

## 國立臺灣科技大學 109 學年度碩士班招生試題

系所組別：工業管理系碩士班甲組

科目：作業研究

(總分為 100 分)

1. Use revised simplex method to solve the following linear program. (20%)

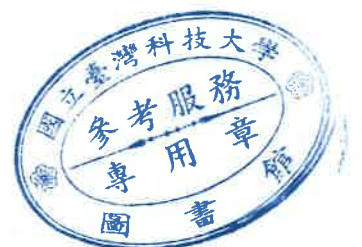
$$\begin{aligned} \text{Maximize } & Z = 2x_1 + x_2 - x_3 \\ \text{subject to } & 3x_1 + x_2 + x_3 \leq 6 \\ & x_1 - x_2 + x_3 \leq 2 \\ & x_1 + 2x_2 - x_3 \leq 1 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

2. A company producing a certain product has three plants and four customers. Plants 1, 2 and 3 will produce 90, 70 and 80 units, respectively, during next week. The company has made a commitment to sell 60 units to customer 1, 70 units to customer 2, and at least 80 units to customer 4. Both customers 3 and 4 also want to buy as many of the remaining units as possible. The profit associated with shipping a unit from plant  $i$  for sale to customer  $j$  is given in the following table.

	Customer			
	1	2	3	4
Plant 1	\$8	\$14	\$10	\$13
Plant 2	\$7	\$10	\$8	\$11
Plant 3	\$11	\$10	\$14	\$12

The company wishes to know how many units to sell to customers 3 and 4 and how many units to ship from each of the plants to each of the customers to maximize profit.

- (a) Formulate this problem as a transportation problem by constructing the appropriate parameter table. (10%)
- (b) Use Russell's approximation method to construct an initial basic feasible solution. (10%)
- (c) Starting with the initial basic solution from part (b), apply the transportation simplex method to obtain an optimal solution. (10%)



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3. Consider the problem (20%)

$$\text{Maximize } z = 6x_1 + 3x_2 - 4x_1x_2 - 2x_1^2 - 3x_2^2$$

$$\text{subject to } x_1 + x_2 \leq 1$$

$$2x_1 + 3x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

Show that  $z$  is strictly concave, and then solve this problem.

4. Customers tend to exhibit loyalty to product brands but may be persuaded through clever marketing and advertising to switch brands. Consider the case of three brands: A, B, and C. Customers of any brand will switch to the other two brands with the probability 0.25. Competitors launch their advertising campaigns once a year. For brand A customers, the probabilities of switching to brands B and C are 0.1 and 0.15, respectively. Customers of brand B are likely to switch to A and C with probabilities 0.2 and 0.05. Brand C customers can switch to A and B with equal probabilities.
- (1) In the long run, how much market share will each brand have? (10%)
- (2) How long on the average will it take for a brand A customer to switch to brand B? To brand C? (10%)
5. In the M/M/k system, what is the probability that a customer will have to wait in queue and what is the value of  $L$  (the average number of customers in the system) and  $W$  (the average amount of time for a customer spent in the system)? (10%)

