國立台灣科技大學九十八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

（總分爲 100 分）

1. (25%) Consider the diet problem with the following data involving two nutrients (vitamins A, K) with minimum daily requirements (MDR), and 5 different foods.

Nutrient	Nutrient units/unit food					MDR for
	1	2	3	4	5	nutrient
Vitamin A	1	0	1	1	2	21
Vitamin K	0	1	2	1	1	12
Cost (cents/unit)	20	20	31	11	12	

(a) (5%) Formulate the problem of finding a minimum cost diet meeting the requirements.

(b) (5%) Find an optimum solution for the problem. Let $\bar{x}$ and $\bar{B}$ denote the optimum solution and basis obtained, respectively.

(c) (5%) For what range of values of c_4 (cost/unit of food 4) is the current optimal solution $\bar{x}$ remains optimal?

(d) (5%) For what range of values of the MDR of vitamin K (whose present value is 12) does the basis $\bar{B}$ remain optimal to the problem?

(e) (2%) A local pharmacist is selling vitamin K pills at a cost of 12 cents/unit of vitamin K content. Is this price competitive with the available foods in meeting this vitamin requirement?

(f) (3%) A delicious new food containing 3, 2 units of vitamins A, K respectively per unit has become available at a price of 28 cents/unit. How much is the urge to include at least 1 unit of this in the daily diet going to cost, over a minimum cost diet?

2. (10%) Construct a system of constraints including binary variables if necessary whose feasible region is $\{(x_1, x_2) : 5 \le x_1 \le 10, 5 \le x_2 \le 10\}$.

3. (15%) Four customers are bidding for four valuable paintings. Customer 2 is willing to buy two paintings, but each other customer is willing to purchase at most one painting. The prices that each customer is willing to pay are given in the following table. Determine how to maximize the total revenue received from the sale of the paintings by the Hungarian method.

Customer	Bid for ($)			
	Painting 1	Painting 2	Painting 3	Painting 4
1	8	11	—	—
2	9	13	12	7
3	9	—	11	—
4	—	—	12	9

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4. (20%) A display at a store has room for 2 items. At the beginning of each day, a clerk checks how many items are left. If there are zero items, he puts two more out, otherwise he does nothing. Also, the daily demand for this item is given by D, where Pr{D = 0} = .4, Pr{D = 1} = .3, Pr{D = 2} = .2, Pr{D = 3} = .1. (Demand exceeding the items available is considered lost sales.) Let X_n be the number of items on the shelf at the end of the n^{th} day.
   (a) (10%) Give the transition matrix for the Markov chain { X_n }.
   (b) (10%) In steady state, give the average number of lost sales daily.

5. (30%) A laundromat has 5 washing machines. A typical machine breaks down once every 5 days. A repairer can repair a machine in an average of 2.5 days. Currently, three repairers are on duty. The owner of the laundromat has the option of replacing them with a super worker, who can repair a machine in an average of 5/6 day. The salary of the super worker equals the pay of the three regular employees. Breakdown and service times are exponential. Should the laundromat replace the three repairers with the super workers?