國立臺灣科技大學

115學年度碩士班招生

試題

系所組別：0110工業管理系碩士班甲組

科　　目：作業研究

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(總分為100分;所有試題務必於答案卷內頁依序作答)

1. **(20%)** Use the **Big-M method** to solve the following problem.

$$\text{Maximize} \quad Z = 2x_1 + 3x_2 + 4x_3$$

subject to

$$x_1 + x_2 + 2x_3 \le 7$$
$$x_1 + 2x_2 + x_3 \ge 8$$
$$x_1 + x_2 + x_3 = 5$$
$$x_1, x_2, x_3 \ge 0$$

2. **(30%)** A company produces a product at three production plants, P_1, P_2, and P_3 with capacities of 35, 25, and 40 units, respectively. All units produced must be shipped to four distributors, D_1, D_2, D_3, and D_4. Each distributor has a specified minimum requirement and a desired maximum quantity, beyond which shipments are not permitted, as shown in the table below.

Distributor	Minimum Requirement	Desired Maximum Quantity
D_1	15	25
D_2	20	30
D_3	20	30
D_4	15	25

Products may be shipped from any plant to any distributor. The unit shipping costs are given in the table below.

From \ To	D_1	D_2	D_3	D_4
P_1	6	5	4	3
P_2	5	4	6	8
P_3	3	6	7	5

(a) **(10%)** Formulate this problem as a **balanced transportation problem** by providing the appropriate parameter table.

(b) **(20%)** Solve the problem using the **transportation simplex method.**

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3. **(20 %)** Find all local maxima, local minima, and saddle points for $f(x_1, x_2) = x_1^3 - 3x_1x_2^2 + x_2^4$.

4. **(15%)** An organization has N employees where N is a large number. Each employee has one of three possible classifications and changes classifications independently according to a Markov chain with transition probabilities

$$\begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.2 & 0.6 & 0.2 \\ 0.1 & 0.4 & 0.5 \end{bmatrix}$$

What percentage of employees are in each classification?

5. **(15%)** Suppose that a single-server queueing system fits all the assumptions of the birth-and-death process except that customers always arrive in *pairs*. The mean arrival rate is 2 pairs per hour (4 customers per hour) and the mean service rate is 5 customers per hour. Construct the rate diagram for this queueing system and develop the balance equations.