國立臺灣科技大學 107 學年度碩士班招生試題

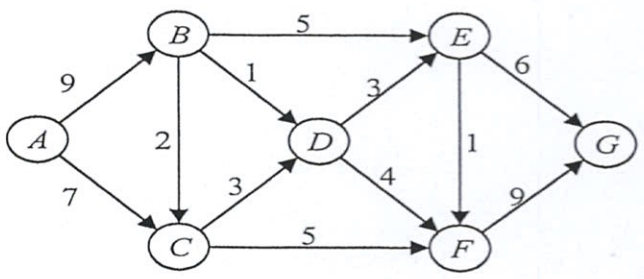
系所組別：工業管理系碩士班甲組

科　　目：作業研究

(總分為 100 分)

1. A company has an inventory of one hundred and twenty 20-meter rods, one hundred and sixty 15-meter rods, and forty 8-meter rods. The rods can be cut to generate rods of desired lengths. The company can purchase additional rods of desired lengths from their supplier to satisfy customers' demand. Their customers demand two hundred 10-meter rods, and two hundred and fifty 6-meter rods. Each cut costs 30 dollars, while buying the rods from the supplier costs 50 dollars and 25 dollars, respectively, for the 10-meter and 6-meter rods. Formulate an integer linear programming model to determine the minimum cost cutting and purchasing plan to satisfy all the demand. **(20%)**

2. Consider the maximum flow problem shown below, where the source is node *A*, the sink is node *G*, and the arc capacities are the numbers shown next to these directed arcs. **(30%)**



(1) Suppose that node capacities of node *D*, node *E*, and node *F* are 3, 6 and 8 respectively. Formulate the resulting new maximum flow problem as a minimum cost flow problem by drawing a network diagram. **(15%)**

(2) Solve the minimum cost flow problem obtained in part (1) by the network simplex method. What is the solution to the new maximum flow problem obtained in part (1)? **(15%)**

3. On a sunny day, NTUST Golf can gross $2,000 in revenues. If the day is cloudy, revenues drop by 20%. A rainy day will reduce revenues by 80%. If today's weather is sunny, there is an 80% chance it will remain sunny tomorrow with no chance of rain. If it is cloudy, there is a 20% chance that tomorrow will be rainy and 30% chance it will be sunny. Rain will continue through the next day with a probability of 0.8, but there is a 10% chance it may be sunny.

(1) Determine the expected daily revenues for NTUST Golf. **(10%)**

(2) Determine the average number of days the weather will not be sunny. **(10%)**

4. In the M/M/1, give a plausible argument as to why *L* (the average number of customers in the system) does not equal to *Lq* + 1 (the average number of customers in the queue + 1), in general. Under what condition will the equality hold? **(10%)**

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5. For a computer to work properly, three subsystems of the computer must all function properly. To increase the reliability of the computer, spare units may be added to each subsystem. It costs \$100 to add a spare unit to system 1, \$300 to system 2, and \$200 to system 3. As a function of the number of added spares (a maximum of two spares may be added to each system), the probability that each system will work is given below. Use dynamic programming to maximize the probability that the computer will work properly, given \$600 is available for spare units. **(20%)**

Number of spares	Probability that a system works		
	System 1	System 2	System 3
0	.85	.60	.70
1	.90	.85	.90
2	.95	.95	.98