Faculty of Engineering

Prince of Songkla University

Midterm Examination : Semester 1 — Academic Year 2007 (2550)

Date : August 5 , 2007 (5 สิงหาคม 2550) — Time : 09:00 – 12:00

Subject : 225-352 Operations Research — Room : A 401

ทุจริตในการสอบ โทษขั้นต่ำ ปรับตกในวิชาที่ทุจริตนั้น
และพักการเรียน 1 ภาคการศึกษา

Instruction:

1. Total 5 topics, 20 pages, and 54 scores.
2. Do your examination in these papers and return all of them.
3. Write down your Name, Surname, Student code in every page.
4. Show all calculation and assumption.
5. All books, notes and calculators are allowed but you are not permitted to borrow anything from the others.
6. All figures are not to scale.
7. Draw the graph in plain paper and the scale should be approximately close to the fact.

	Score	Your Scores
1	13	
2	12	
3	12	
4	5	
5	12	
Total	54	

No.....

(From the number in examination list)

Name.....

Surname.....

Student Code.....

Year.....

Department.....

Assistant Professor Yodduang PANNARA

Name.....Surname.....Student code.....

1. Describe or calculate all the problems with clear statement.

1.1. In Queueing theory, describe the meaning of D/M/5/3/SIRO. What do you think about this system? (1 score) .....

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1.2. What are the meaning and the different of Constant, Parameter and Variable? Show the example that different from describing in our class. (2 scores) .....

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1.3. Calculate mean of exponential distribution from the data in figure 1.1.

(Figure 1.1 is not to scale) (2 scores)

At t = 3 Minutes

F(t=3) = 0.68

F(t) = Cumulative distribution function or distribution function.

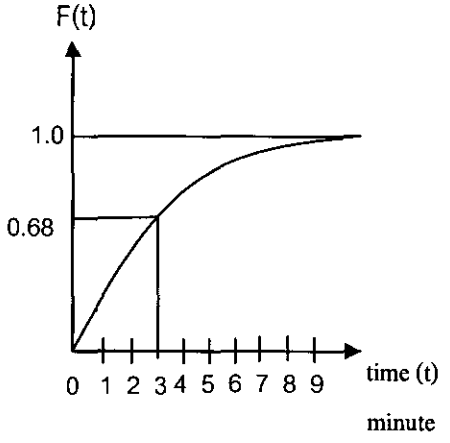

Figure 1.1

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Name.....Surname.....Student code.....

1.4. Calculate mean of poisson distribution from the data in figure 1.2.

(Figure 1.2 is not to scale) (1 score)

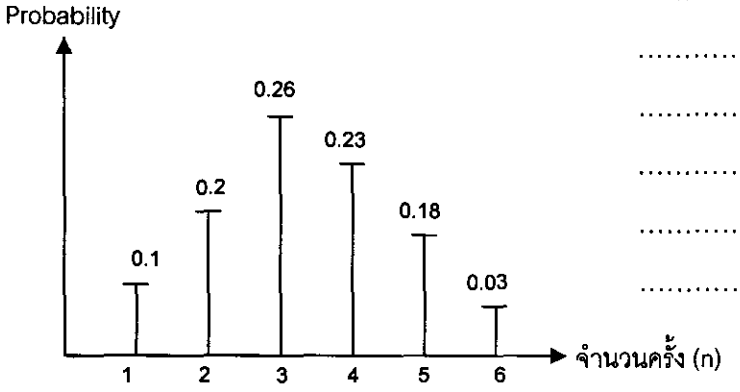

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Figure 1.2

1.5 Figure 1.3 is the graph of customers come and leave the system.

(Figure 1.3 is not to scale)

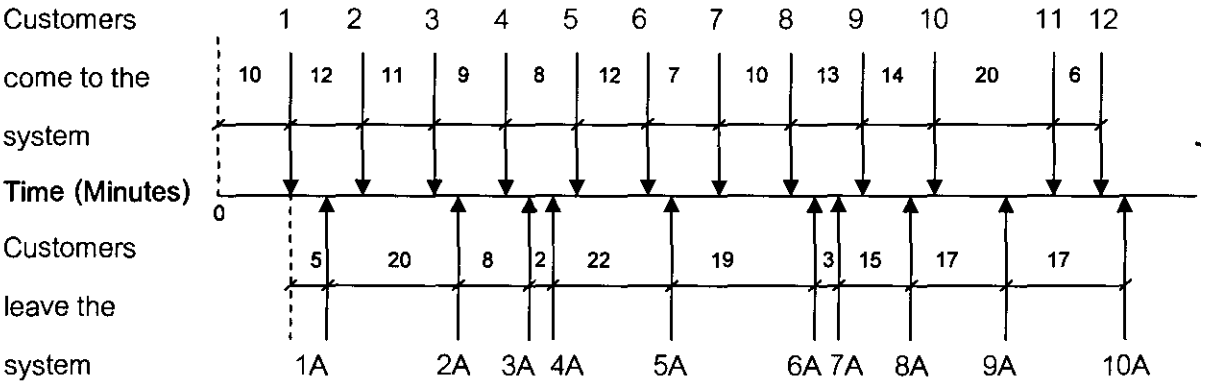

Figure 1.3

From the data that appear above in Figure 1.3, **calculate only 8 customers** come and leave the system.

(Total 7 scores)

Name.....Surname.....Student code.....

1.5.1. Calculate mean interarrival time. (1 score) .....

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1.5.2. Calculate variance of interarrival time. (1 score) .....

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1.5.3. Calculate mean service rate. (1 score) .....

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1.5.4. Calculate variance of service. (1 score) .....

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1.5.5. Calculate mean arrival rate. (1 score) .....

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1.5.6. Calculate variance arrival rate. (1 score) .....

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1.5.7. From Figure 1.3, what is the distribution of arrival? (Explain only) (1 score)

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(Total 13 Scores)

Sunchai

Name.....Surname.....Student code.....

2. Starbook Coffee is very interesting. C is the amount of coffee sold out per day.

If C is between 1 and 20 cups , the sales price of coffee between 1 and 20 cups is 120 Baht per cup and the cost is 50 Baht per cup.

If C is between 21 and 100 cups, the sales price of coffee between 21 and 100 cups is reduced to 100 Baht per cup and the cost is $40+\sqrt{C}$ Baht per cup.

If C is between 101 and 150 cup the sales price of coffee between 101 and 150 cups is reduced to 80 Baht per cup and the cost is C-60 Baht per cup.

If $C \geq 151$ cups, the sale price of coffee that more than 150 cups are increased to 110 Baht per cup and the cost is 50 Baht per cup.

The Starbook Coffee cannot sell more than 200 cups because the limitation of raw material.

From the data above

2.1 Draw the graph between the **profit or loss for each cup** and the amount of each cup of coffee sold. (4 scores)

2.2 Draw the graph between the **total profit or total loss** and amount of each cup of coffee sold. (4 scores)

2.3 How many coffee do we have to sell to make maximum profit? How much is the total profit? (2 scores)

2.4 If the fixed cost (Fixed cost means the cost you must pay although you cannot sell the coffee.) is 2,000 Baht per day. Draw the graph between **the total profit or total loss** and the amount of each cup of coffee sold. (2 scores)

Remark Draw the graph in plain paper and the scale should be approximately close to the fact.

(Total 12 scores)

Sunchai

Name.....Surname.....Student code.....

3. The customers arrive to system according to constant distribution with mean of 5 minutes per customer. The service time is deterministic distribution with mean of 10 minutes per customer. Please calculate, and/or explain, and/or draw the graph for the problem below.

3.1 If the maximum customers in the system are unlimited, when does the transient period start and finish? (1 score)

3.2 If the maximum customers in the system are unlimited, when does the first balk happen? (1 score)

3.3 If the maximum customers in the system are 5, when does the first balk happen? (1 score)

3.4 If the maximum customers in the system are 3, when does the steady state period happen? (1 score)

3.5 Suppose there are 3 customers in the system when the system starts (time=0). If the maximum customers in the system are 8, when does the first balk happen? (1 score)

3.6 If the maximum customers in the system are unlimited. When does the steady state period happen? (1 score)

3.7 Suppose there are 6 customers in the system when the system starts (time=0). If the maximum customers in the system are unlimited, when does the steady state period happen? (1 score)

3.8 Draw the graph

3.8.1 Customers come and leave the system within 0 to 70 minutes. (1.5 score)

3.8.2 Show the numbers of customers in the system within 0 to 70 minutes. (1.5 score)

3.9 If maximum customers in the system are 50. When does the first balk happen? (2 scores)

(Total 12 scores)

Name.....Surname.....Student code.....

4 The customers arrive to the system is constant distribution with mean 12 customers per hour. The service time is Uniform distribution. The distribution is in Figure 4.1. The service time for each customer follows : 10,7,6,8,9,6,8,6,9,6,7,10,7,8,9,10,... minutes.

Draw the graph of customers arrive and leave the system and show the number of customers in the system from time 0 to 80 minutes.

(5 scores)

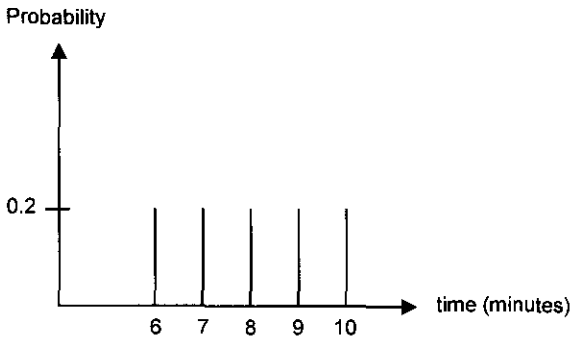

Figure 4.1

Name.....Surname.....Student code.....

5. Fedday company works 30 days/month, 8 hours/day. Each working day, the average arriving time is 3.5 trucks/hour and the distribution is exponential. The salary of each staff is 40 Baht/hour. The cost of each truck waiting in the system is 60 Baht/hour. (Fedday company must pay it.) The income of Fedday company is 280 Baht/truck that it services. The service systems have 4 choices :

   5.1 If there are 2 staffs with good machines, the service capacity of system is unknown distribution with mean 54.4 trucks/day and the standard deviation is 0 truck. Fedday company must pay extra 100 Baht/hour for this system.

   5.2 If there are 3 staffs with good machines and computers, the service capacity of system in unknown distribution with 0.12 truck/minute and the standard deviation is 0.4 truck. Fedday company must pay extra 400 Baht/day for this system.

   5.3 If there are 2 staffs, the service capacity of system is Erlang distribution with mean 3.2 trucks/hour.

   5.4 If there are 5 staffs, the service capacity of system is Poisson distribution with mean 9.5 minutes/truck.

   How much money are the total cost and total benefit of each system (system 5.1, 5.2, 5.3, and 5.4) for every month? What service system do you select to make the best benefit for the Fedday company?

(12 scores)