

Faculty of Engineering
Prince of Songkla University

Midterm Examination : Semester 1

Academic Year 2009 (2552)

Date : August 1, 2009 (1 สิงหาคม 2552)

Time: 09:00 - 12:00

Subject: 225-348 Operations Research

Room : ห้องหัวหุ่น

ทุจริตในการสอบ โทษขั้นต่ำ ปรับตกในวิชาที่ทุจริตนั้น
และพักการเรียน 1 ภาคการศึกษา

Instruction

1. Total 4 topics, 19 pages, and 54 scores.
2. Do your examination in these papers and return all of them.
3. Write down your Name, Surname, and 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.

	Scores	Your Scores
1	15	
2	13	
3	11	
4	15	
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 problem with clear statement (Total 15 scores)

1.1. Calculate mean of the data in figure 1.1 (1 score)

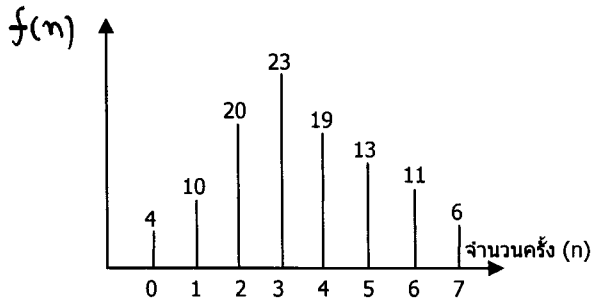


Figure 1.1

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1.2. Calculate the stripped area in figure 1.2 Explain how you calculate it (1 score)

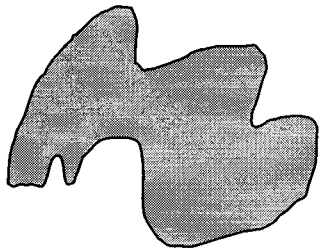


Figure 1.2

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1.3. Calculate or estimate mean of Exponential distribution from the data in figure 1.3. (2 scores)

At $t = 6$
 $F(t = 6) = 0.6 =$ Cumulative distribution function

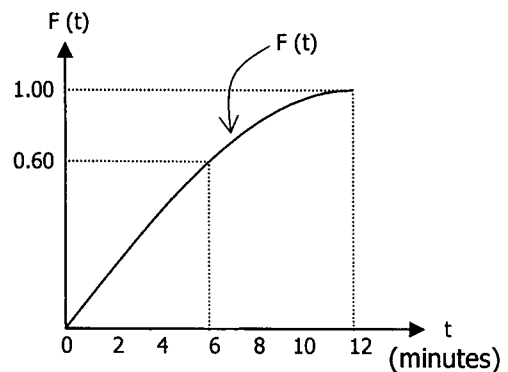


Figure 1.3

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1.4. Figure 1.4 is the data of customers come and leave the system. (Total 3 scores)

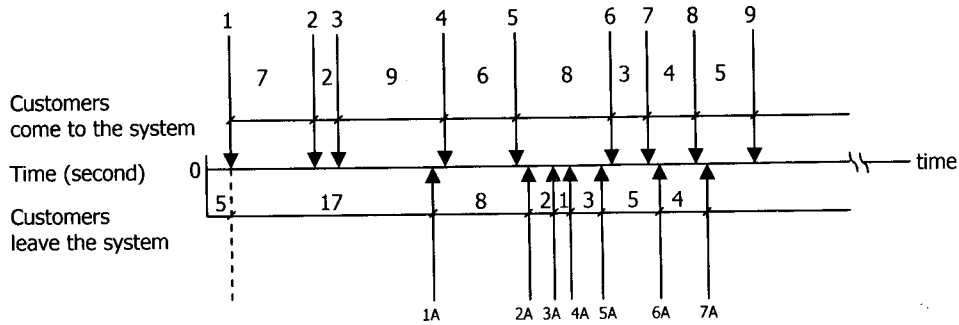


Figure 1.4

From the data in Figure 1.4, Analysis only the data that appear in figure 1.4 and / or show all calculation

1.4.1. Calculate mean inter arrival time. (1 score)

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1.4.2. Calculate mean service rate. (1 score)

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1.4.3. Calculate mean arrival rate. (1 score)

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1.5. In queuing theory, describe the meaning of M/D/9/8/ FCFS. What do you think about this system?
 (1 score)

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1.6. The customers arrive to the system is constant distribution with mean 12 customers per hour.

1.6.1. The service time distribution is in Figure 1.5. If time is 301 minutes, how many customers do they have in the system? (2 scores)

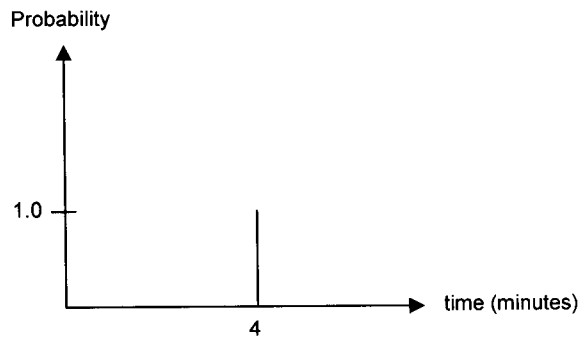


Figure 1.5

1.6.2. The service time is 0.1 customer per minute. If time is 301 minutes, how many customers do they have in the system? (2 scores)

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1.6.3. The service time is 0.1 customer per minute. If number of customers in the system are 50.

When does the first balk happen? (3 scores)



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2. The buses arrive to system according to constant distribution with mean of 6 minutes per bus. The service time is deterministic distribution with mean of 6 buses per hour. Please calculate, and/or explain, and/or draw the graph for the problem below.
- 2.1. If the maximum numbers of buses in the system are 4 buses, when does the first balk happen? (2 scores)
 - 2.2. If the maximum numbers of buses in the station are unlimited, when does the transient period happen? (1 score)
 - 2.3. If the maximum numbers of buses in the station are unlimited, when does the first balk happen? (1 score)
 - 2.4. If the maximum numbers of buses in the station are 20 buses, when does the steady state period happen? (1 score)
 - 2.5. Suppose there are 3 buses in the station when the system starts (time = 0). If the maximum numbers of the buses in the system are 7 buses, when does the first balk happen ? (2 scores)
 - 2.6. Suppose there are 5 buses in the system when the system start (time = 0). If the maximum numbers of buses in the system is unlimited, when does the steady state period happen? (1 score)
 - 2.7. If the maximum number of buses in station are 3 buses, show the graph within 0 to 80 minutes.
 - 2.7.1. Buses come and leave the station. (2 scores)
 - 2.7.2. Show the numbers of buses in the station. (2 scores)
 - 2.7.3. When does the steady state period happen? (1 score)

(Total 13 scores)

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3. From the data in table 3.1,

Interval (minutes)	Frequency
0 - <5	620
5 - <10	540
10 - <15	380
15 - <20	250
20 - <25	180
25 - <30	120
30 - <35	70
35 - <40	30
40 - <45	10
Total	2,200

Table 3.1

Is it Exponential distribution? You must prove it by using statistical technique. (11 scores)

(If you do not have enough data, make your assumption.)

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4. At Suvarn airport, the airplanes arrive to land and park. The arrival time is Exponential distribution and mean is 15 minutes. Time use for each airplane landing form start to finish is in figure 4.1. The airport operates 24 hours throughout the year. If the airplanes finish landing, Suvarn airport finishes the job.

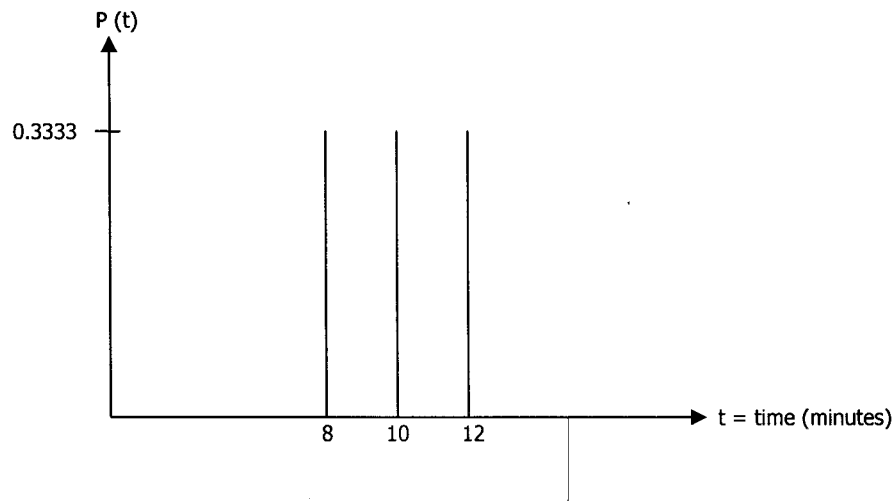


Figure 4.1

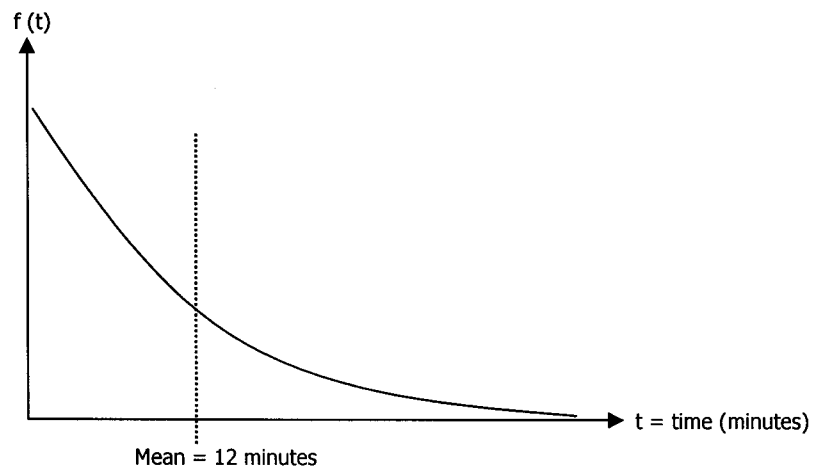


Figure 4.2

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- 4.1. How many airplanes can land at the airport per year? (1 score)
- 4.2. How many airplanes can land at the airport without waiting time per day? (1 score)
- 4.3. What is the average amount of the airplanes in the airport? (1 score)
- 4.4. Find the average time that each airplane has to wait before landing. (1 score)
- 4.5. Find the average system time of each airplane. (1 score)
- 4.6. The mean arrival time of airplanes increases 10 % each year. The distribution is Exponential. If the average system time is more than 48 minutes. Thai government must construct the second run way. Time spend to construct the second run way is 1 year. When does Thai government start construction the second run way? You must calculate data to answer this question. (7 scores)
(Suggestion : Calculate close to the fact, use trial and error method)
- 4.7. After Suvarn airport uses both run way, the service time distribution for each run way changes to figure 4.2. It is Exponential distribution. Calculate P_0 , L, Lq, W, and Wq of new system.
(3 scores)

(Total 15 scores)

