國立臺北科技大學 102 學年度碩士班招生考試

系所組別：4120 工業工程與管理系碩士班乙組

第二節　作業研究　試題

注意事項：

1. 本試題共 5 題，每題 20 分，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Consider the following problem.

Maximize $Z = 4x_1 + x_2 + 3x_3$

Subject to

$2x_1 + 2x_2 + 0.5x_3 \le 4$

$-4x_1 - 2x_2 - 1.5x_3 \le 3$

$x_1 + 2x_2 + 0.5x_3 \le 2$

$x_1, x_2, x_3 \ge 0$

Let x_4, x_5 and x_6 denote the slack variables for the respective constraints. After you apply the simplex method, a portion of the final simplex tableau is as follows:

Basic variable	Eq.	Coefficient of							
		Z	x_1	x_2	x_3	x_4	x_5	x_6	Right sides
Z	(0)	1							
x_5	(1)	0				1	1	2	
x_3	(2)	0				-2	0	4	
x_1	(3)	0				1	0	-1	

Please finish the final simplex tableau. Show your calculations. **(20%)**

2. Consider the following problem.

Maximize $Z = 2x_1 + 7x_2 - 3x_3$

Subject to

$x_1 + 3x_2 + 4x_3 \le 30$

$x_1 + 4x_2 - x_3 \le 10$

$x_1, x_2, x_3 \ge 0$

Let x_4 and x_5 denote the slack variables for the respective constraints. The simplex method yields the following final set of equations:

(0) $Z + x_2 + x_3 + \quad 2x_5 = 20$

(1) $\quad -x_2 + 5x_3 + x_4 - x_5 = 20$

(2) $x_1 + 4x_2 - x_3 + \quad x_5 = 10$

Now you are to conduct sensitivity analysis independently investigating each of the following changes in the original model. For each change, use the sensitivity analysis procedure to revise the set of equations in tableau form and convert it to proper form from Gaussain elimination for identifying and evaluating the current solution. Then test this solution for **feasibility** and for **optimality**.

(a) Change the right-hand sides to

$b_1 = 20, b_2 = 40$ **(10%)**

(b) Introduce a new constraint $2x_1 + 2x_2 + 3x_3 \le 10$ **(10%)**

3. For the coming cold winter, a company wants to plan for its energy system for the building. The energy needs in the building including: (1) electricity (2) heating water, and (3) heater in space. The daily requirement for the three categories are Electricity 30 units, water heating 20 units, heater in space 30 units. The three possible sources of energy to meet these needs are electricity, gas and solar system on the roof. The size of solar system limits the largest possible solar system to 40 units, but there is no limit to the electricity and gas. However, electricity needs can be met only by purchasing electricity at a cost of $40 per unit. Both other energy needs can be met by any source or combinations of sources. The unit costs are

	Electricity	Gas	Solar
Water heating	$70	$60	$20
Heater	$80	$40	$30

The objective is to minimize the total cost of meeting the energy needs.

(a) Formulate this problem as a transportation problem by constructing the appropriate parameter table and formulate a linear programming model. **(10%)**

(b) Use the Vogel's method to obtain an initial BF solution. **(10%)**

注意：背面尚有試題

4. Please use dynamic programming to solve the following problem. **(20%)**

Maximize $Z = 7x_1 + 4x_2$

Subject to

$x_1 + 2x_2 \leq 12$

$3x_1 + x_2 \leq 10$

5. The J&P Company develops three new products 1, 2 and 3. The three products need three different machines to manufacture. The available time for the three machines are milling 500 hours, lathe 400 hours and grinder 350 hours per week. The number of machine hours required for each unit of the respective products is

Machine type	Product 1	Product 2	Product 3
Milling	8	2	5
Lathe	5	0	7
Grinder	4	5	6

The sale department indicates that the sales potential for products 1 and 2 exceeds the maximum production rate and the sales potential for product 3 is 20 units per week. The unit profit would be \$40, \$25 and \$30, respectively, on product 1, 2 and 3. Managers decide to choose no more than two of the three prospective products should be produced. Also, the setup costs for the product 1, 2 and 3 are \$100, \$120 and \$90, respectively. The objective is to determine how much of each product J&P Company should produce to maximize profit. Please formulate a mixed integer programming model for this problem by using auxiliary binary variables. **(20%)**