PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Midterm : Semester 2   Year : 2006

Date   : December 23, 2549 (2006)   Time : 13:00 – 16:00

Subject : 228-513 Operations Research   Room : Com 2 , Com 3

           for Managers

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาค การศึกษา

1. Total examination has 4 topics, 20 pages, and 50 scores.

2. Do your examination in these 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	16	
4	13	
Total	50	

Name.......................................

Surname....................................

Student Code..............................

(Assistant Professor Yodduang Pannara)

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

1. Consider the Linear Programming problem :

$$\text{MAX} \qquad Z = 3X_1 + 2X_2 + 5X_3$$

Subject to

$$X_1 + 2X_2 + X_3 \le 430$$

$$3X_1 \qquad + 2X_3 \le 460$$

$$X_1 + 4X_2 \qquad \le 420$$

$$X_1, X_2, X_3 \qquad \ge 0$$

Find the objective function (Z), X_1, X_2 and X_3 using simplex method   (9 scores)

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

2. Find the objective function (Z), X_1, and X_2 from the Linear Programming below using the graphical technique

$$\text{Max} \quad Z = 5000X_1 + 4000X_2$$

Subject to

$$X_1 + X_2 \geq 5$$
$$X_1 - 3X_2 \leq 0$$
$$10X_1 + 15X_2 \leq 150$$
$$20X_1 + 10X_2 \leq 160$$
$$30X_1 + 10X_2 \geq 135$$
$$X_1, X_2 \geq 0$$

(12 scores)

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

3. The noodle shop sells noodle cup. The selling price is 30 Baht / cup. The variable cost of noodle cup is $4(\text{selling price})^{1/2}$ - I Baht / cup. (I is the parameter.)

- If the amount of selling noodle cup is from 1 to 40 cups / day, I is equal to 2 Baht / cup. The variable cost of every noodle cup from 1 to 40 cups / day is equal to $4(30)^{1/2} - 2$ Baht / cup.

- If the amount of selling noodle cup is from 41 to 80 cups / day, I is equal to 4 Baht / cup. The variable cost of every noodle cup from 41 to 80 cups / day is equal to $4(30)^{1/2} - 4$ Baht / cup.

- If the amount of selling noodle cup is > 80 cups / day, I is equal to $4 + 0.002(\text{amount of selling noodle cup})$ Baht / cup. The variable cost of every noodle cup from 81 to 150 cups / day is equal to $4(30)^{1/2} - (4 + 0.002(\text{amount of selling noodle cup}))$ Baht / cup.

Example :   - If you sell 30 cups / day $\Longrightarrow$ I = 2 Baht / cup and the variable cost of noodle cup $= 4(30)^{1/2} - 2 = 19.908$ Baht / cup.

- If you sell 100 cups / day $\Longrightarrow$ I = $4 + 0.002 (100) = 4.2$ and the variable cost of noodle cup = $4 (30)^{1/2} - (4.2) = 17.7089$ Baht / cup.

Each day the noodle shop has the fixed cost 500 Baht (If the noodle shop sells nothing, the cost is 500 Baht /day.) The noodle shop can not sell more than 150 cups / day because the limitation of raw material.

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

Use your simple logic and / or show all calculation about

selling noodle.

3.1   What does maximum capacity of noodle shop sell noodle cups for each

day? (1 score)

3.2   Suppose the maximum noodle cups sale today are 130 cups. Draw the

graph or calculate the relation between fixed cost and volume of selling

noodle cups from 0 to 130 cups. (1 score)

3.3   Suppose the maximum noodle cups sale today are 140 cups.

Draw the graph or calculate the relation between net profit and volume of

selling noodle cups from 0 to 140 cups. (9 scores)

3.4   How many noodle cups do you sale per day to make maximum profit? How much?

(2 scores)

3.5   How many noodle cups do you sale per day to make zero profit? Zero profit

means income is equal to expense. (3 scores)   (Total 16 scores)

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

4.   The company works 8 hours per day. The company has three grades of inspectors, 1 , 2 and 3 who are assigned for a quality control inspection. It is required that at least 8400 pieces be inspected per day. Grade 1 inspectors can check at the rate of 320 pieces per working day with an accuracy of 98.5%. Grade 2 inspectors can check at the rate of 36 pieces per hour with an accuracy of 97.2%. Grade 3 inspectors can check of the rate of 0.56 pieces per minute with an accuracy of 97%.

The wage rate of a grade 1 inspector is 60 Baht per hour-person, while that of a grade 2 inspector is 400 Baht per day-person. The wage rate of a grade 3 inspector is 0.55 Baht per minute-person . Each time an error is made by an inspector, the cost to the company is 60 Baht per piece.

The company has available for the inspection job nine grade 1 inspectors, twelve grade 2 inspectors and ten grade 3 inspectors. The company wants to determine the optimal assignment of inspectors per hour which will minimize the total cost of the inspection **per hour**

4.1   Using Linear Programming and Lindo find objective function, all variables and the reason of all inequality equations. (10 scores)

4.2   Same with problem 4.1 but the demand to be inspected changes from 8400 pieces per day to 600 pieces per hour. (3 scores)

Remark : If the answer or solution or variables are real number, write the real number. No need to change from real number to integer number

(Total 13 scores)