

考生作答須知：

一、本試卷總共五大題，每題配分標示於題後，總分一百分。

二、請於答案卷上依題號次序作答，題號務必標示清楚，並書寫計算過程，否則不予計分。

1. CCUBA, the owner of a newsstand, wants to determine the number of The Liberty Times newspapers that must be stocked at the start of each day. It costs \$4 to buy a copy, and the CCUBA sells it for \$10. The sale of the newspaper typically occurs between 6:00 and 7:00 a.m. The demand occurs instantaneously at the start of the period immediately after the order is received, and no setup cost is incurred. The demand for the period can be approximated by an exponential distribution with a mean of 50 copies. Newspapers left at the end of the day are recycled for an income of \$1 per copy. Analyze the following questions based on inventory theory.

(1) Develop the associated cost model for finding the optimal order quantity such that the expected cost for the period is minimized. Note that each decision variable and parameter should be defined clearly. (15 %)

(2) How many copies should CCUBA stock every morning? (10 %)

2. Customers arrive at a single-server facility at a Poisson rate of 40 per hour. When three or fewer customers are present, the service time for each customer is exponentially distributed with an expected value of two minutes. However, when there are four or more customers at the facility, the server will speed up for reducing the expected service time to one minute. The system capacity is six customers. Analyze the following questions based on queueing theory.

(1) Construct the corresponding state transition diagram and develop the balance equations. (10 %)

(2) Derive the proportion of time that the server is free. (5 %.)

(3) Determine the expected number of customers in the queue. (10 %)

考生作答須知：

一、本試卷總共五大題，每題配分標示於題後，總分一百分。

二、請於答案卷上依題號次序作答，題號務必標示清楚，並書寫計算過程，否則不予計分。

3. Consider a storage system of 1500 identical bins, which is used to store 4 types of items. Due to management consideration, items stored in a bin must be of the same type. The number of units of item type 1, 2, 3, and 4 that can be stored in a bin is 100, 200, 150, and 120 respectively. The items are retrieved from the storage system in groups, in which a group contains 12, 15, 20, and 10 units of item type 1, 2, 3, and 4 respectively. The objective is to determine how to allocate the bins to store each type of items so that the total number of groups that can be retrieved from the storage system is maximized. Formulate the above problem as an integer linear programming model. (10%)

Note: Be sure to clearly define the decision variables.

4. Consider the following linear programming problem(25%):

$$\begin{aligned} \text{Maximize} \quad & Z = x_1 + ax_2 \\ \text{Subject to} \quad & x_1 + 2x_2 \leq 120 \\ & 2x_1 + x_2 \leq 120 \\ & x_1 + x_2 \leq 75 \\ & x_1 \geq 0, x_2 \geq 0. \end{aligned}$$

Assume the **unique** optimal solution is given by $(x_1, x_2) = (30, 45)$.

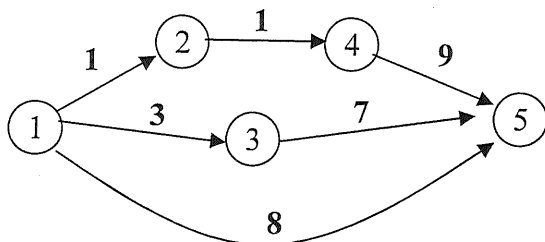
(1) Use graphical method to identify all the feasible extreme points (i.e. basic feasible solutions). (5%)

(2) What is the possible value of a ? (10%)

(3) What is the sequence of extreme points is if the simplex method is used to solve the problem. (10%)

Note: Be sure to show your work.

5. Use Dijkstra's algorithm to find the shortest path from node 1 to node 5 for the following network: (15%)



Note: Be sure to clearly show the solution procedure.