

NameID Code.....

225-352

225-354

**Faculty of Engineering
Prince of Songkla University**

Final Examination : Semester I

Academic Year : 2005

Date : October 10, 2005.

Time : 9.00-12.00

Subject : 225-352, 225-354 Operations Research

Room : R201, R300

**ทฤษฎีในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น
และพักการเรียน 1 ภาคการศึกษา**

Part A

Instructions :

1. There are 3 questions, 40 points.
2. Books and notes are allowed.
3. A calculator and a dictionary are allowed.
4. Borrowing things from other students is prohibited.

Problem no.	Full score	score
1	10	
2	15	
3	15	
Total	40	

**Assoc.Prof.Dr. Sunchai Klinpikul
Instructor**

1. An airline has 26 aircrafts with 20 passenger seats and 13 aircrafts with 30 passenger seats. Each 20-seater aircraft needs a pilot and 2 cabin crew members while a 30-seater aircraft needs a pilot and 5 cabin crew members. The airline wants to carry at least 420 passengers on a certain route and has 60 cabin crew available. What is the minimum number of pilots it has to employ ?

(10 points)

2. A company has 3 supply points A, B and C and 3 destinations X, Y and Z. The cost of transporting unit loads of raw materials between them are as follows :

Supply \ Destination	X	Y	Z
	A	2	10
B	5	3	5
C	2	3	5

The delivery capacities of A, B and C are 150, 200 and 200 units respectively while the needs of X, Y and Z are 300, 100 and 100 respectively.

Find an optimal allocation of units from the supply points to the destinations. What is the total transportation cost ?

(15 points)

3. Two companies A and B are promoting two competing products. Each product currently controls 50% of the market. Because of recent modifications in the two products, the two companies are now preparing for launching new advertisement campaign. If no advertisement is made by either of the two companies, the present status of the market shares will remain unchanged. However, if either company launches a stronger campaign, the other company will certainly lose a proportional percentages of its customers.

A survey of the market indicates that 50% of the potential customers can be reached through television, 30% through newspapers, and the remaining 20% through radio. The objective of each company is to select the appropriate advertisement media.

Formulate the problem as a two-person zero-sum game and find the optimal solution.

(15 points)



Faculty of Engineering
Prince of Songkla University

Final Examination : Semester 1

Academic year 2005 (2548)

Date : October 10 , 2005 (2548)

Time 9:00 – 12:00

Subject : 225 - 352 Operations Research (Part B)

Room R201, R300

225 – 354 Operational Research I (Part B)

ทูลริตในการสอบ โทษขันตำปรับตคในรายวิชานั้น และ พักการเรียน 1 ภาคการศึกษา

PART B

1. There are 3 topics in total examination : 12 pages , and 60 scores.
2. Do your examination in these papers and return all of them.
3. Write down your name , surname , student code in each paper.
4. Show all methods of calculation, and assumption.
5. All books, notes and calculators are allowed, but you are not permitted to borrow anything from others.

Subject 225 - 352 225 - 354

	Scores	Your Scores
1	20	
2	20	
3	20	
Total	60	

No.....

(From the number of examination list)

Name

Surname.....

Student code.....

Year.....

Department.....

Assistant Professor Yodduang Pannara



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

1. Queueing System from figure 1.1 , the probability of no customer in the system (P_0) is in table 1.1

1.1 Explain the meaning of table 1.1 clearly

.....
.....
.....
.....
.....

1.2 The customers go to the system with mean 18.9 customers per hour with poisson distribution. The service time distribution with 7 servers is exponential distribution with mean 0.1 customer per minute per server .

At steady state period , find

1.2.1 The probability of finding 6 customers in the system

1.2.2 The probability of finding 9 customers in the system

1.2.3 Average time of customers in queue

1.2.4 Average time of customers in the system

1.2.5 Average number of customers in queue

1.2.6 Average number of customers in the system

(Remark : Use the data from table 1.1 to help you to calculate this problem)

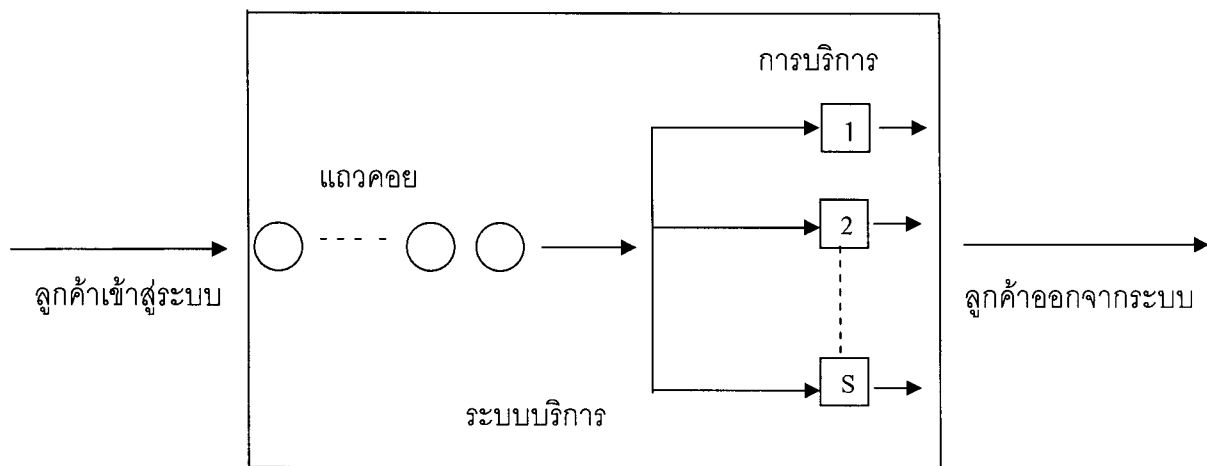


Figure 1.1

(20 scores)

Probability of No Customer in the System (P_0)

For Multiple-Server Facilities

System utilization ratio $\rho = \lambda / s\mu$	Number of servers (s)								
	2	3	4	5	6	7	8	9	10
.05	.9048	.8607	.8187	.7788	.7408	.7047	.6703	.6376	.6065
.10	.8182	.7407	.6703	.6065	.5488	.4966	.4493	.4066	.3679
.15	.7391	.6373	.5487	.4724	.4066	.3499	.3012	.2592	.2231
.20	.6667	.5479	.4491	.3678	.3012	.2466	.2019	.1653	.1353
.25	.6000	.4706	.3673	.2863	.2231	.1738	.1353	.1054	.0821
.30	.5385	.4035	.3002	.2228	.1652	.1224	.0907	.0672	.0498
.35	.4815	.3451	.2449	.1731	.1222	.0862	.0608	.0428	.0302
.40	.4286	.2941	.1993	.1343	.0903	.0606	.0407	.0273	.0183
.45	.3793	.2496	.1616	.1039	.0666	.0426	.0272	.0174	.0111
.50	.3333	.2105	.1304	.0801	.0490	.0298	.0182	.0110	.0067
.55	.2903	.1762	.1046	.0614	.0358	.0208	.0121	.0070	.0040
.60	.2500	.1460	.0831	.0466	.0260	.0144	.0080	.0044	.0024
.65	.2121	.1193	.0651	.0350	.0187	.0099	.0052	.0028	.0015
.70	.1765	.0957	.0502	.0259	.0132	.0067	.0034	.0017	.0009
.75	.1429	.0748	.0377	.0187	.0091	.0044	.0021	.0010	.0005
.80	.1111	.0562	.0273	.0130	.0061	.0028	.0013	.0006	.0003
.85	.0811	.0396	.0186	.0085	.0038	.0017	.0008	.0003	.0001
.90	.0526	.0249	.0113	.0050	.0021	.0009	.0004	.0002	.0001
.95	.0256	.0118	.0051	.0022	.0009	.0004	.0002	.0001	.0000

λ = arrival rate (Poisson)

s = number of servers

μ = service rate (per individual server and exponential service time)

Table 1.1

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

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

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

2. From network in figure 2.1 , Use only dynamic programming to find the 1st , 2nd and 3th longest paths from node ① to node ⑧

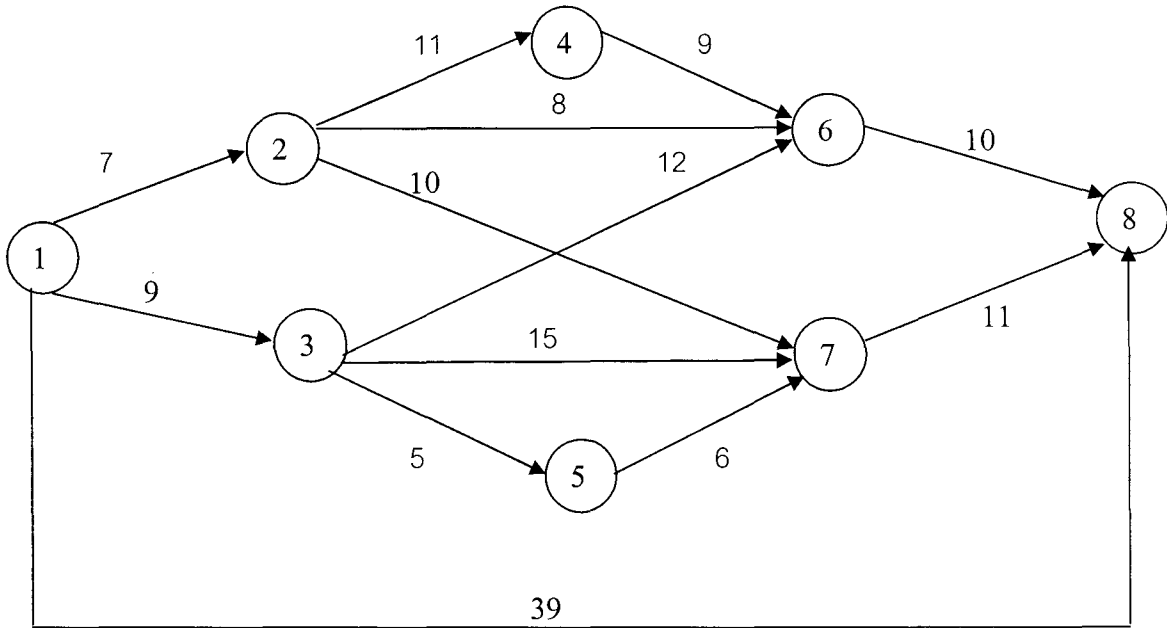


Figure 2.1

Remarks : the number in figure 2.1 is the distance between each node. For example

- The distance from node ① to node ③ is 9 miles.
- The distance from node ③ to node ⑥ is 12 miles.

(20 scores)

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

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

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

3. Use only Dynamic programming to solve this problem

Consider the GMM FUND which plans to invest in the projects for the upcoming year .
The GMM FUND has the budget for 600 million baht and is reviewing 4 possible projects
(MATIKOM , THAIDUT , POST , and WEEKLY NEWS) for funding . Listed below are the projects ,
together with their cost of fund and net present values of return.

Project	FUND (Million Baht)	Return (Million Baht)
MATIKOM	240	15
THAIDUT	210	11
POST	190	13
WEEKLY NEWS	150	6

GMM FUND will not partially fund a project , thus a project will be funded entirely or not at all . GMM FUND objective is to maximize the return of its investment in the projects.

What is GMM FUND decision ?

(20 scores)

