

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別：工程技術研究所
學程別：自動化及控制學程

組別：管理組

科目：作業研究

1. For the following problem, show that the optimal solution is degenerate and that there exist alternative solutions that are all nonbasic (25%):

$$\begin{aligned} \text{Maximize } z &= 3x_1 + x_2 \\ \text{subject to } x_1 + 2x_2 &\leq 5 \\ x_1 + x_2 - x_3 &\leq 2 \\ 7x_1 + 3x_2 - 5x_3 &\leq 20 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

2. Explain how the following conditions can be represented as linear constraints by the use of the binary (0-1) integer variables:

- (a) Either $x_1 + x_2 \leq 2$ or $2x_1 + 3x_2 \geq 8$ (6%).
 (b) Variables can assume values 0, 5, 9 and 12 only (6%).
 (c) If $x_1 \leq 4$, then $x_3 \geq 6$; otherwise $x_3 \leq 3$ (7%).
 (d) At least three out of the following four constraints must hold (6%):

$$\begin{aligned} x_6 + x_7 &\leq 2 \\ x_8 &\leq 2 \\ x_7 - x_9 &\leq 2 \\ x_6 + x_8 &\geq 3 \end{aligned}$$

3. Consider a one-server queue system in which the arrival and the service rate are given by

$$\begin{aligned} \lambda_n &= 10 - n, & \text{for } n = 0, 1, 2, 3 \\ \mu_n &= \frac{n}{2} + 5, & \text{for } n = 1, 2, 3, 4 \end{aligned}$$

- (a) Set up the rate diagram and determine the balance equation for this system (10%).
 (b) Determine the steady-state probabilities (15%).

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別：工程技術研究所

組別：管理組

科目：作業研究

學程別：自動化及控制學程

4. A company needs to have a working machine during each of the next six years. At present, it has a new machine. At the beginning of each year, the company may keep the machine or sell it and buy a new one. A machine cannot be kept for more than three years. A new machine costs \$5,000. The revenue earned by a machine, the costs of maintenance, and the salvage value that can be obtained by selling it at the end of a year depending on the age of the machine are illustrated in the table below. Use dynamic programming to maximize the net profit earned during the next six years (25%).

	Age of machine at beginning of year		
	0 year	1 year	2 years
Revenues	\$4500	\$3000	\$1500
Operating costs	\$500	\$700	\$1100
Salvage value (year end)	\$3000	\$1800	\$500