

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination : Semester 1

Academic Year : 2004

Date : August 7, 2004

Time : 13:30 - 16:30

Subject : 225-354 Operations Research I

Room : R300

ทฤษฎีในการสอบ โทษขึ้นต่ำคือ ปรับตกในรายวิชาที่ทฤษฎี และพักรการเรียน 1 ภาค การศึกษา

1. Total examination has 5 topics, 19 pages, and 66 scores.
2. Do your examination in this papers and return all of them.
3. Write down your name, surname, student code in all the papers.
4. Show all calculation, and assumption.
5. All books, notes, calculators and Computers are allowed but you are not permitted to borrow anything from the others.

	Scores	Your Scores
1	9	
2	12	
3	15	
4	16	
5	14	
Total	66	

Name

Surname

Student Code

Year

Department IE MFE

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

1) Describe all the problems with the clear statement

1.1 Do you think the inventory in the system should be MAXIMUM or MINIMUM ? Explain this topic as much as you can . (2 scores) _____

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) _____

1.3 To build the model , explain the important and meaning of control variable and uncontrol variable . Give the example of them . (1 score) _____

1.4 What is Little's formula ? Explain it as much as you can . (2 scores) _____

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

1.5 Calculate the stripped area in figure 1 . Explain how you calculate them . (2 scores)

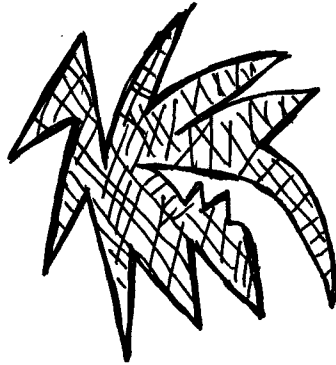


Figure 1

1.6 What is the problem to work with Homework 1 ? (Goodness of fit test) (1 score)

(9 Scores)

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

2) Bicycle business is very exciting . Eachday , the sales price of bicycle is 4,400 baht per set , while its cost is $200(A + 10)$ baht per set . A is the amount of bicycle sold out per day . If $4 \leq A \leq 6$ sets, the sales price is reduced to 4,000 baht per set . If $A \geq 7$ sets, the sales price is reduced to 3,900 baht per set . However every merchandise must have the profit from selling each bicycle. (If we do not have the profit, we do not sale the bicycle.)

From the bicycle business

- 2.1 Draw the graph between profit and the amount of each bicycle sold .
- 2.2 How many bicycles do we sale per day and make the profit ?
- 2.3 How many bicycles do we have to sell to make maximum profit ? How much is the total profit ?
- 2.4 Draw the graph between the **total profit** and amount of each bicycle sold.
- 2.5 If the fixed cost (Fixed cost means the cost you must pay although you cannot sell the bicycle) is 5,000 baht per day . Draw the graph between the **total profit** and the amount of each bicycles sold .

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

(12 scores)



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

3) The service time is constant distribution with mean of 10 minutes per customer . The customers arrive to system according to constant distribution with mean of 12 customers per hour. Please calculate and/or explain and/ or draw the graph for the problems below.

- 3.1 If the maximum numbers of customer in the system is unlimited , when does the transient period start and finish ?
- 3.2 If the maximum numbers of customer in the system is unlimited , when does the first balk happen ?
- 3.3 If the maximum numbers of customer in the system is 4 , when does the steady state period happen ?
- 3.4 If the maximum numbers of customer in the system is 4 , when does the first balk happen ?
- 3.5 Suppose there are 3 customers in the system when the system start (time = 0). If the maximum numbers of customer in the system is 8 , when does the first balk happen ?
- 3.6 Suppose there are 3 customers in the system when the system start (time=0). If the maximum numbers of customer in the system is 8, when does the steady state period happen ?
- 3.7 If the maximum numbers of customer in the system is 9, show the graph :
 - 3.7.1 Customers come and leave the system within 0 to 100 minutes .
 - 3.7.2 Show the numbers of customers in the system within 0 to 100 minutes .

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

(15 scores)



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

4) Factory with many machines needs a maintenance team . Each month the factory has 25 working days and 8 hours per working day . Machine break down time is exponential distribution with mean 3 machines per hour . The factory will lose the money for repairing and waiting each machine 700 baht per hour . There are two maintenance teams : A and B .

Team A : The salary is 5,000 baht/ day . The service time distribution is in Figure 4.1A.

Team B : The charge is 450 baht/ hour . The service time is exponential distribution and the data is Figure 4.1B.

Show all calculations or explanations.

4.1 Calculate ρ , L , L_g , W , W_g , P_0 , I , B of both team (A and B).

4.2 Which team do you select ?

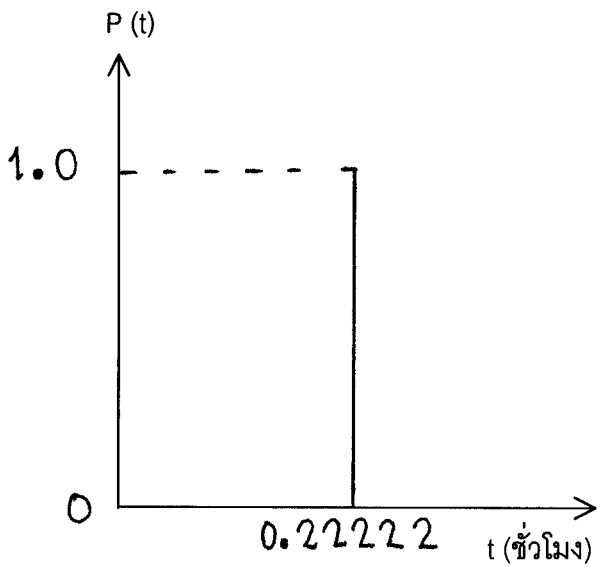


Figure 4.1A

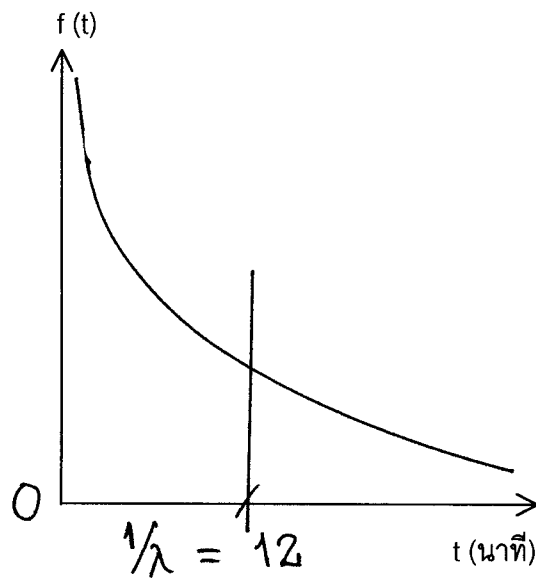


Figure 4.1B

(16 scores)

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

5. Best Truckers company is considering the construction of three repair facilities , each with different characteristics . The probability distribution of truck breakdowns each month follows the poisson distribution with mean 25 trucks per month , that is :

$$P \{ A = n \} = \frac{e^{-25} (25)^n}{n!}, \quad n = 0, 1, \dots$$

The loss of revenue (opportunity cost) to the firm of having a truck in repair is estimated to be \$1400 per month . The three facilities under consideration have the following characteristics.

Characteristics	Facility A	Facility B	Facility C
Installation cost (\$)	300,000	800,000	140,000
Labor cost (\$ per month)	7,000	4,800	2,000
Mean repair rates (trucks per moth)	30	50	12
Service time distribution	Exponential	Exponential	Constant
Economic life (years)	6	8.5	7

Determine : Which facility should be select ?

Remark for this system, we conclude the total annual cost is below.

Total annual cost = 2 (Installation cost / Economic life) + annual labor cost
+ annual cost of the loss revenue due to trucks in maintenance (repair)

(14 scores)

(Assistant Professor Yodduang Pannara)

