

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 $x_1 + x_2 + x_3 \leq 50$ (Sugar constraint) $2x_1 + 3x_2 + x_3 \leq 100$ (Chocolate constraint) $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

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. | Coefficient of: | | | | | Right Side |
|----------------|-----|-----------------|-------|-------|-------|-------|------------|
| | | Z | x_1 | x_2 | x_3 | x_4 | |
| Z | (0) | 1 | 3 | 0 | 0 | 4 | 300 |
| x_3 | (1) | 0 | 0.5 | 0 | 1 | 1.5 | 25 |
| x_2 | (2) | 0 | 0.5 | 1 | 0 | -0.5 | 25 |

- (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)?

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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:

| Last bought from | Will buy next 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:

| Last bought from | Will buy next 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)?