國立雲林科技大學 112 學年度 碩士班招生考試試題

系所：工管系

科目：作業研究

1. Manager Lin is planning to build new warehouses. The candidates consist of eight locations which have been scored (on a scale of 1 = low, 2=average, and 3 = high) according to their building cost, distance to the manufacturing factory and the frequency of traffic jams during the route from factory to the location. The rating of location is listed in Table 1.

Table 1

Location	cost	traffic jam	distance
1	3	1	2
2	1	2	3
3	2	3	2
4	1	2	2
5	3	1	3
6	2	2	3
7	3	3	2
8	2	2	1

Manager Lin would like to select five locations among eight candidates. Following restrictions should be satisfied:

(1) For the selected locations, both the average traffic jam and the distance must be smaller than 2.
(2) If location 7 is selected, then location 3 cannot be selected.
(3) Location 4 and 5 cannot be selected together.
(4) Either location 1 or location 2 must be selected.

Given these constraints, Manager Lin wants to minimize the score of total cost for the selected locations.

(a) Formulate the problem as an integer programming (IP). (20%)

(b) Manager Lin wants to consider another situation. In the new situation, restriction 1, 2, and 3 should be satisfied, however, the restriction 4 will be replaced as follows:

New 4. If location 3 is selected, then either location 1 or 2 (or both) must be selected. Please reformulate this model. (10%)

國立雲林科技大學 112 學年度 系所：工管系
碩士班招生考試試題 科目：作業研究

2. Consider the following Linear Programming (LP) and its optimal tableau shown in Table 2.

$$\max \quad z = c_1x_1 + c_2x_2$$
$$\text{s.t.} \quad a_{11}x_1 + a_{12}x_2 \le b_1$$
$$a_{21}x_1 + a_{22}x_2 \le b_2$$
$$x_1, x_2 \ge 0$$

Table 2

B.V.	z	x_1	x_2	s_1	s_2	RHS
z	1	0	0	2	3	5/2
x_1	0	1	0	3	2	5/2
x_2	0	0	1	1	1	1

Determine $c_1, c_2, b_1, b_2, a_{11}, a_{12}, a_{21}, and\ a_{22}$ (20%)

3. The owner of a chain of three grocery stores has purchased five crates of fresh strawberries. The estimated probability distribution of potential sales of the strawberries before spoilage differs among the three stores. Therefore, the owner wants to know how to allocate five crates to the three stores to maximize expected profit. For administrative reasons, the owner does not wish to split crates between stores. However, he is willing to distribute no crates to any of his stores. The following table gives the estimated expected profit at each store when it is allocated various number of crates:

Table 3

	Store		
Crates	1	2	3
0	0	0	0
1	5	6	4
2	9	11	9
3	14	15	13
4	17	19	18
5	21	22	20

Use dynamic programming to determine how many of the five crates should be assigned to each of the three stores to maximize the total expected profit. (25%)

國立雲林科技大學 112 學年度 碩士班招生考試試題

系所：工管系

科目：作業研究

4. Newell and Jeff are the two barbers in a barber shop they own and operate. The provide two chairs for customers who are waiting to begin a haircut, so the number of customers in the shop varies between 0 and 4. For n=0, 1, 2, 3, 4, the probability P_n that exactly n customers are in the shop is P_0=1/16, P_1=4/16, P_2=6/16, P_3=4/16, P_4=1/16.

(a) Calculate L and describe the meaning. (5%)

(b) For each of the possible value of the number of customers in the queueing system, specify how many customers are in the queue. Calculate L_q and describe the meaning. (5%)

(c) Determine the expected number of customers being served. (5%)

(d) Given that an average of 4 customers per hour arrive and stay to receive a haircut, determine W and W_q and describe the meaning. (5%)

(e) Given that Newell and Jeff are equally fast in giving haircuts, what is the average duration of a haircut. (5%)