4934
40.1500	41	.9966	.0034	47.0731	87.2231
40.2000	41	.9968	.0032	50.0878	90.2878
40.2500	41	.9970	.0030	53.5044	93.7544
40.3000	41	.9972	.0028	57.4092	97.7092
40.3500	41	.9974	.0026	61.9146	102.2646
40.4000	41	.9976	.0024	67.1710	107.5710
40.4500	41	.9978	.0022	73.3831	113.8331
40.5000	41	.9980	.0020	80.8376	121.3376
40.5500	41	.9982	.0018	89.9487	130.4987
40.6000	41	.9984	.0016	101.3376	141.9376
40.6500	41	.9986	.0014	115.9804	156.6304
40.7000	41	.9988	.0012	135.5042	176.2042
40.7500	41	.9990	.0010	162.8375	203.5875
40.8000	41	.9992	.0008	203.8374	244.6374
40.8500	41	.9994	.0006	272.1707	313.0207
40.9000	41	.9996	.0004	408.8374	449.7374
40.9000	42	.9996	.0004	37.1656	78.0656
40.9000	43	.9994	.0006	19.4648	60.3648
40.9000	44	.9940	.0060	13.1139	54.0139
40.9500	41	.9998	.0002	818.8373	859.7873
40.9500	42	.9996	.0004	38.9838	79.9338
40.9500	43	.9994	.0006	19.9642	60.9142
40.9500	44	.9941	.0059	13.3466	54.2966
41.0000	41	1.0000	0.0000	*5262.0000	*5302.0000
41.0000	42	.9996	.0004	40.9838	81.9838
41.0000	43	.9994	.0006	20.4886	61.4886
41.0000	44	.9942	.0058	13.5871	54.5871
41.0500	42	.9996	.0004	43.1944	84.2444
41.0500	43	.9995	.0005	21.0399	62.0899
41.0500	44	.9943	.0057	13.8356	54.8856
41.1000	42	.9996	.0004	45.6505	86.7505
41.1000	43	.9995	.0005	21.6202	62.7202
41.1000	44	.9944	.0056	14.0928	55.1928
41.1500	42	.9997	.0003	48.3956	89.5456
41.1500	43	.9995	.0005	22.2319	63.3819
41.1500	44	.9945	.0055	14.3590	55.5090
41.2000	42	.9997	.0003	51.4838	92.6838
41.2000	43	.9995	.0005	22.8775	64.0775
41.2000	44	.9946	.0054	14.6346	55.8346
41.2500	42	.9997	.0003	54.9838	96.2338
41.2500	43	.9995	.0005	23.5601	64.8101
41.2500	44	.9947	.0053	14.9204	56.1704

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
41.3000	42	.9997	.0003	58.9838	100.2838
41.3000	43	.9995	.0005	24.2828	65.5828
41.3000	44	.9948	.0052	15.2166	56.5166
41.3500	42	.9997	.0003	63.5992	104.9492
41.3500	43	.9995	.0005	25.0492	66.3992
41.3500	44	.9949	.0051	15.5241	56.8741
41.4000	42	.9998	.0002	68.9838	110.3838
41.4000	43	.9996	.0004	25.8636	67.2636
41.4000	44	.9950	.0050	15.8434	57.2434
41.4500	42	.9998	.0002	75.3475	116.7975
41.4500	43	.9996	.0004	26.7306	68.1806
41.4500	44	.9951	.0049	16.1752	57.6252
41.5000	42	.9998	.0002	82.9839	124.4839
41.5000	43	.9996	.0004	27.6553	69.1553
41.5000	44	.9952	.0048	16.5203	58.0203
41.5500	42	.9998	.0002	92.3172	133.8672
41.5500	43	.9996	.0004	28.6438	70.1938
41.5500	44	.9953	.0047	16.8795	58.4295
41.6000	42	.9998	.0002	103.9839	145.5839
41.6000	43	.9996	.0004	29.7029	71.3029
41.6000	44	.9954	.0046	17.2536	58.8536
41.6500	42	.9999	.0001	118.9839	160.6339
41.6500	43	.9996	.0004	30.8405	72.4905
41.6500	44	.9955	.0045	17.6437	59.2937
41.7000	42	.9999	.0001	138.9839	180.6839
41.7000	43	.9996	.0004	32.0656	73.7656
41.7000	44	.9956	.0044	18.0507	59.7507
41.7500	42	.9999	.0001	166.9839	208.7339
41.7500	43	.9997	.0003	33.3886	75.1386
41.7500	44	.9957	.0043	18.4758	60.2258
41.8000	42	.9999	.0001	208.9839	250.7839
41.8000	43	.9997	.0003	34.8220	76.6220
41.8000	44	.9958	.0042	18.9203	60.7203
41.8500	42	.9999	.0001	278.9839	320.8339
41.8500	43	.9997	.0003	36.3799	78.2299
41.8500	44	.9959	.0041	19.3854	61.2354
41.9000	42	1.0000	.0000	418.9839	460.8839
41.9000	43	.9997	.0003	38.0795	79.9795
41.9000	44	.9960	.0040	19.8726	61.7726
41.9500	42	1.0000	.0000	838.9839	880.9339
41.9500	43	.9997	.0003	39.9410	81.8910
41.9500	44	.9961	.0039	20.3837	62.3337
42.0000	42	1.0000	0.0000	*6366.0000	*6407.0000
42.0000	43	.9997	.0003	41.9886	83.9886
42.0000	44	.9962	.0038	20.9202	62.9202
42.0500	43	.9997	.0003	44.2518	86.3018
42.0500	44	.9963	.0037	21.4843	63.5343
42.1000	43	.9998	.0002	46.7664	88.8664
42.1000	44	.9964	.0036	22.0781	64.1781
42.1500	43	.9998	.0002	49.5769	91.7269
42.1500	44	.9965	.0035	22.7040	64.8540
42.2000	43	.9998	.0002	52.7386	94.9386
42.2000	44	.9966	.0034	23.3647	65.5647
42.2500	43	.9998	.0002	56.3220	98.5720

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
42.2500	43	.9998	.0002	56.3220	98.5720
42.2500	44	.9967	.0033	24.0631	66.3131
42.3000	43	.9998	.0002	60.4172	102.7172
42.3000	44	.9968	.0032	24.8026	67.1026
42.3500	43	.9998	.0002	65.1425	107.4925
42.3500	44	.9969	.0031	25.5869	67.9369
42.4000	43	.9998	.0002	70.6553	113.0553
42.4000	44	.9970	.0030	26.4202	68.8202
42.4500	43	.9999	.0001	77.1705	119.6205
42.4500	44	.9971	.0029	27.3073	69.7573
42.5000	43	.9999	.0001	84.9886	127.4886
42.5000	44	.9972	.0028	28.2535	70.7535
42.5500	43	.9999	.0001	94.5442	137.0942
42.5500	44	.9973	.0027	29.2650	71.8150
42.6000	43	.9999	.0001	106.4886	149.0886
42.6000	44	.9974	.0026	30.3487	72.9487
42.6500	43	.9999	.0001	121.8458	164.4958
42.6500	44	.9975	.0025	31.5128	74.1628
42.7000	43	.9999	.0001	142.3220	185.0220
42.7000	44	.9976	.0024	32.7663	75.4663
42.7500	43	.9999	.0001	170.9886	213.7386
42.7500	44	.9977	.0023	34.1201	76.8701
42.8000	43	.9999	.0001	213.9886	256.7886
42.8000	44	.9978	.0022	35.5868	78.3868
42.8500	43	1.0000	.0000	285.6553	328.5053
42.8500	44	.9979	.0021	37.1810	80.0310
42.9000	43	1.0000	.0000	428.9886	471.8886
42.9000	44	.9980	.0020	38.9201	81.8201
42.9500	43	1.0000	.0000	858.9886	901.9386
42.9500	44	.9980	.0020	40.8249	83.7749
43.0000	44	.9981	.0019	42.9201	85.9201
43.0500	44	.9982	.0018	45.2359	88.2859
43.1000	44	.9983	.0017	47.8090	90.9090
43.1500	44	.9984	.0016	50.6848	93.8348
43.2000	44	.9985	.0015	53.9201	97.1201
43.2500	44	.9986	.0014	57.5867	100.8367
43.3000	44	.9987	.0013	61.7772	105.0772
43.3500	44	.9988	.0012	66.6124	109.9624
43.4000	44	.9989	.0011	72.2534	115.6534
43.4500	44	.9990	.0010	78.9201	122.3701
43.5000	44	.9991	.0009	86.9200	130.4200
43.5500	44	.9992	.0008	96.6978	140.2478
43.6000	44	.9993	.0007	108.9200	152.5200
43.6500	44	.9994	.0006	124.6343	168.2843
43.7000	44	.9995	.0005	145.5867	189.2867
43.7500	44	.9995	.0005	174.9200	218.6700
43.8000	44	.9996	.0004	218.9200	262.7200
43.8000	45	.9996	.0004	36.4863	80.2863
43.8000	46	.9984	.0016	19.8766	63.6766
43.8500	44	.9997	.0003	292.2533	336.1033
43.8500	45	.9996	.0004	38.1168	81.9668
43.8500	46	.9984	.0016	20.3628	64.2128
43.9000	44	.9998	.0002	438.9200	482.8200
43.9000	45	.9997	.0003	39.8954	83.7954

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
43.9000	44	.9998	.0002	438.9200	482.8200
43.9000	45	.9997	.0003	39.8954	83.7954
43.9000	46	.9984	.0016	20.8722	64.7722
43.9500	44	.9999	.0001	878.9200	922.8700
43.9500	45	.9997	.0003	41.8435	85.7935
43.9500	46	.9985	.0015	21.4065	65.3565
44.0000	45	.9997	.0003	43.9863	87.9863
44.0000	46	.9985	.0015	21.9675	65.9675
44.0500	45	.9997	.0003	46.3547	90.4047
44.0500	46	.9986	.0014	22.5572	66.6072
44.1000	45	.9997	.0003	48.9863	93.0863
44.1000	46	.9986	.0014	23.1780	67.2780
44.1500	45	.9997	.0003	51.9275	96.0775
44.1500	46	.9986	.0014	23.8323	67.9823
44.2000	45	.9998	.0002	55.2363	99.4363
44.2000	46	.9987	.0013	24.5230	68.7230
44.2500	45	.9998	.0002	58.9863	103.2363
44.2500	46	.9987	.0013	25.2532	69.5032
44.3000	45	.9998	.0002	63.2720	107.5720
44.3000	46	.9988	.0012	26.0263	70.3263
44.3500	45	.9998	.0002	68.2171	112.5671
44.3500	46	.9988	.0012	26.8462	71.1962
44.4000	45	.9998	.0002	73.9863	118.3863
44.4000	46	.9988	.0012	27.7175	72.1175
44.4500	45	.9998	.0002	80.8045	125.2545
44.4500	46	.9989	.0011	28.6449	73.0949
44.5000	45	.9998	.0002	88.9863	133.4863
44.5000	46	.9989	.0011	29.6341	74.1341
44.5500	45	.9999	.0001	98.9863	143.5363
44.5500	46	.9989	.0011	30.6916	75.2416
44.6000	45	.9999	.0001	111.4863	156.0863
44.6000	46	.9990	.0010	31.8246	76.4246
44.6500	45	.9999	.0001	127.5578	172.2078
44.6500	46	.9990	.0010	33.0415	77.6915
44.7000	45	.9999	.0001	148.9863	193.6863
44.7000	46	.9991	.0009	34.3521	79.0521
44.7500	45	.9999	.0001	178.9863	223.7363
44.7500	46	.9991	.0009	35.7675	80.5175
44.8000	45	.9999	.0001	223.9863	268.7863
44.8000	46	.9991	.0009	37.3008	82.1008
44.8500	45	1.0000	.0000	298.9863	343.8363
44.8500	46	.9992	.0008	38.9675	83.8175
44.9000	45	1.0000	.0000	448.9863	493.8863
44.9000	46	.9992	.0008	40.7856	85.6856
44.9500	45	1.0000	.0000	898.9863	943.9363
44.9500	46	.9992	.0008	42.7770	87.7270
45.0000	46	.9993	.0007	44.9674	89.9674
45.0500	46	.9993	.0007	47.3885	92.4385
45.1000	46	.9994	.0006	50.0786	95.1786
45.1500	46	.9994	.0006	53.0851	98.2351
45.2000	46	.9994	.0006	56.4674	101.6674
45.2500	46	.9995	.0005	60.3008	105.5508
45.3000	46	.9995	.0005	64.6817	109.9817
45.3500	46	.9995	.0005	69.7367	115.0867

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
45.4000	46	.9996	.0004	75.6341	121.0341
45.4000	47	.9996	.0004	28.3625	73.7625
45.4000	48	.9980	.0020	17.4267	62.8267
45.4500	46	.9996	.0004	82.6038	128.0538
45.4500	47	.9996	.0004	29.3101	74.7601
45.4500	48	.9980	.0020	17.7887	63.2387
45.5000	46	.9996	.0004	90.9674	136.4674
45.5000	47	.9996	.0004	30.3208	75.8208
45.5000	48	.9981	.0019	18.1651	63.6651
45.5500	46	.9997	.0003	101.1897	146.7397
45.5500	47	.9996	.0004	31.4013	76.9513
45.5500	48	.9981	.0019	18.5570	64.1070
45.6000	46	.9997	.0003	113.9674	159.5674
45.6000	47	.9996	.0004	32.5589	78.1589
45.6000	48	.9982	.0018	18.9651	64.5651
45.6500	46	.9998	.0002	130.3960	176.0460
45.6500	47	.9996	.0004	33.8023	79.4523
45.6500	48	.9982	.0018	19.3907	65.0407
45.7000	46	.9998	.0002	152.3008	198.0008
45.7000	47	.9996	.0004	35.1414	80.8414
45.7000	48	.9982	.0018	19.8347	65.5347
45.7500	46	.9998	.0002	182.9674	228.7174
45.7500	47	.9997	.0003	36.5875	82.3375
45.7500	48	.9983	.0017	20.2985	66.0485
45.8000	46	.9999	.0001	228.9674	274.7674
45.8000	47	.9997	.0003	38.1542	83.9542
45.8000	48	.9983	.0017	20.7833	66.5833
45.8500	46	.9999	.0001	305.6341	351.4841
45.8500	47	.9997	.0003	39.8571	85.7071
45.8500	48	.9984	.0016	21.2907	67.1407
45.9000	46	.9999	.0001	458.9674	504.8674
45.9000	47	.9997	.0003	41.7148	87.6148
45.9000	48	.9984	.0016	21.8223	67.7223
45.9500	46	1.0000	.0000	918.9674	964.9174
45.9500	47	.9997	.0003	43.7494	89.6994
45.9500	48	.9984	.0016	22.3798	68.3298
46.0000	47	.9997	.0003	45.9875	91.9875
46.0000	48	.9985	.0015	22.9651	68.9651
46.0500	47	.9997	.0003	48.4612	94.5112
46.0500	48	.9985	.0015	23.5805	69.6305
46.1000	47	.9998	.0002	51.2097	97.3097
46.1000	48	.9986	.0014	24.2283	70.3283
46.1500	47	.9998	.0002	54.2816	100.4316
46.1500	48	.9986	.0014	24.9111	71.0611
46.2000	47	.9998	.0002	57.7375	103.9375
46.2000	48	.9986	.0014	25.6318	71.8318
46.2500	47	.9998	.0002	61.6542	107.9042
46.2500	48	.9987	.0013	26.3937	72.6437
46.3000	47	.9998	.0002	66.1304	112.4304
46.3000	48	.9987	.0013	27.2004	73.5004
46.3500	47	.9998	.0002	71.2952	117.6452
46.3500	48	.9988	.0012	28.0560	74.4060
46.4000	47	.9998	.0002	77.3208	123.7208
46.4000	48	.9988	.0012	28.9651	75.3651

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MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
46.4500	47	.9999	.0001	84.4421	130.8921
46.4500	48	.9988	.0012	29.9329	76.3829
46.5000	47	.9999	.0001	92.9875	139.4875
46.5000	48	.9989	.0011	30.9651	77.4651
46.5000	49	.9989	.0011	18.5789	65.0789
46.5500	47	.9999	.0001	103.4320	149.9820
46.5500	48	.9989	.0011	32.0686	78.6186
46.5500	49	.9989	.0011	18.9789	65.5289
46.6000	47	.9999	.0001	116.4875	163.0875
46.6000	48	.9990	.0010	33.2508	79.8508
46.6000	49	.9989	.0011	19.3955	65.9955
46.6500	47	.9999	.0001	133.2732	179.9232
46.6500	48	.9990	.0010	34.5207	81.1707
46.6500	49	.9989	.0011	19.8299	66.4799
46.7000	47	.9999	.0001	155.6542	202.3542
46.7000	48	.9990	.0010	35.8882	82.5882
46.7000	49	.9990	.0010	20.2832	66.9832
46.7500	47	.9999	.0001	186.9875	233.7375
46.7500	48	.9991	.0009	37.3651	84.1151
46.7500	49	.9990	.0010	20.7567	67.5067
46.8000	47	.9999	.0001	233.9875	280.7875
46.8000	48	.9991	.0009	38.9651	85.7651
46.8000	49	.9990	.0010	21.2516	68.0516
46.8500	47	1.0000	.0000	312.3208	359.1708
46.8500	48	.9991	.0009	40.7042	87.5542
46.8500	49	.9990	.0010	21.7696	68.6196
46.9000	47	1.0000	.0000	468.9875	515.8875
46.9000	48	.9992	.0008	42.6015	89.5015
46.9000	49	.9991	.0009	22.3122	69.2122
46.9500	47	1.0000	.0000	938.9875	985.9375
46.9500	48	.9992	.0008	44.6794	91.6294
46.9500	49	.9991	.0009	22.8813	69.8313
47.0000	48	.9993	.0007	46.9651	93.9651
47.0000	49	.9991	.0009	23.4789	70.4789
47.0500	48	.9993	.0007	49.4914	96.5414
47.0500	49	.9991	.0009	24.1071	71.1571
47.1000	48	.9993	.0007	52.2984	99.3984
47.1000	49	.9991	.0009	24.7684	71.8684
47.1500	48	.9994	.0006	55.4357	102.5857
47.1500	49	.9992	.0008	25.4654	72.6154
47.2000	48	.9994	.0006	58.9651	106.1651
47.2000	49	.9992	.0008	26.2011	73.4011
47.2000	50	.9992	.0008	16.8435	64.0435
47.2500	48	.9994	.0006	62.9651	110.2151
47.2500	49	.9992	.0008	26.9789	74.2289
47.2500	50	.9992	.0008	17.1682	64.4182
47.3000	48	.9995	.0005	67.5365	114.8365
47.3000	49	.9992	.0008	27.8024	75.1024
47.3000	50	.9992	.0008	17.5049	64.8049
47.3500	48	.9995	.0005	72.8113	120.1613
47.3500	49	.9993	.0007	28.6759	76.0259
47.3500	50	.9992	.0008	17.8543	65.2043
47.4000	48	.9996	.0004	78.9651	126.3651
47.4000	49	.9993	.0007	29.6039	77.0039

[redacted]

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
47.4000	48	.9996	.0004	78.9651	126.3651
47.4000	49	.9993	.0007	29.6039	77.0039
47.4000	50	.9993	.0007	18.2172	65.6172
47.4500	48	.9996	.0004	86.2378	133.6878
47.4500	49	.9993	.0007	30.5918	78.0418
47.4500	50	.9993	.0007	18.5942	66.0442
47.5000	48	.9996	.0004	94.9651	142.4651
47.5000	49	.9993	.0007	31.6456	79.1456
47.5000	50	.9993	.0007	18.9864	66.4864
47.5500	48	.9997	.0003	105.6318	153.1818
47.5500	49	.9994	.0006	32.7720	80.3220
47.5500	50	.9993	.0007	19.3945	66.9445
47.6000	48	.9997	.0003	118.9651	166.5651
47.6000	49	.9994	.0006	33.9789	81.5789
47.6000	50	.9993	.0007	19.8197	67.4197
47.6500	48	.9997	.0003	136.1080	183.7580
47.6500	49	.9994	.0006	35.2752	82.9252
47.6500	50	.9993	.0007	20.2630	67.9130
47.7000	48	.9998	.0002	158.9651	206.6651
47.7000	49	.9994	.0006	36.6712	84.3712
47.7000	50	.9993	.0007	20.7255	68.4255
47.7500	48	.9998	.0002	190.9651	238.7151
47.7500	49	.9994	.0006	38.1789	85.9289
47.7500	50	.9994	.0006	21.2086	68.9586
47.8000	48	.9999	.0001	238.9651	286.7651
47.8000	49	.9995	.0005	39.8122	87.6122
47.8000	50	.9994	.0006	21.7137	69.5137
47.8500	48	.9999	.0001	318.9651	366.8151
47.8500	49	.9995	.0005	41.5876	89.4376
47.8500	50	.9994	.0006	22.2422	70.0922
47.9000	48	.9999	.0001	478.9651	526.8651
47.9000	49	.9995	.0005	43.5243	91.4243
47.9000	50	.9994	.0006	22.7959	70.6959
47.9500	48	1.0000	.0000	958.9651	1006.9151
47.9500	49	.9995	.0005	45.6456	93.5956
47.9500	50	.9994	.0006	23.3766	71.3266
48.0000	49	.9996	.0004	47.9789	95.9789
48.0000	50	.9994	.0006	23.9864	71.9864
48.0500	49	.9996	.0004	50.5578	98.6078
48.0500	50	.9994	.0006	24.6274	72.6774
48.1000	49	.9996	.0004	53.4233	101.5233
48.1000	50	.9995	.0005	25.3022	73.4022
48.1500	49	.9996	.0004	56.6259	104.7759
48.1500	50	.9995	.0005	26.0134	74.1634
48.2000	49	.9996	.0004	60.2289	108.4289
48.2000	50	.9995	.0005	26.7642	74.9642
48.2500	49	.9997	.0003	64.3122	112.5622
48.2500	50	.9995	.0005	27.5578	75.8078
48.3000	49	.9997	.0003	68.9789	117.2789
48.3000	50	.9995	.0005	28.3982	76.6982
48.3500	49	.9997	.0003	74.3635	122.7135
48.3500	50	.9995	.0005	29.2894	77.6394
48.4000	49	.9997	.0003	80.6456	129.0456
48.4000	50	.9996	.0004	30.2364	78.6364

[redacted]

MULTI-CHANNEL QUEUEING TABLE DATA

RHO	S	BP	IP	QL	TNS
48.4500	49	.9998	.0002	88.0698	136.5198
48.4500	50	.9996	.0004	31.2445	79.6945
48.5000	49	.9998	.0002	96.9789	145.4789
48.5000	50	.9996	.0004	32.3197	80.8197
48.5500	49	.9998	.0002	107.8678	156.4178
48.5500	50	.9996	.0004	33.4691	82.0191
48.6000	49	.9998	.0002	121.4789	170.0789
48.6000	50	.9996	.0004	34.7007	83.3007
48.6500	49	.9998	.0002	138.9789	187.6289
48.6500	50	.9996	.0004	36.0234	84.6734
48.7000	49	.9999	.0001	162.3122	211.0122
48.7000	50	.9996	.0004	37.4479	86.1479
48.7500	49	.9999	.0001	194.9789	243.7289
48.7500	50	.9997	.0003	38.9864	87.7364
48.8000	49	.9999	.0001	243.9789	292.7789
48.8000	50	.9997	.0003	40.6531	89.4531
48.8500	49	.9999	.0001	325.6456	374.4956
48.8500	50	.9997	.0003	42.4646	91.3146
48.9000	49	1.0000	.0000	488.9789	537.8789
48.9000	50	.9997	.0003	44.4409	93.3409
48.9500	49	1.0000	.0000	978.9789	1027.9289
48.9500	50	.9997	.0003	46.6054	95.5554
49.0000	50	.9997	.0003	48.9864	97.9864
49.0500	50	.9997	.0003	51.6180	100.6680
49.1000	50	.9998	.0002	54.5419	103.6419
49.1500	50	.9998	.0002	57.8099	106.9599
49.2000	50	.9998	.0002	61.4864	110.6864
49.2500	50	.9998	.0002	65.6531	114.9031
49.3000	50	.9998	.0002	70.4150	119.7150
49.3500	50	.9998	.0002	75.9095	125.2595
49.4000	50	.9998	.0002	82.3197	131.7197
49.4500	50	.9998	.0002	89.8955	139.3455
49.5000	50	.9999	.0001	98.9864	148.4864
49.5500	50	.9999	.0001	110.0975	159.6475
49.6000	50	.9999	.0001	123.9864	173.5864
49.6500	50	.9999	.0001	141.8435	191.4935
49.7000	50	.9999	.0001	165.6531	215.3531
49.7500	50	.9999	.0001	198.9864	248.7364
49.8000	50	.9999	.0001	248.9864	298.7864
49.8500	50	1.0000	.0000	332.3197	382.1697
49.9000	50	1.0000	.0000	498.9864	548.8864
49.9500	50	1.0000	.0000	998.9864	1048.9364

A CASE STUDY USING THE SIMPLIFIED APPROACH

COMMENTS:

The data of this training center problem is taken from Wilson(1977). This training problem is most representative to those involving cost effective allocation of learning resources in any self-instructional system. We have assumed cost data in the Forms which are necessary to show how the simplified approach developed can be used. We have omitted the data that are not necessary at this stage.

In Form C for subsystem: Audio, the optimum number of servers (S) will be 16, for which the total cost is minimum. The waiting time corresponding to these servers is 0.03 hours or 1.80 minutes. If, as decision makers, we decide that the waiting time should be approximately one minute, we look for the values of RHO (at the table) lower than the calculated one. We then see that for RHO = 8.9 the waiting time is approximately 1 minute. Therefore RHO = 8.9 is optimal.

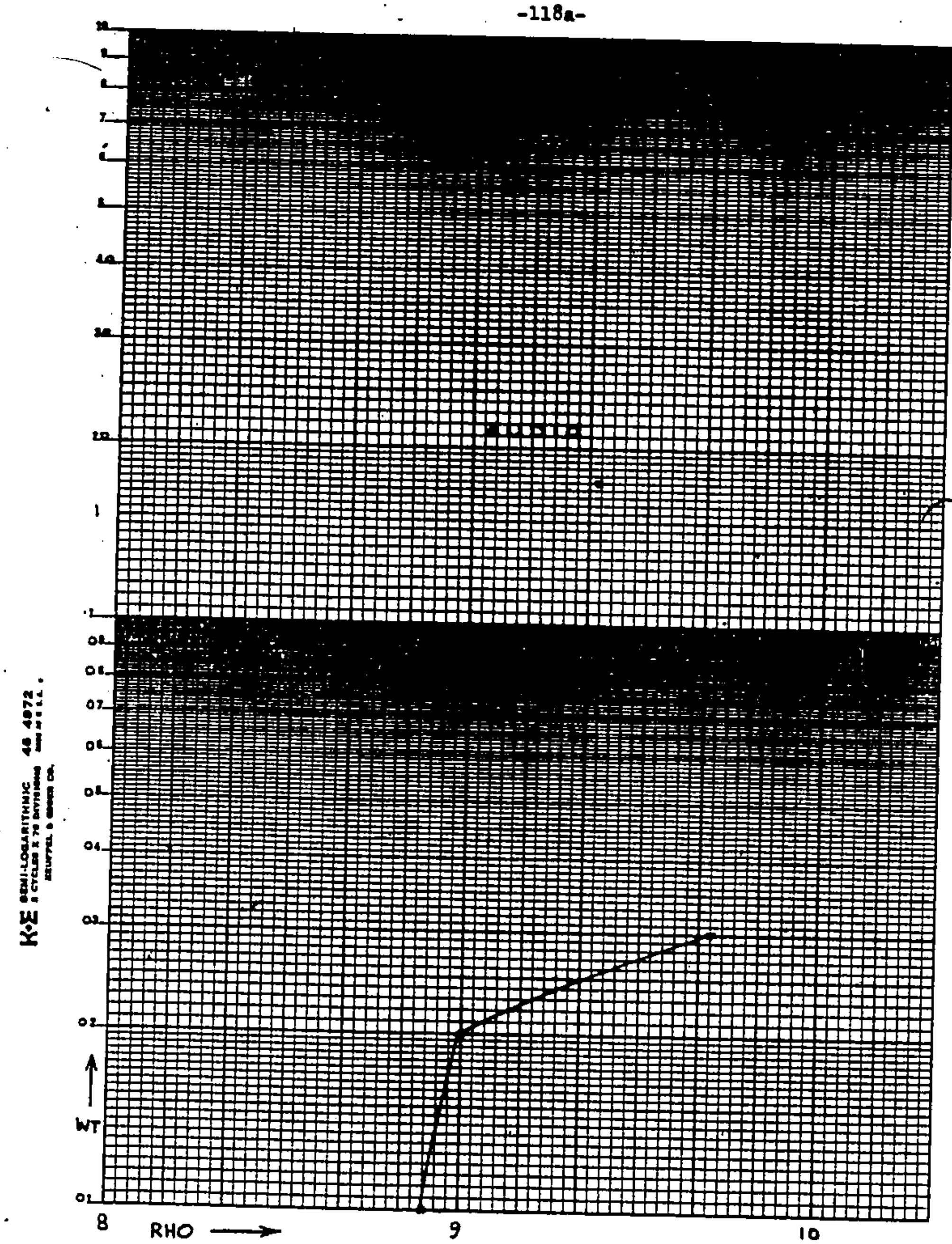
Again in another case for subsystem: Audio-visual, the optimum number of servers (S) will be 4, for which the total cost is minimum. The waiting time corresponding to these servers is 0.02 hrs. (ie: 1.20 minutes). If we, as decision makers, decide that this waiting time may be increased to approximately two (2) minutes so as to increase the percentage utilization of the servers selected, then we look for the values of RHO (at the table) higher than the calculated one. We find that for RHO value = 1.15, the waiting time is approximately 2 minutes as desired. Therefore RHO = 1.15 is optimal in this case.

$$\% \text{ utilization increase} = \frac{IP_{S=4,\ RHO=1.0} - IP_{S=4,\ RHO=1.15}}{IP_{S=4,\ RHO=1.0}} \times 100$$

$$= \frac{0.9796 - 0.9677}{0.9796} \times 100$$

$$= 1.24$$

The effects of RHO for the two situations are shown in graphs.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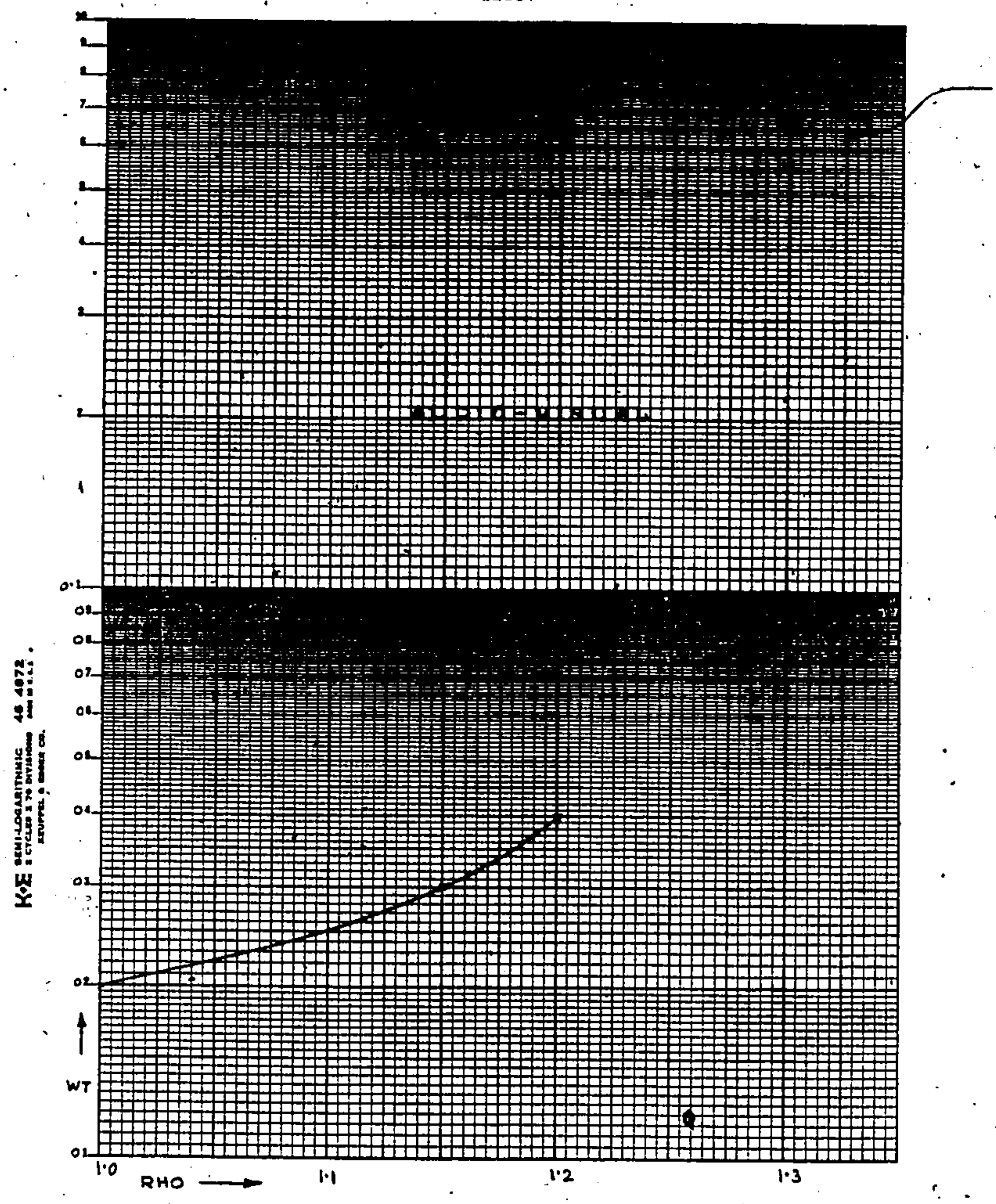

FORM AA: OPERATING/NEW SYSTEM

	TYPES OF LEARNING RESOURCES AVAILABLE							
Special No. of lessons in the program	Audio	Audio-Visual	Print	Simulation				
1	X							
2			X					
3		X						
4			X					
5			X					
6			X					
7			X					
8	X							
9			X					
10			X					
11			X					
12	X							
13	X							
14			X					
15			X					
16	X							
17			X					
18			X					
19			X					
20	X							
21			X					
22			X					
23			X					
24			X					
25				X				
26		X						
27				X				
28				X				
29	X							
30				X				
31				X				
32	X							
Total No. of lessons to be offered by each type of learning resources (I_{LG}),								

FORM AA: OPERATING/NEW SYSTEM

Special No. of lessons in the program	TYPES OF LEARNING RESOURCES AVAILABLE							
	Audio	Audio-Visual	Print	Simulation				
33	X							
34			X					
35	X							
36	X							
37			X					
38			X					
39			X					
40		X						
41			X					
42			X					
43			X					
44	X							
45			X					
46			X					
47			X					
48			X					
49			X					
50	X							
51			X					
52			X					
53			X					
54			X					
55			X					
56			X					
57			X					
58				X				
59			X					
60			X					
61			X					
62			X					
63			X					
64	X							
Total No. of lessons to be offered by each type of learning resources (I_{LG})								

FORM AA: OPERATING/NEW SYSTEM

Special No. of lessons in the program	TYPES OF LEARNING RESOURCES AVAILABLE							
	Audio	Audio-visual	Print	Simulation				
65			x					
66			x					
67			x					
68			x					
69				x				
Total No. of lessons to be offered by each type of learning resources (I_{LG})	14	3	45	7				

[redacted]

FORM AB

SUB-SYSTEM: Audio OPERATING/NEW/SYSTEM

	TIME TAKEN BY STUDENTS FOR LESSONS																TOTAL TIME TAKEN BY EACH STUDENT FOR ALL THE LESSONS (T_A)
STUDENTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14			
Total Time Taken by all Students for each lesson (T_{Mi})																	ΣT_A = ___ ; $T_M = \Sigma T_{Mi}$ = ___
Average Time Per Student Per Lesson (T_B) = T_{Mi}/N	3.75	3.50	6.25	5.25	4.75	3.0	16.0	2.75	4.25	4.25	7.0	1.75	2.0	2.5			$T_M = \Sigma T_A$ = ___ ; T_M* = $(\Sigma T_B) \cdot N$ = 67 x 26

N = Number of students in the program

TOTAL TIME TAKEN BY ALL STUDENTS FOR ALL LESSONS (T_M) = 1742 hrs.

AVERAGE TIME OF SERVICE (T_{Am}) PER STUDENT PER LESSON = T_M/PT = 1742/364 = 4.78

PT = (number of students) x (number of lessons)
= 26 x 14 = 364

* NOTE: T_M may be calculated in either way depending on the availability of data.

[redacted]

FORM A8

SUB-SYSTEM: Audio-Visual OPERATING/NEW/SYSTEM

STUDENTS	TIME TAKEN BY STUDENTS FOR LESSONS 1	2	3														TOTAL TIME TAKEN BY EACH STUDENT FOR ALL THE LESSONS (T_A)
Total Time Taken by all Students for each lesson (T_{M_i})																	ΣT_A = ___ $T_M = \Sigma T_{M_i}$ = ___
Average Time Per Student Per Lesson (T_B) = T_{M_i}/N	0.75	1.0	5.05														$T_M = \Sigma T_A$ = ___ $T_M^* = (\Sigma T_B) \times N$ = 7.0 × 26

N = Number of students in the program

TOTAL TIME TAKEN BY ALL STUDENTS FOR ALL LESSONS (T_M) = 182

AVERAGE TIME OF SERVICE (T_{A_M}) PER STUDENT PER LESSON = T_M/PT = 182/78

PT = (number of students) × (number of lessons) = 2.33

= 26 × 3 = 78

* NOTE: T_M may be calculated in either way depending on the availability of data.

[redacted]

FORM A

FORM FOR DATA COLLECTION

Name of the Institution XYZ training center

OPERATING SYSTEM

Program length in days (PL) = 26

Study hrs. per day (SH) = 7

Program length in hrs. (L) = PL x SH = 26 x 7 = 180

Number of pupils in the program (N) = 26

Types of learning resources (subsystems): to be used	Number Available
a)	
b)	
c)	
d)	
e)	
f)	
g)	
h)	
i)	
j)	

Number of lessons offered through each learning resource per pupil (using Form AA)

Types of learning resources:	Number of lessons (I_{LG})
a) Audio	14
b) Audio-Visual	3
c) Print	45
d) Simulation	7
e)	
f)	
g)	
h)	
i)	
j)	

Name of the Institution ______

NEW SYSTEM

Program length in days (PL) = ______

Study hrs. per day (SH) = ______

Program length in hrs. (L) = PL x SH = ______ = ______

Number of pupils in the program (N) = ______

Types of learning resources (subsystems): to be used	Number Available
a)	
b)	
c)	
d)	
e)	
f)	
g)	
h)	
i)	
j)	

Number of lessons offered through each learning resource per pupil (using Form AA)

Types of learning resources:	Number of Lessons (I_{LG})
a)	
b)	
c)	
d)	
e)	
f)	
g)	
h)	
i)	
j)	

[redacted]

OPERATING SYSTEM

Average time of service for each learning resource (T_{AM}), (using Form AB)

Types of learning resources	T_{AM}
a) Audio	9·7
b) Audio-Visual	2·33
c)	
d)	
e)	
f)	
g)	
h)	
i)	
j)	

Wages (~~actual~~ or estimated) per pupil per hr. (C_W) $3·0

Fixed cost of each type of learning resources:

Type	Cost of hardware Life in hr.		Cost of software Life in hr.		Fixed Cost per hr. (C_F)
a)	:	+		=	
b)	:	+		=	
c)	:	+		=	
d)	:	+		=	
e)	:	+		=	
f)	:	+		=	
g)	:	+		=	
h)	:	+		=	
i)	:	+		=	
j)	:	+		=	

NEW SYSTEM

Average time of service for each learning resource (T_{AM}), (using Form AB)

Types of learning resources	T_{AM}
a)	
b)	
c)	
d)	
e)	
f)	
g)	
h)	
i)	
j)	

Wages (actual or estimated) per pupil per hr. (C_W) ______

Fixed cost of each type of learning resources:

Type	Cost of hardware Life in hr.		Cost of Software Life in hr.		Fixed Cost per hr. (C_F)
a)	:	+		=	
b)	:	+		=	
c)	:	+		=	
d)	:	+		=	
e)	:	+		=	
f)	:	+		=	
g)	:	+		=	
h)	:	+		=	
i)	:	+		=	
j)	:	+		=	

OPERATING SYSTEM

Operating Cost of each type of learning resources

Type	Operating Cost per hr. (C_{OP})
a)	:
b)	:
c)	:
d)	:
e)	:
f)	:
g)	:
h)	:
i)	:
j)	:

Maintenance Cost of each type of learning resources

Type	Maintenance Cost per hr. (C_M)
a)	:
b)	:
c)	:
d)	:
e)	:
f)	:
g)	:
h)	:
i)	:
j)	:

NEW SYSTEM

Operating Cost of each type of learning resources

Type	Operating cost pe hr. (C_{OP})
a)	:
a)	:
c)	:
d)	:
e)	:
f)	:
g)	:
h)	:
i)	:
j)	:

Maintenance Cost of each type of learning resources

Type	Maintenance Cost per hr. (C_M)
a)	:
b)	:
c)	:
d)	:
e)	:
f)	:
g)	:
h)	:
i)	:
j)	:

[redacted]

OPERATING SYSTEM

Cost of service for each type of learning resources (C_S) per hour (~~actual~~/estimated).

Type	: C_F	+ C_{OP}	+ C_M	= C_S
a) Audio				$1·00
b) Audio-Visual				$1·00
c)				
d)				
e)				
f)				
g)				
h)				
i)				
j)				

NEW SYSTEM

Cost of service for each type of learning resources (C_S) per hour (actual/estimated).

Type	: C_F	+ C_{OP}	+ C_M	= C_S
a)				
b)				
c)				
d)				
e)				
f)				
g)				
h)				
i)				
j)				

FORM B

(CALCULATION OF TRAFFIC INTENSITY (RHO), USING FORM A)
SUBSYSTEM (IE: NAME OF THE LEARNING RESOURCE): Audio

OPERATING SYSTEM

Program length in hrs. (L) = 180

Number of pupils in the system (N) = 26

Number of lessons offered in the subsystem (I_{LG}) = 14

Total population (PT) $N \times I_{LG}$
= 26 x 14
= 364

Population arriving per hr. (P) = PT/L
= λ = 364/180
= 2·03

Average time of service for the subsystem (T_{AM}) in hr. = 4·78

Rate of service (ie: the population that can be served by the subsystem per hr), $\mu = 1/T_{AM}$
= 1/4·78
=

Traffic intensity (RHO) $P \times \frac{1}{T_{AM}}$ or λ/μ
= 2·03x4·78
= 9·7

NEW SYSTEM

Program length in hrs. (L) =

Number of pupils in the system (N) =

Number of lessons offered in the subsystem (I_{LG}) =

Total population (PT) $N \times I_{LG}$
=
=

Population arriving per hr. (P) = PT/L
= λ =
=

Average time of service for the subsystem (T_{AM}) in hr. =

Rate of service (ie: the population that can be served by the subsystem per hr), $\mu = 1/T_{AM}$
=
=

Traffic intensity (RHO) $P \times \frac{1}{T_{AM}}$ or
=
=

FORM B

(CALCULATION OF TRAFFIC INTENSITY (RHO), USING FORM A)
SUBSYSTEM (IE: NAME OF THE LEARNING RESOURCE): Audio-Visual

OPERATING SYSTEM		NEW SYSTEM	
Program length in hrs. (L)	= 180	Program length in hrs. (L)	= ____
Number of pupils in the system (N)	= 26	Number of pupils in the system (N)	= ____
Number of lessons offered in the subsystem (I_{LG})	= 3	Number of lessons offered in the subsystem (I_{LG})	= ____
Total population (PT) $N \times I_{LG}$	= 26x3 = 78	Total population (PT) $N \times I_{LG}$	= ____ = ____
Population arriving per hr. (P) = PT/L	= λ = 78/180 = 0·43	Population arriving per hr. (P) = PT/L	= λ = ____ = ____
Average time of service for the subsystem (T_{AM}) in hr.	= 2·33	Average time of service for the subsystem (T_{AM}) in hr.	= ____
Rate of service (ie: the population that can be served by the subsystem per hr), $\mu = 1/T_{AM}$	= 1/2·33 = ____	Rate of service (ie: the population that can be served by the subsystem per hr), $\mu = 1/T_{AM}$	= ____ = ____
Traffic intensity (RHO) $P \times 1 / T_{AM}$ or λ/μ	= 0·43x2·33 = 1·0019	Traffic intensity (RHO) $P \times 1 / T_{AM}$ or	= ____ = ____

FORM C (FOR COST ANALYSIS AND DECISION MAKING)

SUB-SYSTEM: Audio

OPERATING SYSTEM

Wages (Actual or estimated) per student per hour (C_W)= $3.00

Cost of providing service per resource per hour (C_S)= $1.00

Arrival rate (λ) per hour= 2.03

Data from table for calculated traffic intensity (RHO) = 9.7

NEW SYSTEM

Wages (Actual or estimated) per student per hour (C_W)= ______

Cost of providing service per resource per hour (C_S)= ______

Arrival rate (λ) per hour= ______

Data from table for calculated traffic intensity (RHO) = ______

	Traffic Intensity	Number of Servers	Probability of Idle Time	Queue Length per hr	Waiting Time in hrs	Total Population in The System per hr.	Total Time per population in the System in hrs.	A: Cost of Idle Time per hr.	B: Cost of Waiting Time per hr.	TC: Total Cost per hr.
	RHO	S	IP	QL	WT = QL/λ	TNS	TNS/λ	IP x C_S	WT x C_W	A + B
STAGE I	9.7	10	.1067	28.88	14.23	38.58	19.00	0.11	42.68	42.79
	9.7	11	.4004	4.47	2.20	14.17	6.98	0.40	6.61	7.01
	9.7	12	.6119	1.64	0.81	11.34	5.58	0.61	2.42	3.03
	9.7	13	.7584	0.71	0.35	10.41	5.13	0.76	1.05	1.81
	9.7	14	.8556	0.33	0.16	10.03	4.94	0.85	0.48	1.34
	9.7	15	.9173	0.15	0.07	9.85	4.85	0.92	0.22	1.14
STAGE 2	9.6	16	.9581	.0628	.03	9.66	4.76	0.96	0.09	1.05
	9.5	16	.9614	.0583	.03	9.56	4.71	0.96	0.08	1.04
	9.4	16	.9646	.0505	.02	9.45	4.65	0.96	0.07	1.03
	9.3	16	.9675	.0452	.02	9.34	4.60	0.97	0.07	1.04
	9.2	16	.9702	.0403	.02	9.24	4.55	0.97	0.06	1.03
	9.1	16	.9727	.0360	.02	9.13	4.50	0.97	0.05	1.02

New System:

Traffic Intensity	Number of Servers	Probability of Idle Time	Queue Length per hr.	Waiting Time in hrs	Total Population In The System per hr.	Total Time Per population In The System in hrs.	A: Cost of Idle Time per hr.	B: Cost of Waiting Time per hr.	TC: Total Cost per hr.
RHO	S	IP	QL	WT = QL/λ	TNS	TNS/λ	IP x C_S	WT x C_W	A + B

STAGE I: Cost against different S corresponding to the same RHO as calculated. Select S that leads to minimum total cost.

STAGE 2: Cost against lower or higher values of RHO (calculated)* corresponding to the S(as selected in Stage I). Select RHO that leads to acceptable waiting time.

*Calculation of Stage 2 is necessary when the decision maker finds that queue length corresponding to the optional servers (S) selected in Stage 1 is (A) either high enough to demotivate the students; in this case, he looks for the lower value of RHO, or, (B) low enough which may be increased by looking for higher values of RHO in order to increase the percentage utilization of the learning resources.

[redacted]

FORM C (FOR COST ANALYSIS AND DECISION MAKING)

SUB-SYSTEM: Audio

OPERATING SYSTEM

Wages (Actual or estimated) per student per hour (C_W) = $3.00

Cost of providing service per resource per hour (C_S) = $1.00

Arrival rate (λ) per hour = 2.03

Data from table for calculated traffic intensity (RHO) = 9.7

NEW SYSTEM

Wages (Actual or estimated) per student per hour (C_W) = ________

Cost of providing service per resource per hour (C_S) = ________

Arrival rate (λ) per hour = ________

Data from table for calculated traffic intensity (RHO) = ________

	Operating: Traffic Intensity	Number of Servers	Probability of Idle Time	Queue Length per hr	Waiting Time in hrs	Total Population in The System per hr.	Total Time per population in the System in hrs.	Cost of Idle Time per hr. (A)	Cost of Waiting Time per hr. (B)	Total Cost per hr. (TC)	New: Traffic Intensity	Number of Servers	Probability of Idle Time	Queue Length per hr.	Waiting Time in hrs	Total Population In The System per hr.	Total Time Per population In The System in hrs.	Cost of Idle Time per hr. (A)	Cost of Waiting Time per hr. (B)	Total Cost per hr. (TC)
	RHO	S	IP	QL	WT = QL/λ	THS	THS/λ	IP x C_S	WT x C_W	A + B	RHO	S	IP	QL	WT = QL/λ	THS	THS/λ	IP x C_S	WT x C_W	A + B
STAGE I	9.7	16	.9546	.07	0.03	9.77	4.81	0.95	0.10	1.06										
STAGE 2	9.0	16	.9751	.032	0.02	9.03	4.45	0.97	.05	1.02										
	8.9	16	.9773	.0285	0.01	8.93	4.40	0.98	0.04	1.02										

STAGE I: Cost against different S corresponding to the same RHO as calculated. Select S that leads to minimum total cost.

STAGE 2: Cost against lower, or higher values of RHO (calculated)* corresponding to the S(as selected in Stage I). Select RHO that leads to acceptable waiting time.

*Calculation of Stage 2 is necessary when the decision maker finds that queue length corresponding to the optional servers (S) selected in Stage 1 is (A) either high enough to demotivate the students; in this case, he looks for the lower value of RHO, or, (B) low enough which may be increased by looking for higher values of RHO in order to increase the percentage utilization of the learning resources.

[redacted]

FORM C (FOR COST ANALYSIS AND DECISION MAKING)

SUB-SYSTEM: Audio Visual

OPERATING SYSTEM

Wages (Actual or estimated) per student per hour (C_W)= $3.00

Cost of providing service per resource per hour (C_S)= $1.00

Arrival rate (λ) per hour= 0.43

Data from table for calculated traffic intensity (RHO) = 1.00

Stage	Traffic Intensity RHO	Number of Servers S	Probability of Idle Time IP	Queue Length per hr. QL	Waiting Time in hrs WT = QL/λ	Total Population in The System per hr. THS	Total Time per population in the System in hrs. THS/λ	Cost of Idle Time per hr. A (IP x C_S)	Cost of Waiting Time per hr. B (WT x C_W)	Total Cost per hr. TC (A + B)
STAGE I	1.00	2	.6667	.3333	0.75	1.33	3.10	0.67	2.25	2.92
	1.00	3	.9091	.0455	0.11	1.05	2.43	0.91	0.32	1.23
	1.00	4	.9778	.0068	0.02	1.01	2.34	0.98	0.05	1.03
STAGE 2	1.10	4	.9721	.0106	.02	1.11	2.58	0.97	0.07	1.04
	1.15	4	.9677	.0130	.03	1.16	2.70	0.97	0.09	1.06
	1.20	4	.9630	.0159	.04	1.21	2.83	0.96	0.11	1.07
	1.25	4	.9578	.0192	.04	1.27	2.95	0.96	0.12	1.08

NEW SYSTEM

Wages (Actual or estimated) per student per hour (C_W) = ________

Cost of providing service per resource per hour (C_S) = ________

Arrival rate (λ) per hour = ________

Data from table for calculated traffic intensity (RHO) = ________

Traffic Intensity RHO	Number of Servers S	Probability of Idle Time IP	Queue Length per hr. QL	Waiting Time in hrs WT = QL/λ	Total Population In The System per hr. THS	Total Time Per population In The System in hrs. THS/λ	Cost of Idle Time per hr. A (IP x C_S)	Cost of Waiting Time per hr. B (WT x C_W)	Total Cost per hr. TC (A + B)

STAGE I: Cost against different S corresponding to the same RHO as calculated. Select S that leads to minimum total cost.

STAGE 2: Cost against lower or higher values of RHO (calculated)* corresponding to the S(as selected in Stage I). Select RHO that leads to acceptable waiting time.

*Calculation of Stage 2 is necessary when the decision maker finds that queue length corresponding to the optional servers (S) selected in Stage I is (A) either high enough to demoralize the students; in this case, he looks for the lower value of RHO, or, (B) low enough which may be increased by looking for higher values of RHO in order to increase the percentage utilization of the learning resources.

EVALUATION OF THE APPROACH DEVELOPED

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We think that the evaluation of the approach developed should be made on the basis of its generating question which asks "Can we develop an alternative way of solving resource allocation problems (e.g. queueing problems) with respect to optimization of the cost of lost time due to a pupil waiting in a queue to use a resource, and the resource being idle for a period of time, other than going through all the difficult jobs of manipulating a mathematical queueing model or spending much time running a queueing simulation model in a computer, yet the alternative to be developed should be reliable enough to justify the rejection of a mathematical or a simulation model?".

Now analysing the problem we find two strategic points which frame a guideline of the evaluation. These two points can be asked in a question form:

a) Is the approach simpler than the available methods?

b) Is the approach reliable enough to justify the rejection of the available methods?

To investigate these two questions of evaluation, we can quickly establish the fact that the approach we have displayed is at least simpler than the similar approaches developed by the authors like Redfearn (1973), Kaufmann (1968), Mitchell (1976) and Wilson (1977). All of these authors feel that either a mathematical or a simulation queueing model is fairly difficult specially to educational administrators who are not usually trained for this. Yet educators are badly in need of quantitative data in their process of decision making with respect to cost effective allocation of learning resources in self-instructional systems.

Redfearn (1973) has developed a table of formulas to calculate the number of students arriving during successive weeks of a program to use self-instructional packages. He has then shown as to how to develop a statistical table to determine the peak arrivals during a period of a day. With this information he has calculated the mean arrival rate during that period of the day. He has produced a graphical model which gives data like number of servers. Traffic intensities, products of mean queueing time and mean service time. With the information of the calculated arrival rate and a given service rate, one can calculate other desired data from the graphical model.

We find that Redfearn's approach requires the educational administrators to have some sort of formal training in systems approach techniques and methods to use it. More importantly, his graphical model yields sufficiently approximate data leading to greater

probability of error in decision making.
Typically one would use the method of interpolation to read the required data. Since the method of interpolation interpolates data linearly, and since the curves of traffic intensities are not straight lines and since they are not parallel to each other, data read through interpolation have the greater possibility of being inaccurate. Inaccurate data are undesirable particularly in case of cost effective analysis of a system.

Kaufmann (1968) has developed a graphical model similar to that of Redfearn, but all the problems stated in connection with Redfearn's approach exist in Kaufmann's approach.

Both Kaufmann and Redfearn have calculated traffic intensities as $\lambda/(\mu s)$ which states that they have assumed that each of the servers operates independently of the other. That is there are separate queue lines for each of the servers, in such case the time one expends in the system is approximately twice as much as one expends if the servers were operating in a single station serving a common stream of traffic. (Wagner, 1970, p. 479; Edie, 1954, p. 6; Gillett, 1976, p. 470-473).

There is another aspect in Kaufmann's approach, which we think needs improvement is that he has used the method of average in determining the idle time of the servers, thus he has neglected the important element of a waiting problem, which is the variability (Edie, 1954, p.6).

Mitchell (1976) has shown simplified approaches in dealing with queuing/waiting problems which are often found in learning resource centers. In one of these approaches he has used the values of Po from the table of Po (Plahe and Kochenberger, 1972) in the available analytical formulas (Taha, 1971; Wagner, 1972) to calculate queueing data necessary for decision making with respect to determination of optimum number of resources required. Even so, one is required to deal with expressions such as power and factorial that exist in those analytical formulas. Moreover the Po table is designed assuming that there are separate queueing lines in front of each server, in this situation the waiting time is greater than it would be if the servers would serve a common stream of traffic in co-operation (Wagner, 1970, p. 479 Edie, 1954, p. 6; Gillett, 1976, p. 470-473).

In another approach he has simplified the available analytical formulas. These simplified formulas do not require the use of any sort of tables or graphs. He admits that there is a difference between results produced by this approach of simplified formulas and other approaches using either Po table or Redfearn's graph of waiting time. He does not recommend one to use his simplified formulas where the objective is to analyse a system for cost effectiveness.

A recent study has been conducted by Wilson (1977) to analyse a learning resources center (Bell Canada Training System) to plan the media resource requirements for this center.

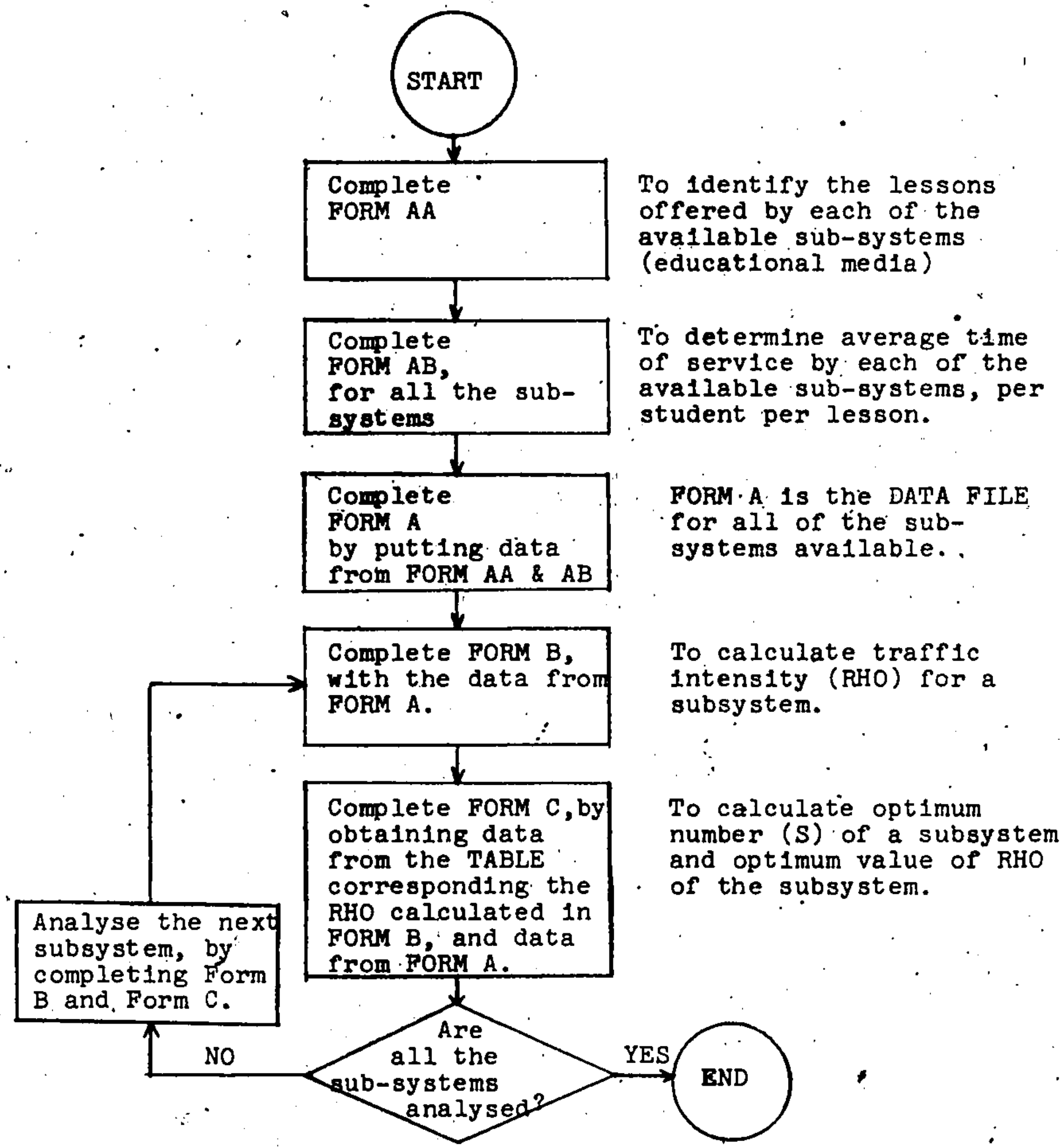
She has tried two time-consuming methods, analytic and computer simulation. In my opinion, both the methods are not likely to be performed by ordinary educational planners and administrators. Moreover she has analysed the system on the basis of queue length. I think a system should be analysed on the basis of its associated costs. That is, in a queueing system, we need to balance between the cost of waiting time and the cost of idle time, because one is inversely proportional to the other. So the number of servers leading to minimum combined cost of waiting time and idle time should be accepted as cost effective and thus optimal.

We have duly recognised these drawbacks in Wilson's study, and have tried to take this planning technique one further step, ie. a set of easily followed procedures using self-explanatory forms and a handy table of queueing data.

Since our hypothesis advocates for a much simpler yet fairly accurate approach than those mentioned above, our approach has fulfilled the two strategic points of our hypothesis in that one is to simply follow a number of self-explanatory forms in sequence and automatically arriving to the final stage of decision making.

Our approach is as simple as shown in a Flowchart which shows that one is to simply follow the track which will automatically lead him/her to the goal of analysing a learning resources center for cost effective allocation of its resources.

THE APPROACH IN A FLOW CHART



Now the question arises how accurate are the table data? The table gives extended data to that produced by Wagner (1970) using available mathematical formulas. As the computer program which we have developed using same mathematical formulas as used by Wagner, produces identical data accurate to four places of decimal, the extended data are assumed to be reliable. That is our table data are reliable (For Wagner's table of queueing data, see Appendix D).

The results of the case study using the new approach developed may be compared with that of Wilson (1977) whose data have been used in our case study.

		Optimum Servers	Waiting Time
Wilson's Approach (single server approximation)	Audio	24	1.0 minute
	Audio Visual	10	0.9 minute
Our Approach (multi-servers method)	Audio	16 (cost effective)	1.8 minute
	Audio Visual	4 (cost effective)	1.20 minute

We see that the results of the two approaches are different. This is due to two reasons. First, Wilson has assumed that the facilities are working independently of each other. For example if there are 25 customers arriving per hour for four available facilities, she has assumed that there are 5 customers per hour for each facility. Whereas in practice the service facilities work in co-operation resulting in greater efficiency of the system as a whole. Edie (1954, p. 6); Wagner (1970, p. 479); Gillett (1976, p. 470-473) have clearly stated with examples that the time one expends in the system where the servers are assumed to work independently is more than twice as much time he spends in the system where the servers work in co-operation serving a common stream of traffic.

Secondly, Wilson ignored costs associated with waiting in line and with idle facilities. Thus she focused on waiting time alone. Considering realistic situations, the results of our approach are likely to be more valid because they are cost effective too, whereas Wilson did not consider cost effectiveness at all.

SUMMARY & CONCLUSION

SUMMARY & CONCLUSION

We have investigated in this study the development of an approach simpler than, yet at least as accurate as the approaches available to solve problems of proper allocation of learning resources in a self-instructional system. This is the strategic aspect of the problem of our research study. We have chosen this subject of study because we have seen that present educational systems are tending towards individualization resulting in switching over to self instructional systems which are so designed that pupils may arrive at and depart from such a system whenever they feel like. That is, pupils arrive at a learning resources center at random and they are permitted to learn a module at the rate of their individual capacity. This has created a problem to the educational administrators who must decide how many learning resources should be provided so that pupils will not have to wait in a queue for long and so that resources will not be idle for a considerable period of time. Long waiting time is not desirable on two points, firstly sometime pupils are paid, and secondly, it demotivates pupils to learn. Idle time is also not desirable because providing service may sometimes be very expensive.

From experience, we have found that the educational administrators are not usually trained to deal with such a problem, where as they are badly in need of quantitative data in order to make decision on this situation. Yet they are responsible in one way to maintain effective learning environment and in another way they are accountable to proper budgeting because the budget is supported by taxpayers' money.

We have also found from a literature survey that the available approaches are not simple enough so that educational administrators can profitably use them.

We have, therefore, brought an idea from industrial practices where technicians and practising engineers use forms and tables to solve the problems which they are involved with.

Then we have asked ourselves why not develop a computer program with a mathematical model of a queueing theory and run it for a wide range of traffic intensities, so that across the traffic intensity of a given problem, one can read all the necessary queueing data from a table.

So we have developed a computer program in Fortran IV using the mathematical formulas of a M/M/S:FIFO queueing model. We have run the program for traffic intensities ranging from .05 to 50.0 with an increment of .05 and for a range of servers/resources from 1 to 50, to produce a table of queueing data for each traffic intensity.

One might inquire about the reliability of the table's data. In this regard we like to mention that we have used the same mathematical formulas in our computer program as those used by Wagner (1971) who has produced a few of queueing data for a short range of traffic intensities. We have found that our computer program produces identical data for that range of traffic intensities (Wagner's) accurate to fourth places of decimal, so there remains no doubt that the extended data are correct.

One might again ask why we have used that particular mathematical model. The argument to this question can be given on the basis of the definition of a self instructional system which demands that:-

a) Pupils may arrive at a resource center at random. We have, therefore, assumed that the arrival process follows a negative exponential distribution. This statement is represented by the first M of the model.

b) Pupils are permitted to learn a module according to their individual learning capacity (ie. a pupil can hold a learning resource as long as he needs). But from statistical study it is found that the holding/servicing time of a resource follows a negative exponential distribution which is represented by the second M in the model.

c) From practical observation of any-self-instructional system we find that there is at least more than one identical learning resource available. The S in the model stands for multiple servers in parallel.

d) It is quite logical that there should be some sort of discipline as regards how to serve the arrivals. We find that most acceptable one is to serve the arrivals in the order of their arrival, which is FIFO in the model.

e) Pupils are expected not to wait in a queue for a long time. We have seen that a single queue line for a group of identical resources serving in co-operation has the advantage of shorter waiting time per pupil than separate queuelines for each of the available resources cooperate with each other in serving a common source of traffic (Gillett,1976). The model M/M/S:FIFO satisfies this principle.

Then we felt that as we intend to develop an approach for educational administrators who we suppose have no formal training in such problematic areas, we have produced a number of self-explanatory forms which are to be used and followed in sequence, which will lead automatically to the determination of the traffic intensity of a given problem and then to the determination of the optimum number of learning resources to provide.

Our approach is simple as shown in the Flow Chart (p.139) which shows that this approach is an algorithmic one because the operations are broken down to the elementary levels of the intended users (educational planners and administrators) who are presumed to have no prior training in this problematic area.

We have adopted the following strategies in designing the above forms:

1. Rate of population available for a particular media is equal to the product of the number of pupils in the program times the number of lessons to be offered by that media divided by the program length in hours ($P = N \times I_{LG_n}/L$).

2. Rate of service is equal to the sum of time taken by each pupil for each of the lessons offered by a media divided by the product of the number of pupils times the number of lessons offered by that media ($T_{AM_n} = \sum_{S=1}^{I} \sum_{L=1}^{J} t_{sL}/N x I_{LG_n}$)

3. Traffic intensity (RHO) = P/T_{AM_n}

4. Cost of waiting time of an arrival is proportional to the waiting time of an arrival (ie: cost of waiting time of an arrival is equal to the product of his wages per hour times the time he spends in the queue) ($C_{WT} = C_W \times WT$)

5. Cost of idle time is proportional to the probability of a resource being idle (ie: cost of idle time of a resource is equal to the product of cost of providing service by a resource per hour times its probability of being idle) ($C_{IT} = C_S \times IP$)

6. Total cost of waiting time and idle time may be calculated for various numbers of servers for a given (calculated) traffic intensity, so as to decide for what number of servers/resources the total cost is minimum. Now the number of servers leading to minimum total cost of waiting time and idle time is the optimum number to be selected.

7. We have seen that waiting time is proportional to traffic intensity, and as the self-instructional system is aimed at motivating pupils to learn, higher waiting time is not acceptable, though such a waiting time leads to a minimum total cost of waiting time and idle time, for a particular number of servers/resources. In this case we can keep the optimum number of servers as selected, and corresponding to this number of servers we can look for traffic intensities lower than the calculated or given one, then we can calculate again the total cost of waiting time and idle time for each of the feasible lower values of traffic intensities; the optimum value

of RHO will be the one which will produce lower waiting time as desired.

An opposite situation may also arise where queue length corresponding to the optimal number of servers (S) (S) selected, is too low. We can see from the table that queue length is inversely proportional to the probability of idle time (IP) of the servers, and vice-versa.

So when the queue length is too low, the IP is considerably high. In this case we look for higher values of RHO corresponding to the same S selected. We select the optimal RHO for which the desired higher value of waiting time is obtained.

To implement the optimum traffic intensity (lower than the given/calculated one) one can either increase the rate of service by decreasing average time needed for a module or by decreasing the rate of arrivals by admitting lesser number of pupils for the program period ($\rho_{Lower} = \lambda/\mu$; $\rho\downarrow$ either $\lambda\downarrow$ or $\mu\uparrow$). In the second case, when the optimum traffic intensity is higher than the given/calculated one, one is to follow a procedure reverse to the preceding one (i.e. $\rho_{Higher} = \lambda/\mu$; for $\rho\uparrow$ either $\lambda\uparrow$ or $\mu\downarrow$).

Considering the possibility of breakage, one might decide for the next higher number of servers to the optimum number selected, if the cost of providing service is within acceptable limits. Such a limit is usually decided by the decision maker.

A decision-maker should also consider the following practical problems that might arise in specific situations, while deciding for optimum number of facilities:

a) Maintenance of facilities.

b) School schedule for various activities, which may not permit random student arrivals which may indicate an uneven demand for a service facility.

c) Variation in service time from one person to another and with subject matter of study.

With idle time for print materials, cost may be insignificant. In this case it is desired that the users do not have to wait for the print materials, which might result in improvement of total system efficiency in terms of flow of pupils through the entire system. This is certainly not applicable in the case of costly print materials in the library such as professional journals, encyclopaedia, etc.

At this stage one might ask about how to determine the cost of waiting time in a formal educational setting where pupils are not usually paid. In this case, Aspiration level model (Appendix A) is used where decision maker sets the upper limits on the values of expected waiting time of the pupils in the system and the percentage of servers ' idle time. Still there is another approach available where cost of waiting time is taken as the average of loss of earning opportunities for various income classes of the pupils in the queue (Hubbard, et al., 1972).

We finally claim that we have at least made it easier to the educational administrators/manager of learning resources to obtain quantitative data as regards the planning and budgeting for learning resources without being involved in complicated calculations.

By comparing our approach (multi-servers method) with Wilson's approach (single queue approximation), we find that our approach is better in threedrespects: firstly, it replicates realistic situations; secondly, the waiting time in case of our approach is much less than that in the case of Wilson's approach for the same number of facilities, because of this reason our approach recommends lesser number of facilities for the same amount of waiting time; thirdly, Wilson ignored an important aspect of systems analysis: the costs associated with waiting in line and with idle facilities. Wilson did not consider cost effectiveness at all whereas our approach is aimed at cost effectiveness.

One might use our approach as well as the table of queueing data in designing programmed texts where the learners may be assumed as a processing device and the texts are the arrivals; in curriculum planning as regards the length, content and resource allocation; and the study of flow of trainees or information through various phases of a training system.

APPENDIX A

TYPES OF QUEUEING SYSTEMS

AND

ASPIRATION LEVEL MODEL

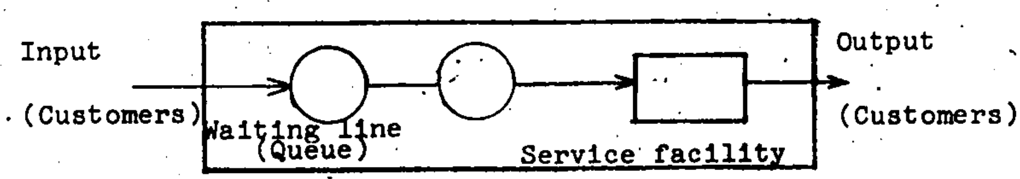
Types of Queueing Systems (Gillett, 1976):

All queueing systems can be classified according to the following characteristics:-

1. The input or arrival process which includes the distribution of the number of arrivals per unit of time, the number of queues that are permitted to form, the maximum queue length permitted in a steady state and the maximum number of customers desiring service.

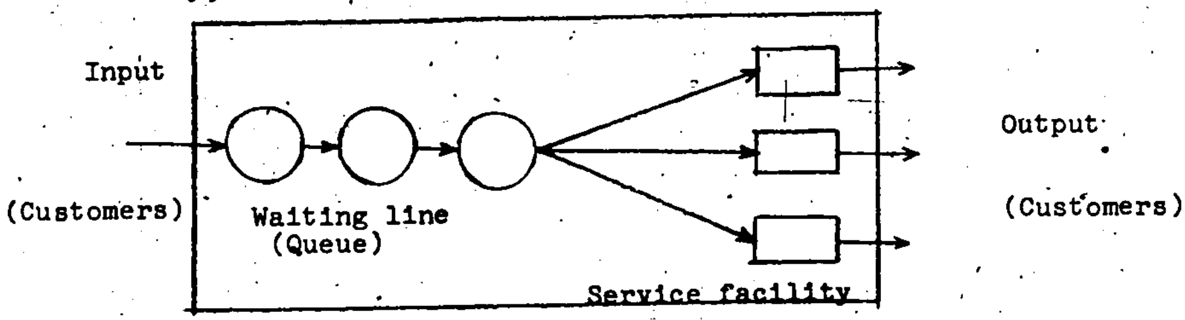
2. The service process which includes the distribution of the time to serve a customer, the number of servers and the arrangement of servers (parallel or series, ~~etc.)~~.

3. Queue discipline which is the manner in which customers form a queue: First come first served (FIFO), last come, first served (LIFO), random selection, priority selection, etc.



a) Single queue, single-server queue system.

This situation arises where there is only one server ie: if there is only one toll both in a highway or if there is only one book issue counter in a school library, etc.



b) Single queue, Multiple Servers in Parallel.

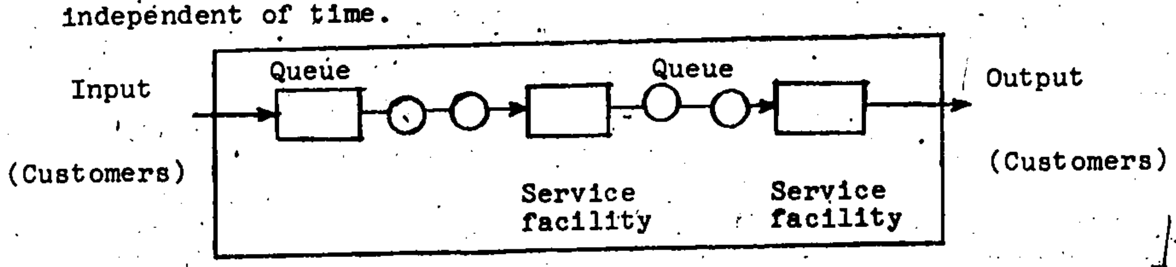
This type of queueing system may be observed in any bank where people make a single queueing line and there are more than one cash counters (service facilities). Whoever has come first (ie: whoever is ahead of the line) has the right to go to a counter which is just empty(free).

The following assumptions are taken in the above queueing systems:

a) A queueing discipline of "first come, first served" (FIFO).

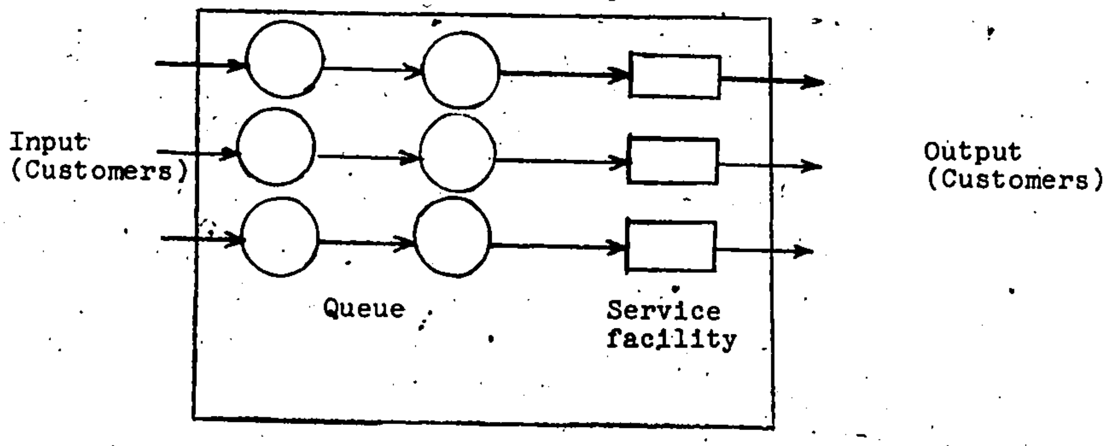
b) The arrival pattern of the customers is completely random, but the customers arrive at a certain average rate.

c) The queueing system is considered to have reached to a steady state condition so that it can be studied independent of time.



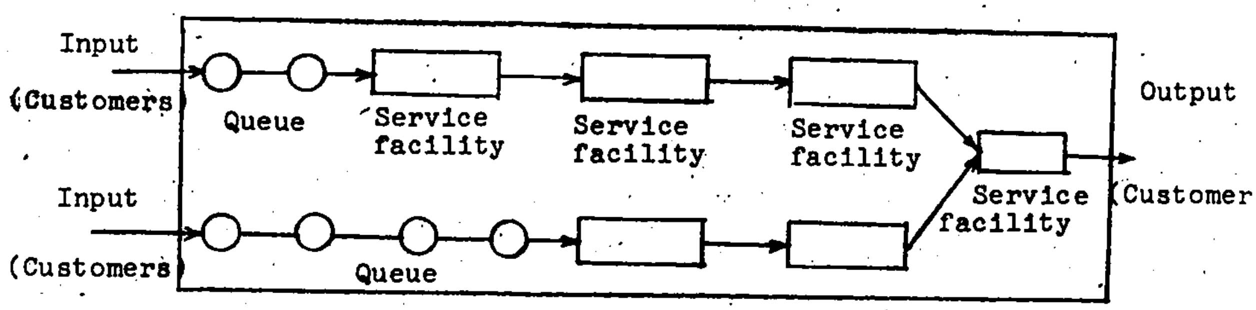
C) Single Queue, Multiple Servers in Series

Single queue, multiple servers in series type of situation may be found in a job shop where a job waits to be operated (served) by a machine No. 1. After the job is operated in machine No. 1, then it waits again in queue to be operated in Machine No. 2. This process continues until the job is operated in all the machines. Then the job leaves the system.



d) Multiple Queue, Multiple Servers

Multiple queue, multiple servers situation may be observed in a big supermarket, where people (customers) make queues in front of each cash counter (service facility).



e) Mixed Multiple Queues, Multiple Servers

This situation may arise when the initial (entering) characteristics of two different inputs are different. To certain extent they are operated (processed) in two separate subsystems to equalize their entering characteristics, then they are permitted to enter a common subsystem. In each case when one is served in a server, then he waits in a queue to be served by the next server. This type of situation may be found in industries and in educational/training institutions where entering characteristics of each of the input types are different.

Aspiration - Level Model (Taha, 1971, p. 560)

This model is used when estimating the cost parameters in cost models is difficult. For example, a queueing situation in a learning resources center where the students are usually not paid but if the students have to wait for a long time in order to use a resource, then they will lose their motivation to learn. So there should be a limit to waiting time beyond which the students will not wait. The decision maker (ie. the educational administrator) sets this upper limit to students waiting time. Again, many of the learning resources are considerbly costly.

So it is not desirable that these resources should remain idle for a long time. In this case too, the decision maker sets a limit to the maximum permitted idle time of a resource.

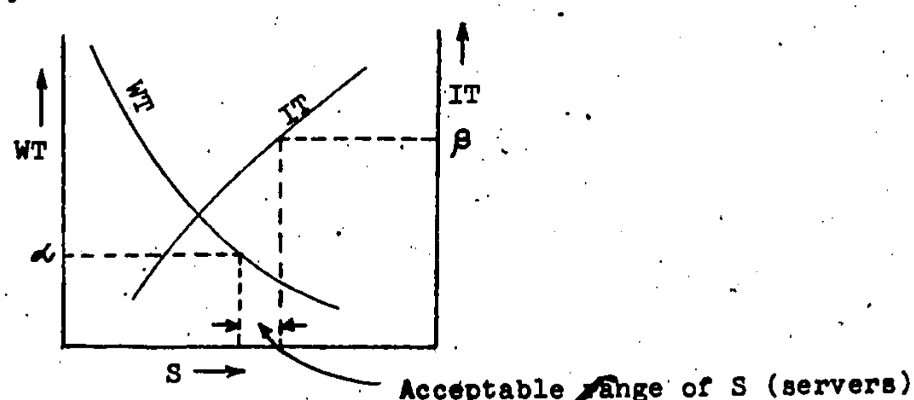
In this model, the decision maker therefore, pre-sets the upper limits on the values of the conflicting measures which are desired to be balanced.

The conflicting measures in the case of a multi-channel queueing model where it is required to determine the optimum value of the number of servers (S) are:

1) The expected waiting time of an arrival in the system, WT.

II) The percentage of the servers' idle time IT.

These two measures are conflicting in the sense that one is inversely proportional to the other ie: if one increases the other decreases. Let the levels of aspiration (upper limits) for WT and IT are α and β, respectively



APPENDIX B

Mathematical Formulas of a Multi-Channel Queueing Model

Mathematical Formulas for a Multi-Channel Queueing Model of the Type, M/M/S:FIFO (Sources: Wagner, 1970; Naylor, 1966; Gillett, 1976).

First M stands for arrival pattern which follows a negative exponential distribution; the second M stands for service pattern which also follows negative exponential distribution; S states that there are more than one server available; and FIFO means whoever comes first is served first.

Expected Queue Length $= P(\text{busy period}) \times \frac{\rho}{S-\rho}$

Where P stands for probability of busy period of a server (here a server means a resource which may be a slide/tape unit, or an audio unit, etc).

S stands for number of available servers.

ρ is read as RHO which stands for λ/μ, where λ, reads as LAMBDA stands for rate of arrival of the "customers" (which may be the pupils, lessons, information, etc), and μ reads as MU, stands for the rate of service of a server (which maybe an audio tape). The factor λ/μ or is known as "Traffic Intensity Factor" or it can be called "Utilization Factor", because this factor indicates what extent the capacity of a server/servers is being used.

$$P(\text{busy period}) = \frac{\rho^S}{S!\,(1-\rho/S)} \cdot Po$$

P(busy period) means that probability that all the servers or channels are busy (the probability that there will be a delay).

Po stands for probability of no arrival (i.e. no customer has arrived) in the system at a particular time interval.

$$Po = \frac{1}{\displaystyle\sum_{j=0}^{S-1} \frac{\rho^j}{j!} + \frac{\rho^S}{S!\,(1-\rho/S)}}$$

Expected number of customers in service $= \rho$

Expected number of customers in the system. $=$

Expected queue length + Expected customers in service

Expected waiting time of an arrival (i.e. a customer)

$$\frac{\text{Expected Queue length}}{\lambda}$$

Expected total time that an arrival spends in the system $=$

$$\frac{\text{Expected number of customers in the system.}}{\lambda}$$

The formulas shown are valid for $\lambda < \mu S$ (or $\rho < S$). This is because for $\lambda < S\mu$, the mean arrival rate will be less than the maximum service rate. Otherwise (ie. for $\lambda > S\mu$), the mean arrival rate will be greater than the maximum service rate. In this case the queue length will increase and it cannot be controlled.

APPENDIX C

THE FLOW CHART OF THE COMPUTER PROGRAM DEVELOPED

AND

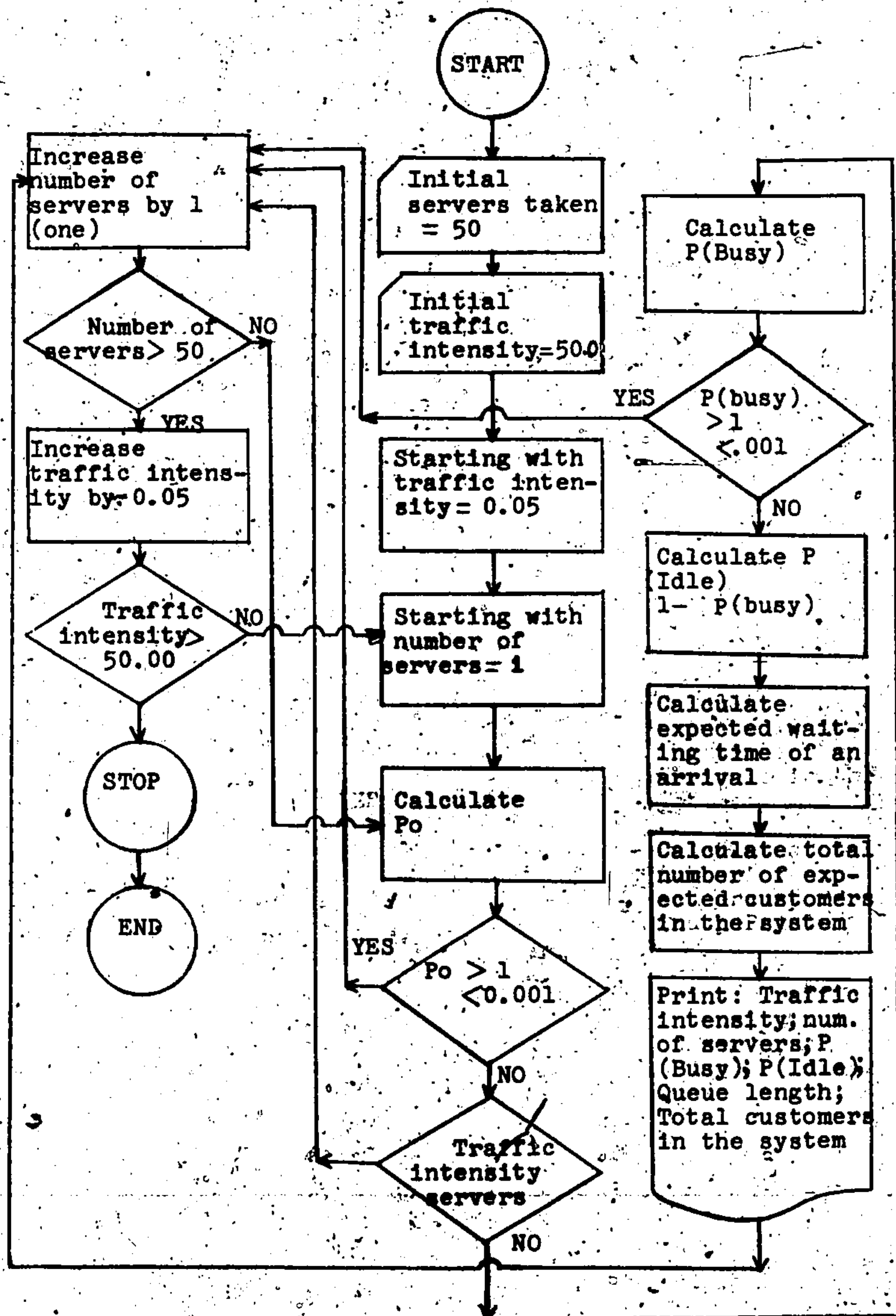
THE COMPUTER PROGRAM

[redacted]

PROGRAM/ QUEUEM

```
REAL IDLEP,NCUSSV,NCUSSY
1 FORMAT(19X,*MULTI-CHANNEL QUEUEING TABLE DATA*,/)
PRINT 1
2 FORMAT(9X,*RHO*,10X,*S*,6X,*BP*,8X,*IP*,8X,*QL*,8X,*TNS*,/)
PRINT 2
LINE=0
START=48.45
PLUS=.05
DO 5 I=1,50
XBP=1.0
XI=FLOAT(I)
RHO=START+(XI-1.0)*PLUS
DO 6 IS=1,50
S=FLOAT(IS)
IF (RHO.GE.S) GO TO 6
KSUMS=1
DO 20 K=1,IS
KSUMS=KSUMS*K
20 XKS=FLOAT(KSUMS)
RS=RHO/S
PB=(RHO**S)/(XKS*(1.0-RS))
SUMPA=1.0
M=IS-1
IF (M.LT.1) GO TO 25
DO 30 J=1,M
KSUMJ=1
DO 40 KJ=1,J
KSUMJ=KSUMJ*KJ
40 XKJ=FLOAT(KSUMJ)
PA=(RHO**J)/XKJ
SUMPA=SUMPA+PA
30 CONTINUE
25 PO=1.0/(SUMPA+PB)
IF (PO.GT.1.0) GO TO 6
BUSYP=PO*PB
IF (BUSYP.GT.1.0) GO TO 5
IF (BUSYP.LT.0.001) GO TO 5
IF (BUSYP.GT.XBP) GO TO 5
XBP=BUSYP
IDLEP=1.0-BUSYP
QLINE=BUSYP*RHO/(S-RHO)
IF (QLINE.LT.0.001) GO TO 5
NCUSSV=RHO
NCUSSY=QLINE+NCUSSV
PRINT 50,RHO,IS,BUSYP,IDLEP,QLINE,NCUSSY
50 FORMAT(3X,F10.4,I10,4F10.4)
LINE=LINE+1
IF (LINE-54) 6,7,7
7 LINE=0
PRINT 11
11 FORMAT(///////)
8 FORMAT(19X,*MULTI-CHANNEL QUEUEING TABLE DATA*,/)
PRINT 8
9 FORMAT(9X,*RHO*,10X,*S*,6X,*BP*,8X,*IP*,8X,*QL*,8X,*TNS*,/)
PRINT 9
6 CONTINUE
5 CONTINUE
END
READY.
```

FLOW CHART OF THE COMPUTER PROGRAM DESIGNED FOR THE PRODUCTION OF THE TABLE OF QUEUEING DATA



APPENDIX D

WAGNER'S DATA OF P(BUSY):
(PROBABILITY OF DELAY)

WAGNER'S DATA

Table of Probability of Delay: P[n≥S] M/M/S Model

ρ	S = 1	2	3	4
.1	.1000			
.15	.1500	.0104		
.2	.2000	.0181		
.25	.2500	.0277		
.3	.3000	.0391		
.35	.3500	.0521		
.4	.4000	.0666		
.45	.4500	.0826	.0113	
.5	.5000	.1000	.0151	
.55	.5500	.1186	.0195	
.6	.6000	.1384	.0246	
.65	.6500	.1594	.0304	
.7	.7000	.1814	.0369	
.75	.7500	.2045	.0441	
.8	.8000	.2285	.0520	
.85	.8500	.2535	.0606	.0117
.9	.9000	.2793	.0700	.0143
.95	.9500	.3059	.0801	.0171
1.00		.3333	.0909	.0204

Note: $\rho = \lambda/\mu$ traffic intensity

λ = arrival rate

μ = service rate

S = number of servers

ρ	S = 2	3	4	5	6	7	8	9	10
1.0	.3333	.0909	.0204						
1.2	.4499	.1411	.0370						
1.4	.5764	.2033	.0603	.0153					
1.6	.7111	.2737	.0906	.0258					
1.8	.8526	.3547	.1285	.0404	.0111				
2.0		.4444	.1739	.0597	.0180				
2.2		.5421	.2267	.0839	.0274				
2.4		.6471	.2870	.1135	[illegible]	.0125			
2.6		.7588	.3544	.1486	[illegible]	.0187			
2.8		.8766	.4286	.1895	.0734	.0270			
3.0			.5094	.2361	[illegible]	[illegible]	.0129		
3.2			.5964	[illegible]	.1271	[illegible]	.0184		
3.4			.6893	.3466	[illegible]	[illegible]	.0256		
3.6			.7877	.4103	[illegible]	[illegible]	.0346	.0127	
3.8			.8914	[illegible]	[illegible]	[illegible]	.0456	.0175	
4.0				.5541	[illegible]	[illegible]	[illegible]	.0237	
4.2				.6337	[illegible]	[illegible]	[illegible]	.0313	.0121
4.4				.7183	[illegible]	[illegible]	[illegible]	.0407	.0164
4.6				.8077	[illegible]	[illegible]	.1150	.0518	.0217
4.8				.9016	[illegible]	[illegible]	[illegible]	[illegible]	.0282
5.0					[illegible]	[illegible]	.1672	[illegible]	.0361

Note: $\rho = \lambda/\mu$, traffic intensity

λ = arrival rate

μ = service

S = number of servers

[redacted]

ρ	s = 6	7	8	9	10	11	12	13	14	15
5.0	.5875	.3241	.1672	.0805	.0361	.0150				
5.2	.6616	.3740	.1982	.0983	.0455	.0196				
5.4	.7401	.4279	.2827	.1186	.0565	.0252	.0105			
5.6	.8227	.4859	.2706	.1415	.0694	.0319	.0137			
5.8	.9094	.5479	.3120	.1673	.0843	.0398	.0176			
6.0		.6138	.3569	.1959	.1012	.0492	.0224			
6.2		.6836	.4055	.2275	.1204	.0600	.0281	.0124		
6.4		.7572	.4576	.2622	.1420	.0725	.0349	.0158		
6.6		.8345	.5133	.2999	.1660	.0868	.0428	.0199		
6.8		.9155	.5725	.3408	.1925	.1029	.0520	.0248	.0112	
7.0			.6353	.3849	.2217	.1211	.0626	.0306	.0141	
7.2			.7015	.4322	.2536	.1413	.0746	.0373	.0177	
7.4			.7711	.4827	.2882	.1637	.0883	.0451	.0219	.0100
7.6			.8441	.5363	.3256	.1884	.1036	.0541	.0268	.0126
7.8			.9204	.5932	.3659	.2154	.1208	.0644	.0326	.0156
8.0				.6533	.4091	.2449	.1398	.0759	.0392	.0193
8.2				.7165	.4582	.2769	.1608	.0890	.0469	.0235
8.4				.7828	.5042	.3114	.1838	.1036	.0556	.0284
8.6				.8522	.5561	.3484	.2090	.1198	.0655	.0342
8.8				.9246	.6110	.3881	.2364	.1377	.0767	.0407
9.0					.6687	.4304	.2660	.1575	.0891	.0482
9.2					.7293	.4754	.2979	.1790	.1030	.0567
9.4					.7927	.5231	.3322	.2025	.1184	.0662
9.6					.8590	.5734	.3688	.2280	.1353	.0769
9.8					.9281	.6264	.4078	.2956	.1538	.0888
10.0						[illegible]	.4493	.2852	.1741	.1020

Note: $\rho = \lambda/\mu$ traffic intensity

λ = arrival rate

μ = service rate

S = number of servers

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