國立臺灣科技大學 104 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

(總分為 100 分)

1. Consider the problem of locating a new machine to an existing layout consisting of five machines. These machines are located at the following x_1 and x_2 coordinates: $(3,-1),(-2,-3),(-3,4),(4,-6)$ and $(2,5)$. Let the coordinates of the new machine be (x_1,x_2). Formulate a linear program to minimize the sum of the street distances from the new machine to the five existing machines. **(20%)**

   [Hint: Street distance from (x_1,x_2) to the machine located at $(2,5)$ is $|x_1-2|+|x_2-5|$.]

2. An RRT (round robin tournament) is being held between 10 football teams. Each team plays every other team exactly 6 times and every play ends with one of the two participating teams as the winner and the other the loser. We are given a vector $\alpha=(\alpha_1,\alpha_2,\ldots,\alpha_{10})$ of nonnegative integers with the claim that $\alpha_i=$ total number of wins in the RRT for team *i*, for *i* = 1, 2, …, 10. It is required to check whether this claim can be correct.
   a) Formulate a network flow model for checking it. **(20%)**
   b) Given $\alpha=(20,12,31,38,35,13,32,40,10,39)$, use the model developed in part (a) to check whether the claim is correct. **(10%)**

3. Consider a Markov chain with states 0, 1, 2, 3, 4. Suppose $P_{0,4}=1$; and suppose that when the chain is in state *i*, $i>0$, the next state is equally likely to be any of the states 0, 1, …, $i-1$. Find the limiting probabilities of this Markov chain. **(15 %)**

4. Potential customers arrive at a single-server station in accordance with a Poisson process with rate λ. However, if the arrival finds *n* customers already in the station, then she/he will enter the system with probability α_n. Assuming an exponential service rate μ, set this up as a birth and death process and determine the birth and death rate. **(15 %)**

5. For the M/M/1 queue (let the arrival rate be λ, and service rate be μ), compute
   a) the expected number of arrivals during a service period. **(10 %)**
   b) the probability that no customers arriving during a service period. **(10 %)**