國立成功大學 106 學年度碩士班招生考試試題

系　　所：工業與資訊管理學系

考試科目：作業研究

考試日期：0214，節次：2

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

I. Formulation and analyses

1. How do you detect infeasibility, unboundedness, and multiple solutions in the simplex method? Give your reasons. (20%)

2. A company has m plants to manufacture a type of product for its n stores to sell. The ith plant, i=1,…, m, can manufacture an amount of at most a_i each month, and the jth store, j=1,…, n, needs an amount of at least b_j each month. The unit shipping cost from plant i to store j is c_{ij}. Formulate the problem of shipping the product manufactured by the m plants to the n stores (as a linear program) that will minimize the total shipping cost. Also formulate the dual of this linear program. (15%)

3. You have a budget of B to buy n commodities. Your utility of consuming x_i quantity of commodity i is $U(x_1, x_2,\ldots, x_n)$, which is assumed to be a concave function. Suppose the unit price of commodity i is p_i. How would you allocate the budget to the n commodities so that your utility will be maximized? You need to formulate the problem first; then derive the solution. (15%)

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II.1 (15%) Suppose X has a binomial distribution with parameters p and N, where N has a Poisson distribution with mean λ, derive the marginal distribution for X.

II.2 (15%) You are given the following payoff table (in units of thousands of dollars) for the production planning of two types of rice in a decision analysis problem.

	State of Nature (Rain fall in the year)		
Rice type	Above average S_1	Average S_2	Below Average S_3
R_1	220 tons)	170	110
R_2	200	180	150
Prior probability	0.6	0.3	0.1

a. Which alternative should be chosen under the Maximin payoff criterion?

b. Which alternative should be chosen under the Bayes' decision rule?

c. Using Bayes' decision rule, if the true probability of the state of nature S_3 is 0.1, perform sensitivity analysis with respect to the prior probabilities of states S_1 and S_2 to determine the crossover point where the decision shifts from one alternative to the other.

II.3 (20%) A production process changes states in accordance with the following transitional probability matrix in a Markov chain:

$$P = \begin{array}{c|cccc} 1 & 0.9 & 0.1 & 0 & 0 \\ 2 & 0 & 0.8 & 0.1 & 0.1 \\ 3 & 0 & 0 & 0.7 & 0.3 \\ 4 & 0.9 & 0 & 0 & 0.1 \end{array}$$

Where States 1, 2, 3 denote the acceptable states (up) and state 4 denotes the unacceptable one (down). Determine

a. The rate of breakdown (the rate at which the process goes from up to down)

b. The expected length of time the process remains up when it goes up.

c. The expected length of time the process remains down when it goes down.