Faculty of Engineering

Prince of Songkla University

Midterm Examination : Semester 1 Academic year 2005 (2548)

Date : August 4, 2005 (4 สิงหาคม 2548) Time : 13:30-16:30 น.

Subject : 225-352 Operations Research Room : R300

225-354 Operations Research I

ทุจริตในการสอบ โทษขั้นต่ำปรับตกในที่ทุจริตนั้น และพักการเรียน 1 ภาคการศึกษา

Instructions:

1. Total 5 topics, 19 pages, and 54 scores
2. Do you 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

	Scores	Your Scores
1	10	
2	6	
3	15	
4	10	
5	13	
Total	54	

Subject ☐ 225-352 ☐ 225-354

No.....

(From The number in examination list)

Name.....

Surname.....

Student code.....

Year.....

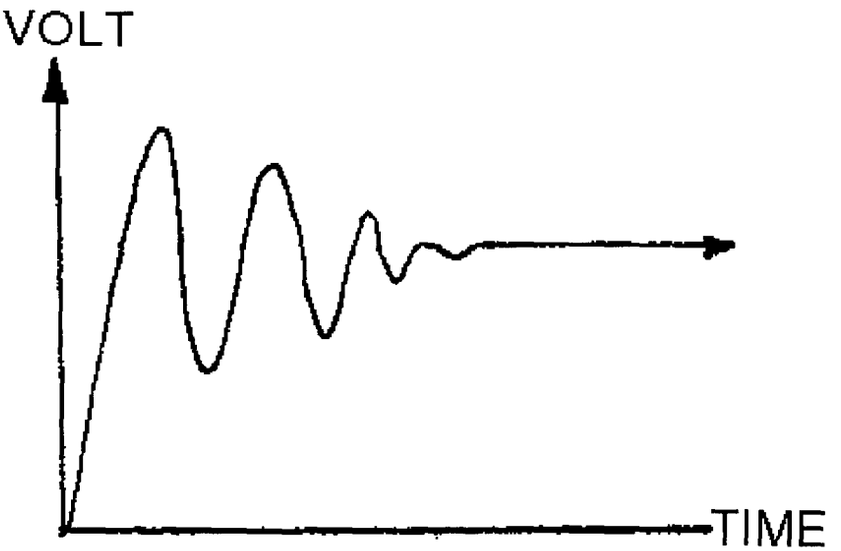
Department.....

Assistant Professor Yodduang Pannara

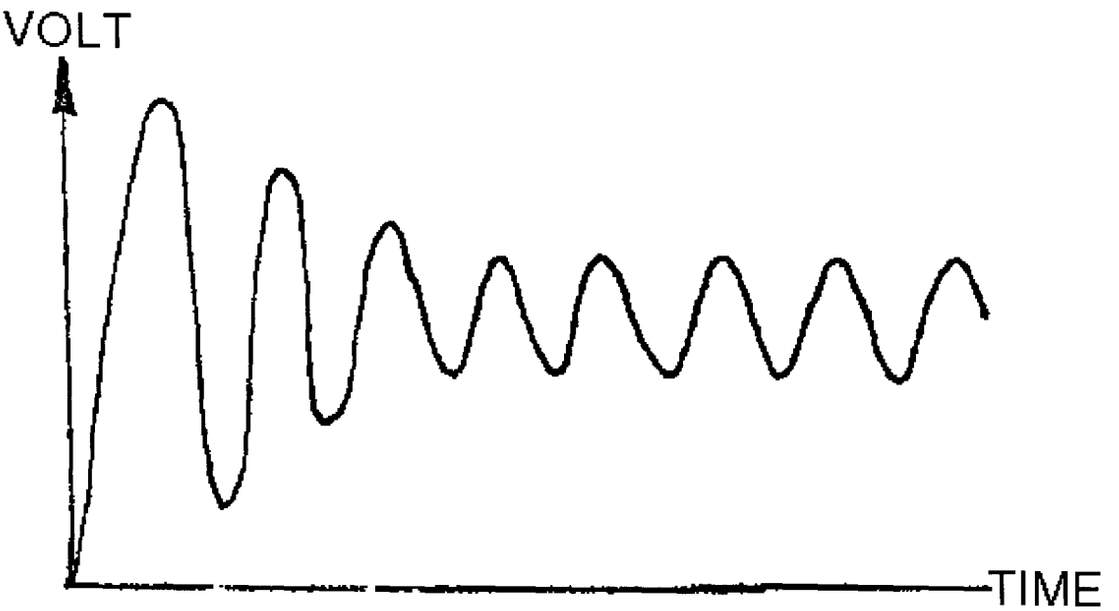
Name.....Surname.....Student code.....

1. Describe all the problems with the clear statement.

1.1. From figure 1.1A, 1.1B, 1.1C describe in each figure which part is transient period or steady state period (1.5 scores)

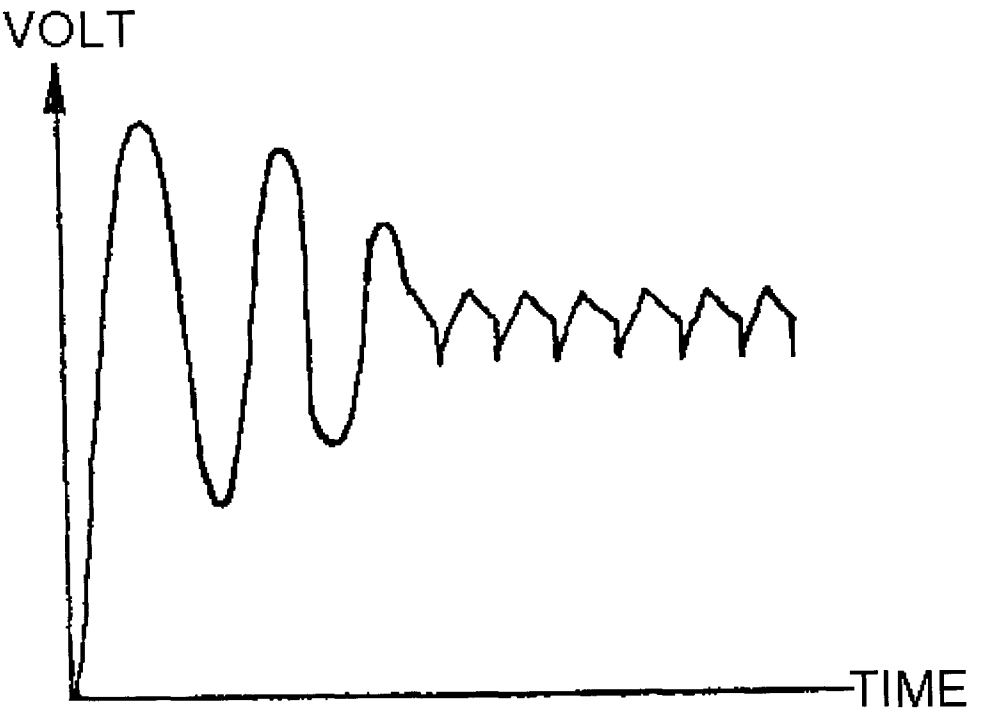


รูป 1.1A



รูป 1.1B

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



รูป 1.1C

1.2. In the topic of queuing theory, explain and give the example of the words below. What are the different among all of them? How can you apply them in queuing theory?

(2 scores)

- Mean Arrival Rate
- Mean Interarrival Time
- Mean Service Rate

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

1.3. General factory in Thailand has three parts of inventory : (2 scores)

1. Raw materials
2. Inprocess Inventory
3. Finished products

How many inventory does it have in each part? What do you suggest to adjust them?

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1.4. Describe the meaning and objective of Validation the model. (1 score)

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1.5. In queuing theory, describe the meaning of M/D/5/3. What do you think about this system? (2 scores)

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1.6. If you must collect the data , what is the different between sampling and historical search? How do you select each technique? (1.5 scores)

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(Total 10 scores)

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

2. Figure 2.1 the data of customers come and leave the system.

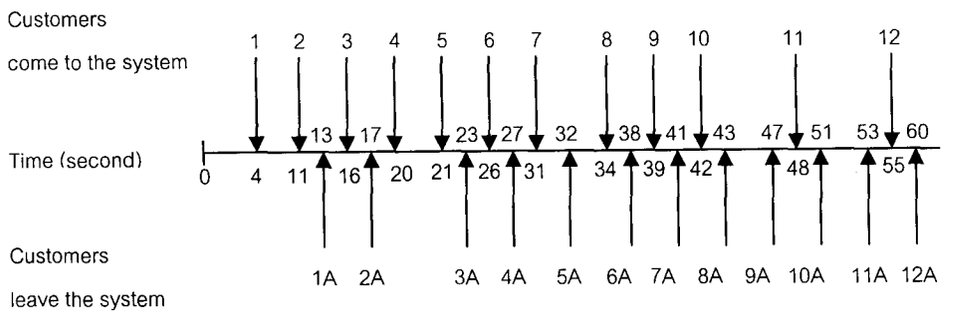

Figure 2.1 (Figure 2.1 not to scale)

From the data in figure 2.1, analyse only the data that appear in Figure 2.1 and show all calculation.

2.1. Calculate mean arrival time. (1 score)

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2.2. Calculate standard deviation of arrival time. (1 score)

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

2.3. Calculate mean interarrival time. (1 score)

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2.4. Calculate standard deviation of interarrival time (1 score)

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2.5. Calculate mean service rate (1 score)

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2.6. Calculate standard deviation of service rate. (1 score)

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(Total 6 scores)

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

3. The buses arrive at the station according to deterministic distribution with mean of 20 buses per hour. The service time is in figure 3.1. Please calculate and/or explain and/or draw the graph for the problems below.

   3.1. The maximum numbers of buses in the station are 3 buses. When does the first balk happen?

   3.2. If the maximum numbers of buses in the station are 2 buses. When does the steady state period happen?

   3.3. If the maximum numbers of buses in the station are unlimited, when does the transient period start and finish?

   3.4. If the maximum numbers of buses in the station are unlimited, when does the first balk happen?

   3.5. Suppose there are 3 buses in the station when the system starts (time=0). If the maximum numbers of the buses in the station is 6, when does the first balk happen?

   3.6. Suppose there are 6 buses in the station when the system starts (time=0). If the maximum numbers of buses in the station is unlimited, when does the steady state period happen?

   3.7. If the maximum number of buses in station is 4 buses, show the graph.

      3.7.1. Buses come and leave the station within 0 to 66 minutes.

      3.7.2. Show the numbers of buses in the station within 0 to 66 minutes.

      3.7.3. When does the steady state happen?

(If you draw the graph, draw in plain paper and the scale should be approximately close to the fact) (15 scores)

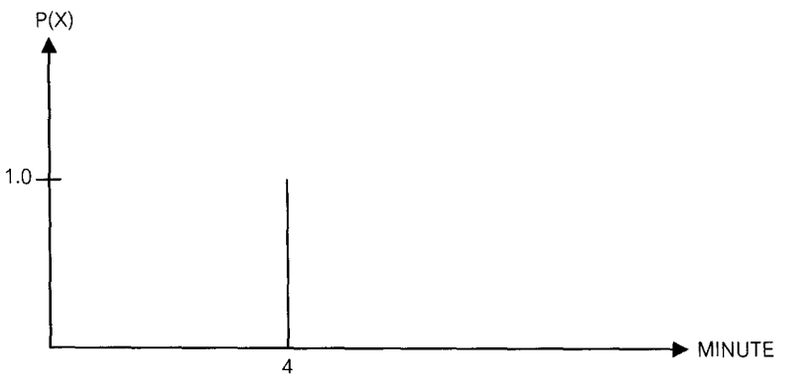

Figure 3.1

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

4. Computer business is very high competitive. Eachday, the sales price of computer is 50,000 baht/set, while its cost is 45,000 baht per set. The fixed expense is 3,000 baht/day. The variable expense is 1,000C baht/set. C is the amount of computer sold out per day. If C is ≥ 8, the variable expense is changed to 2,000C baht/set. If $C \geq 10$, the variable expense is changed to 5,000C baht/set. However the shop must have the profit form selling computers except it cannot sell any computer in that day.

From all the system above, draw the graph or calculate (You select one method.)

4.1. Profit from selling computers and the amount of computers sold for each day. (C)

4.2. The total net profit and the amount of computers sold for each day. (C)

4.3. How many computers do we have to sell to make maximum profit ?

4.4. If we can sell unlimited amount of computers, how much is the maximum total net profit and what is the amount of computer sale per day ?

Remarks

1. Draw the graph in plain paper and the scale should be approximately close to fact.
2. Profit from selling computers หมายถึง ผลกำไรที่ได้จากการขายคอมพิวเตอร์และหักต้นทุนเครื่องรวมกับค่าใช้จ่ายผันแปร (Variable expense) (ซึ่งคอมพิวเตอร์ที่ขายได้เริ่มจาก 1, 2, 3, . . . เครื่อง จนกระทั่งไม่มีกำไร).
3. The total net profit หมายถึง ผลกำไรรวมที่ได้จากการขายคอมพิวเตอร์รวมกันทุกเครื่องและหักกับต้นทุนเครื่องคอมพิวเตอร์และค่าใช้จ่ายทั้งหมด

(10 scores)

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

5. The factory operates 8 hours a day, 300 days per year. Everyday the machines break down and the cost of waiting in the system is 145 baht per hour. The machine break down at the mean rate of 0.07 machine per minute and it is exponential distribution. The service rate is 12 minutes per machine and it is poisson distribution. The cost of technician who operates this system is 140 baht per hour. The manager is concerned about the manufacturing time lost and total cost. He is considering the other system to improve service.

The second system, the manager will use the robot system. Purchase and installation of robot system would add extra 200,000 baht/year. The other fixed expense for maintenance facility is 170 baht per working hour, but provide a mean service rate of 10 machines per hour. The service distribution of robot system is constant.
The operation cost of robot system is 225 baht per working hour.

The third system is to replace the existing technician with the 2 professional technicians. Under this plan the mean service rate for each professional technician will change to 6.5 machines per hour and third system will has two parallel services. The service time is poisson distribution. However, the cost of professional technician is 180 baht per hour-person. The other fixed expenses for maintenance facility would remain at 400,000 baht per year that is equal to first system.

What is the total cost for each system ? What is the best system ?

(13 scores)