國立台灣科技大學九十七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 100 分

1. NTUST manufactures 3 types of candy bar. Each candy bar consists totally of sugar and chocolate. 50 oz. sugar and 100 oz. of chocolate are available. Let x_i be the number of Type i candy bars manufactured.

   Maximize　　　$Z = \$3x_1 + \$7x_2 + \$5x_3,$　　　(Profit)

   subject to　　　$x_1 + \ x_2 + \ x_3 \le 50$　(Sugar constraint)

   　　　　　　　$2x_1 + \ 3x_2 + \ x_3 \le 100$　(Chocolate constraint)

   　　　　　　　$x_1 \ge 0,$　　$x_2 \ge 0,$　　$x_3 \ge 0.$

   Let x_4 and x_5 denote the slack variables for the respective functional constraints. After we apply the simplex method, the final simplex tableau is

Basic Variable	Eq.	Z	x_1	x_2	x_3	x_4	x_5	Right Side
Z	(0)	1	3	0	0	4	1	300
x_3	(1)	0	0.5	0	1	1.5	-0.5	25
x_2	(2)	0	0.5	1	0	-0.5	0.5	25

   Coefficient of: (spanning x_1 through x_5)

   (a) For what values of Type **1** candy bar profit does the current basis (x_2=25, x_3=25) remain optimal? (6 pts)

   (b) For what values of Type **2** candy bar profit does the current basis remain optimal? (6 pts)

   (c) For what amount of available **sugar** would the current basis remain optimal? (6pts)

   (d) Suppose a Type 1 candy bar used only 0.5 oz. of sugar and 0.5 oz. of chocolate. Should NTUST now make Type 1 candy bars? (6 pts)

   (e) NTUST is considering making Type 4 candy bars. A Type 4 candy bar earns $17, and requires 3 oz. of sugar and 4 oz. of chocolate. Should NTUST manufacture any Type 4 candy bars? (6 pts)

2. It costs $40 to buy a telephone from the department store. Assume that I can keep a telephone for at most five years and that the estimated maintenance cost each year of operation is as follows: year 1, $20; year 2, $30; year 3, $40; year 4, $60; year 5, $70. I have just purchased a new telephone. Assuming that a telephone has no salvage value, determine how to minimize the total cost of purchasing and operating a telephone for the next six years. (20 pts)

3. An average of 10 cars per hour arrives at a single-server drive-in teller. Assume the average service time for each customer is 4 minutes, and both interarrival times and service times are exponential.

   (a) What is the probability that the teller is idle (10 pts)?

   (b) On the average, how many customers per hour will be served by the teller (15 pts)?

4. Customers buy computers from three companies. Given the company from which a customer last bought a computer, the probability that he/she will buy next computer from each company is as follows:

<div align="center">

Will buy next from

</div>

Last bought from	Co. 1	Co. 2	Co. 3
Co. 1	.80	.10	.10
Co. 2	.05	.85	.10
Co. 3	.10	.20	.70

(a) If someone currently owns a company 1 computer, what is the probability that at least one of the next two computers he/she buys will be a company 1 computer (15 pts)?

(b) At present, it costs company 1 an average of $500 to produce a computer, and the average price a customer pays for a company 1 computer is $800. Company 1 is considering instituting a three-year warranty. It is estimated that this will increase the cost per computer by $30, but a market research survey indicates that the probabilities will change as follows:

<div align="center">

Will buy next from

</div>

Last bought from	Co. 1	Co. 2	Co. 3
Co. 1	.85	.10	.05
Co. 2	.10	.80	.10
Co. 3	.15	.10	.75

Should company 1 institute the three-year warranty (10 pts)?