

Student ID.....

Student Name:.....

**PRINCE OF SONGKLA UNIVERSITY**  
**FACULTY OF ENGINEERING**

Final Examination : Semester 1

Academic Year: 2010

Date: October 10, 2010

Time: 09:00-12:00

Subject: 225-348 Operations Research

Room: ๕๖๓๕๐๑๑๑

ทุจริตในการสอบ โทษขั้นต้นปรับตกในรายวิชาทั้งและพักการเรียน 1 ภาคการศึกษา

Instructions:

1. There are 5 questions, 100 points (40%).
2. Books and notes are allowed.
3. A calculator and a dictionary are allowed.
4. Borrowing things from other students is prohibited.

Question No.	Full Score	Score
1	25	
2	15	
3	15	
4	30	
5	15	
<b>Total</b>	<b>100</b>	

Napisorn Memongkol  
Runchana Sinthavalai  
Instructor

1. **(25 Points)** A toy manufacturer supplies four retail outlets by three factories. The transportation costs from each factory to each retail outlet are shown in the following table.

	A	B	C	D	Supply (Units/ week)
1	4	7	7	1	100
2	12	3	8	8	200
3	8	10	16	5	150
Demand (Units/ week)	80	90	120	160	

The retired manager has used his experience and performed the transportation system as shown in the table. However, the new manager would like to plan for new transportation system by using the transportation method for the minimum cost. Does the solution from new manager save cost for the manufacturer? How much?

2. **(15 Points)** Two companies share the bulk of the market for a particular kind of product. Each is now planning its new marketing plan for the next year in an attempt to wrest some sales away from the other company. (The total sales for the product are relatively fixed, so one company can increase its sales only by winning them away from the other.) Each company is considering three possibilities: (1) better packaging of the product, (2) increased advertising and (3) a slight reduction in price. The costs of the three alternatives are quite comparable and sufficiently large that each company will select just one. The estimated effect of each combination of alternatives on the increase percentage of the sales for company 1 is as follows:

Strategy		Company 2		
		1	2	3
Company 1	1	2	3	1
	2	1	4	0
	3	3	-2	-1

Each company must make its selection before learning the decision of another company.

- 2.1 Without eliminating dominated strategies, use the minimax (or maximin) criterion to determine the best strategy for each company.
- 2.2 Now identify and eliminate dominated strategies as far as possible. Make a list of the dominated strategies, showing the order in which you were able to eliminate them. Then show the resulting reduced payoff table with no remaining dominated strategies.
- 2.3 Is there a saddle point?

Continue next page

3. **(15 Points)** The Wendy Corporation has three branch plants with excess production capacity. Fortunately, the corporation has a new product ready to begin production, and all three plants have this capacity, so some of the excess capacity can be used in this way. This product can be made in three sizes—large, medium, and small— that yield a net unit profit of \$420, \$360, and \$300, respectively. Plant # 1, 2, and 3 have the excess capacity to produce 750, 900, and 450 units per day of this product, respectively, regardless of the size or combination of sizes involved.

The amount of available in-process storage space also imposes a limitation on the production rates of the new product. Plant # 1, 2, and 3 have 13,000, 12,000, and 5,000 square feet, respectively, of in-process storage space available for a day's production of this product. Each unit of the large, medium, and small sizes produced per day requires 20, 15, and 12 square feet, respectively.

Sales forecasts indicate that available 900, 1,200, and 750 units of the large, medium, and small sizes respectively would be sold per day.

At each plant, some employees will need to be laid off unless most of the plants' excess production capacity can be used to produce the new product. To avoid layoff if possible, management has decided that the plants should use the same percentage of their excess capacity to produce the new product.

Management wishes to know how much of each product size should be produced by each plant to maximize profit.

Formulate a linear programming model for this problem.

Continue next page

4. (30 Points) Consider the following problem.

$$\text{Minimize } Z = 0.4x_1 + 0.5x_2$$

Subject to

$$0.3x_1 + 0.1x_2 \leq 2.7$$

$$0.5x_1 + 0.5x_2 = 6$$

$$0.6x_1 + 0.4x_2 \geq 6$$

and  $x_1 \geq 0, \quad x_2 \geq 0$

- 4.1 Using the Big M method, work through the simplex method step by step to solve the problem
- 4.2 Using the Two-phase method, work through the simplex method step by step to solve the problem

Continue next page

Cont' Question 4

Continue next page

5. **(15 Points)** Skyway Airlines is considering air service from its hub of operations in Cicely, to Wisconsin, and Washington. Skyway has one gate at the Cicely Airport, which operates 12 hours per day. Each flight requires 1 hour of gate time. Each flight to Wisconsin consumes 15 hours of pilot crew time and is expected to produce a profit of \$2,500. Serving Washington uses 10 hours of pilot crew time per flight and will result in a profit of \$2,000 per flight. Pilot crew labor is limited to 150 hours per day. The market for service to Wisconsin is limited to nine flights per day.
- Formulate linear programming to maximize the profit for Skyway Airline.
  - Use the graphical method to solve this model.

หน้านี้ เป็นกระดาษกราฟ สำหรับข้อ 5

