國立臺灣科技大學102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 ***parametric linear programming*** to find an optimal solution for the following problem as a function of θ, for $0 \le \theta \le 20$. **(20%)**

$$\begin{aligned} \text{Maximize} \quad & z(\theta) = 5x_1 + (30-3\theta)x_2 + (20+4\theta)x_3 \\ \text{subject to} \quad & x_1 + 3x_2 + 3x_3 \le 10 \\ & 4x_1 + 6x_2 + 8x_3 \le 25 \\ & x_1 + x_2 + 6x_3 \le 15 \\ & x_1, x_2, x_3 \ge 0 \end{aligned}$$

2. A company supplies a certain product to its four retail outlets from its three plants. The supply of each plant, the minimum demand and maximum demand of each retail outlet, the shipping cost per unit from each plant to each retail outlet are given in the following table.

		Retail outlet 1	2	3	4	Supply (unit)
Plant	1	8	7	11	9	60
	2	7	9	10	8	50
	3	8	10	12	10	40
Minimum demand (unit)		30	50	20	0	
Maximum demand (unit)		30	70	∞	40	

All the supplies must be shipped to the retail outlets. The number of units shipped to each retail outlet must be between the retail outlet's minimum demand and maximum demand. The management wishes know how many units to ship from each of the plants to each of the retail outlets to minimize the total transportation cost. Formulate this problem as a ***transportation problem*** by constructing the appropriate cost and requirements table. **(15%)**

3. The coach of the NTUST women's basketball team is trying to choose the starting lineup. The team consists of seven players who have been rated (on a scale of 1=poor to 3=excellent) according to their ball-handling, shooting, rebounding, and defensive abilities. The positions that each player is allowed to play and the player's abilities are listed in the following table.

Player	Position	Ball-handling	Shooting	Rebounding	Defense
1	G	3	3	1	3
2	C	2	1	3	2
3	G-F	2	3	2	2
4	F-C	1	3	3	1
5	G-F	3	3	3	3
6	F-C	3	1	2	3
7	G-F	3	2	2	1

The five-player starting lineup must satisfy the following restrictions:

(1) At least 3 members must be able to play guard (G), at least 2 members must be able to play forward (F), and at least 1 member must be able to play center (C).
(2) The average ball-handling, shooting, and rebounding level of the starting lineup must be at least 2.

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(3) If player 3 starts, then player 6 cannot start.
(4) If player 1 starts, then players 4 and 5 must both start.
(5) Either player 2 or player 3 must start.

Given these constraints, the coach wants to maximize the total defensive ability of the starting team. Formulate an ***integer program*** that will help the coach choose the starting team. **(15%)**

4. A taxi driver provides service in two zones of a city. Fares picked up in zone A will have destinations in A with probability 0.6 or in zone B with probability 0.4. Fares picked up in zone B will have destinations in zone A with probability 0.3 or in zone B with probability 0.7. The driver's expected profit for a trip entirely in zone A is 6; for a trip entirely in zone B is 8; and for a trip that involves both zones is 12. Find the taxi driver's average profit per trip. **(20 %)**

5. A small barbershop, operated by a single barber, has room for at most two customers. Potential customers arrive at a Poisson rate of three per hour, and the successive service times are independent exponential random variables with mean 1/4 hour.
   (a) What is the average number of customers in the shop? **(10 %)**
   (b) What is the proportion of potential customers that enter the shop? **(10 %)**
   (c) If the barber could work twice as fast, how much more business would he do? **(10 %)**