國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：工業管理系碩士班　　組別：甲組　　科目：作業研究

1. Customers buy cars from three auto companies, A, B and C. Given the company of the car a customer currently owns, the probability that he (or she) will buy next car from each company is as follows:

		Will buy next from		
		Co. A	Co. B	Co. C
Currently owns	Co. A	0.80	0.10	0.10
	Co. B	0.05	0.85	0.10
	Co. C	0.10	0.20	0.70

(a) If someone currently owns a company A car, what is the probability that at least one of his (or her) next two cars will be a company A car (5%)?

(b) At present, it costs company A an average of $5,000 to produce a car, and the average price a customer pays for a company A car is $8,000. Company A is considering instituting a five-year warranty. It is estimated that this will increase the cost per car by $300, but a market survey indicates that the probabilities will change as follows:

		Will buy next from		
		Co. A	Co. B	Co. C
Currently owns	Co. A	0.85	0.10	0.05
	Co. B	0.10	0.80	0.10
	Co. C	0.15	0.10	0.75

If the average price of a car remains at $5,000, should company A institute the five-year warranty (20%)?

2. The Production Control Department of a company has two phone lines. An average of 30 people per hour try to call the Production Control Department, and the average length of a phone call is 1 minute. If a person attempts to call when both lines are busy, he or she hangs up and is lost to the system. Assume that the time between people attempting to call and service times are exponential.

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(a) What fraction of time will both lines be free? What fraction of time will both lines be busy (10%)?

(b) On the average, how many lines will be busy (8%)?

(c) On the average, how many callers will hang up each hour (7%)?

3. Consider the following linear programming problem and its optimal tableau:

$$\text{Maximize } z = c_1x_1 + c_2x_2$$

$$\text{Subject to } a_{11}x_1 + a_{12}x_2 \le b_1$$

$$a_{21}x_1 + a_{22}x_2 \le b_2$$

$$x_1, x_2 \ge 0$$

Basis	x_1	x_2	s_1	s_2	RHS
x_1	1	0	3	2	5/2
x_2	0	1	1	1	1
$\bar{c}_j$	0	0	−2	−3	5/2

Determine the values of c_1, c_2, b_1, b_2, a_{11}, a_{12}, a_{21}, and a_{22} (25%)

4. Consider the following primal linear programming problem:

$$\text{Maximize } z = x_1 + 2x_2 + x_3$$

$$\text{Subject to } x_1 + x_2 - x_3 \le 2$$

$$x_1 - x_2 + x_3 = 1$$

$$2x_1 + x_2 + x_3 \ge 3$$

$$x_1 \ge 0, x_2 \le 0$$

(a) Write the dual of the above problem (15%).

(b) Prove using the duality theory that the maximum value z for the primal problem cannot exceed 1 (10%).