

**PRINCE OF SONGKLA UNIVERSITY  
FACULTY OF ENGINEERING**

**Final Examination :** Semester II

**Academic Year :** 2005

**Date :** February 22, 2006.

**Time :** 13.30-16.30

**Subject :**     225-352 Operations Research  
                   225-354 Operations Research

**Room :** A201

ทฤษฎีในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และ  
พักการเรียน 1 ภาคการศึกษา

**PART A**

**Instruction :**

1. There are 3 problem, 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	15	
2	15	
3	10	
Total	40	

Assoc. Prof. Dr. Sunchai Klinpikul  
Instructor



1. Consider the LP problem :

$$\text{Max } Z = 5X_1 + 12X_2 + 4X_3$$

S.T.


$$X_1 + 2X_2 + X_3 \leq 5$$

$$2X_1 - X_2 + 3X_3 = 2$$

$$X_1, X_2, X_3 \geq 0$$

Formulate dual problem for this problem and find the optimal solution from dual problem.

( 15 points )



2. A freezer manufacturer has factories at Bath, London and Oxford each capable of producing 200 freezers per week while the one at Leeds makes only 50 each week. Its 3 main customers in Cardiff, Norwich and York each want 100 freezers in any one week and the freezers are transported by a road haulage company at the following cost per freezer ;

Cost in Pounds	To:		
	Cardiff	Norwich	York
From :			
Bath	15	33	40
Leeds	21	na	4
London	36	28	51
Oxford	na	32	30

Note : na = Route not available

Determine the allocation of freezers from factories to destinations which minimizes the overall transportation cost.

Hint : For Route not available assign 500 pounds of transportation cost per freezer.

(15 points)

3. Solve the following 4 x 2 game graphically by calculating  $V^*$ ,  $Y_1^*$  and  $Y_2^*$ .

(10 points)

		B	
		1	2
A	1	2	4
	2	2	3
	3	3	2
	4	-2	6

**Faculty of Engineering**  
**Prince of Songkla University**

Final Examination : Semester 2

Academic year 2005 ( 2548 )

Date : February 22, 2006 ( 22 กุมภาพันธ์ 2549 )

Time : 13:30 – 16:30

Subject : 225-352 Operations Research

Room : A201

ทฤษฎีในการสอบ โทษขั้นต่ำปรับตกในที่ทฤษฎีนั้น และ  
พักการเรียน 1 ภาคการศึกษา

**Part B :**

1. Total 3 topics, 15 pages and 60 scores.
2. Do your examination in these papers and return all of them.
3. Write down your number, 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.

	Scores	Your Scores
1	20	
2	20	
3	20	
Total	60	

Number.....

( From the number in examination list )

Name.....

Surname.....

Student code.....

Year / Department.....

Assistant Professor Yodduang Pannara



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

1) The cost of waiting for spareparts from Toyopet's storeroom is \$ 12 per hour .

The spareparts arrive at the rate of 6 units per hour. The production manager is concerned about the manufacturing time lost by the employees at the spareparts storeroom.

Toyopet is considering three options for improving service.

1.1. Use the existing system .

1.2. Replace the existing clerk with the specially trained and certified clerk .

Under this new plan, the service rate will increase from 8.2 to 14 units per hour.

However, the new clerk will be paid \$ 10 per hour as compared to the \$ 6.5 hourly wage of the existing clerk .

1.3. Purchase and installation of the required equipment would add \$ 9,700 to annual fixed expenses but provide a service rate of 20 units per hour.

Operating cost, insurance and other fixed expenses for the storeroom facility should remain at \$ 13,000 per year. The facility operates 8 hours a day, 240 days per year. All of arrival time and service time is exponential distribution. Toyopet management must decide which option to select the best total cost.

( 20 scores )



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

A handwritten signature in black ink, located in the bottom right corner of the page. The signature is stylized and appears to be a cursive name.

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

2). Consider the design of an electronic device consisting of three main components . The three components are arranged in series so that the failure of one component will cause the failure of the entire device .

The reliability ( probability of non failure ) of the device can be improved by installing standby units in each component . The design may use one or two standby units, which means that each main component may include up to three units in parallel .

The total capital available for the design of the device is \$ 10,400. The data for the reliability  $R_j ( k_j )$  and cost  $C_j ( k_j )$  for the  $j^{\text{th}}$  component (  $j = 1, 2, 3$  ) given  $k_j$  parallel units are summarized below.

	j = 1		j = 2		j = 3	
$k_j$	$R_1$	$C_1$	$R_2$	$C_2$	$R_3$	$C_3$
1	0.6	1000	0.7	3050	0.5	1020
2	0.8	1900	0.8	4950	0.7	4000
3	0.9	3000	0.9	6000	0.9	5100

The objective is to determine the number of parallel units in component j that will maximize the reliability of the device without exceeding the allocated capital. Using Dynamic Programming to find the best reliability.

( 20 scores )





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

- 3). The Honya company plans to replace the machine in 5 years project. The Honya company has 4 years old machine. The maximum life time of machine is only 5 years. The profit of machine is  $27 - T^2$  baht

T = time of machine

The new machine costs 17 baht. The salvage value of machine is  $8 - T$  baht. Using Dynamic Programming to find the best replacement policy.

( 20 scores )

