

國立臺北科技大學 103 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

第三節 作業研究 試題

第一頁 共二頁

注意事項：

1. 本試題共 5 題，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

$$\text{Minimize } Z = 3x_1 + 2x_2 + 7x_3$$

Subject to

$$-x_1 + x_2 = 10$$

$$2x_1 - x_2 + x_3 \geq 10$$

$$x_1, x_2, x_3 \geq 0$$

Using the two-phase method, work through the simplex method step by step to solve the problem. (20%)

2. The Wonderful company has decided to produce three new products. Five branch plants now have excess product capacity. The unit manufacturing cost of the first product would be \$41, \$39, \$42, \$38, and \$39 in plants 1, 2, 3, 4, and 5, respectively. The unit manufacturing cost of the second product would be \$55, \$51, \$56, \$52, and \$53 in plants 1, 2, 3, 4, and 5, respectively. The unit manufacturing cost of the third product would be \$48, \$45, and \$50 in plant 1, 2, and 3, respectively, whereas plant 4 and 5 do not have the capacity for producing this product. Sales forecasts indicate that 700, 1,000, and 900 units of products 1, 2, and 3, respectively, should be produced per day. Plant 1, 2, 3, 4, and 5 have the capacity to produce 400, 600, 400, 600, and 1,000 units per day, respectively. Regardless of the product or combination of products involved. Assume that any plant having the capability and capacity to produce them can produce any combination of the products in any quantity. Management wishes to know how to allocate the new products to

the plants to minimize total manufacturing cost.

- (1) Formulate this problem as a transportation problem by constructing the appropriate parameter table. (5%)
- (2) Use Northwest corner rule to obtain initial basic feasible solution. (5%)
- (3) Apply the transportation simplex method to obtain an optimal solution for this problem. (10%)

3. Consider the following nonlinear programming problem.

$$\text{Maximize } Z = 3x_1^2 + 2x_2^2 + 12x_3$$

Subject to

$$x_1 x_2 x_3 = 8$$

$x_1, x_2, x_3 \geq 1$ and are integer

Solve the problem by dynamic programming. (20%)

4. You are given the following payoff table (in units of thousands of dollars) for a decision analysis problem.

Alternative	State of Nature		
	S ₁	S ₂	S ₃
A ₁	50	100	-100
A ₂	10	10	-10
A ₃	30	40	-50
Prior Probability	0.5	0.3	0.2

- (1) According to Baye's decision rule, which alternative should be chosen? (5%)
- (2) Find the expected value of perfect information? (5%)
- (3) You are offered the opportunity to obtain information which will tell you with certainty whether the first state of nature S₁ will occur. What is the maximum amount you should pay for the information? (10%)

注意：背面尚有試題

5. The H&M company received purchase requests for three products 1, 2, and 3 with short deadlines. However, because the company's production facilities already are almost completely tied up filling previous orders, it will not be able to accept all three orders. Therefore, a decision now needs to be made on the number of products the company will agree to produce for each of the three orders. The relative data are given in the next table.

	Product		
	1	2	3
Capacity used per product	20%	40%	20%
Maximum order	3	2	5

Also, the profits are given as the following table.

Product produced	Profit from product		
	1	2	3
0	0	0	0
1	\$1 million	\$1 million	\$0.5 million
2	\$3 million	\$5 million	\$1 million
3	\$6 million		\$3 million
4			\$5 million
5			\$8 million

The H&M company wants to determine how many products to produce for product 1, 2 and 3 to maximize the company's total profit. Please formulate a Binary Integer Programming model for this problem that includes constraints for mutually exclusive alternatives. (20%) (Do not need to solve it)