***Assignment-3***

***Quantitative Methods***

***(STAT-201)***

***Student’s Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

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***Branch:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***Note: All the questions are to be attempted.***

***Section-I***

***State whether the following statements are True or False. (1×6=6)***

1. A balanced transportation problem is one in which total demand (from all destinations) is exactly equal to total supply (from all sources). True
2. In a transportation problem, a single source may supply something to all destinations. True
3. The objective of a transportation problem solution is to schedule shipments from sources to destinations while minimizing total transportation and production costs. True
4. The objective of the simple EOQ model is to maximize ordering and carrying costs. False
5. In an inventory management problem if the lead-time is 10 days and daily demand is 30 per day then re-order point is 100. False
6. The Economic order quantity (EOQ) is not one of the oldest and most commonly known inventory control techniques. False

**Section-II**

***Circle/tick the right answer from the answers given below. (1×6=6)***

1. Linear programming can be used to select effective media mixes, allocate fixed or limited budgets across media, and

A) Quantity discount model.

B) budget Safety stock model.

C) minimize audience exposure.

D) maximize audience exposure

1. What is the total transportation cost for the given data in Table below?



A) 50

B) 30

C) 80

D) 40

1. Consider the material structure tree for item A below. If 20 units of A are needed, how many units of E are needed?



A) 200

B) 160

C) 100

D) 180

1. Extra inventory that is used to avoid stockouts is known as

A) Quantity discount.

B) Safety stock.

C) Service level.

D) ABC Analysis.

1. If the annual demand is 1,000 units, the ordering cost is $10 per order, and the average carrying cost per unit per year is $0.50. Then the EOQ is

A) 100

B) 200

C) 60

D) 120

1. The "point at which to reorder" depends directly on which of the following?

A) EOQ

B) Ordering cost

**C) Lead-time**

D) Storage costs

**Section-III**

**Answer the following Essay Type Questions. (Total mark =18)**

1. The West Valve sells industrial valves and fluid control devices. One of the most popular valves is the Western, which has an annual demand of 4,000 units. The cost of each valve is $90, and the inventory carrying cost is 10% of the cost of each valve. The average ordering cost is $25 per order. Furthermore, it takes about two weeks for an order to arrive and during this time, the demand per week is approximately 80. (6 marks)
   1. What is the EOQ?
   2. What is the ROP?
   3. What is the average inventory?
   4. What is the annual holding cost?
   5. How many orders is placed per year?
   6. What is the annual ordering cost?

Solution:

D = 4,000 units

1. =
2. ROP = (2 weeks) × (80 per week) = 160
3. Average inventory= *Q*/ 2 =149/2 =74.5 units
4. Total holding cost = 74.5(9) = $670.50 per year
5. Number of orders per year *D/Q=* 4,000/149=26.85
6. Total ordering cost = 26.85($25) = $671.25 per year
7. A Computer Company sells a desktop computer that is popular among gaming enthusiasts. In the past few months, demand has been relatively consistent, although it does fluctuate from day to day. The company orders the computer cases from a supplier. It places an order for 5,000 cases at the appropriate time to avoid stockouts. The demand during lead-time is normally distributed with a mean of 1,000 units and a standard deviation of 200 units. The holding cost per unit per year is estimated to be $4.
8. How much safety stock should the company carry to maintain a 96% service level? (Using the table for the normal distribution, the Z value for a 96% service level is about 1.75)
9. What is the reorder point?
10. What would the total annual holding cost be if this policy is followed?

(3 marks)

Solution

1. Using the table for the normal distribution, the Z value for a 96% service level is about 1.75. The standard deviation is 200. The safety stock is calculated as
2. For a normal distribution with a mean of 1,000, the reorder point is

ROP=(Average demand during lead time)+=1000+350=1,350 units

1. The total annual holding cost is
2. Winkler Furniture manufactures two different types of china cabinets: a French provincial model and a Danish Modern model. Each cabinet produced must go through three departments: carpentry, painting, and finishing. The table below contains all relevant information concerning production times per cabinet produced and production capacities for each operation per day, along with net revenue per unit produced. The firm has a contract with an Indiana distributor to produce a minimum of 300 of each cabinet per week (or 60 cabinets per day). Owner Bob Winkler would like to determine a product mix to maximize his daily revenue.

Formulate as an LP problem and obtain the revenue

(3 marks)



Solution:

Since the decision centers about the production of the two different cabinet models, we let

*X*1 = number of French provincial cabinets produced each day

*X*2 = number of Danish Modern cabinets produced each day

Objective: maximize revenue = $28*X*1 + $25*X*2

subject to

3*X*1 + 2*X*2 ≤ 360 hours (carpentry department)

*1 ½ X*1 + 1*X*2 ≤ 200 hours (painting department)

*¾ X*1 + ¾ *X*2 ≤ 125 hours (finishing department)

*X*1 ≥ 60 units (contract requirement)

*X*2 ≥ 60 units (contract requirement)

*X*1, *X*2 ≥ 0

By solving 60 French provincial cabinets (*X*1) per day is produced and 90 Danish Modern cabinets (*X*2) per day is produced.

Revenue =$28*X*1 + $25*X*2  =$28(60)+ $25(90)=$3,930

1. The three blood banks in Franklin County are coordinated through a central office that facilitates blood delivery to four hospitals in the region. The cost to ship a standard container of blood from each bank to each hospital is shown in the table below. Also given are the biweekly number of containers available at each bank and the biweekly number of containers of blood needed at each hospital.
2. How many shipments should be made biweekly from each blood bank to each hospital so that total shipment costs are minimized? (Solve using north west corner method ) (3marks)
3. Formulate the Franklin County Blood Bank situation as a linear program problem (3marks)



Solution:



Cost = 50($8) + 70($7) + 10($5) + 40($14) + 30($6) + 50($7)

= $2,030

1. Let B1H1, B1H2, B1H3, B1H4, B2H1, B2H2, B2H3, B2H4, B3H1, B3H2, B3H3, and B3H4 represent the containers of blood shipped from blood banks 1, 2, and 3 to hospitals 1, 2, 3, and 4 respectively. :

Minimize costs: 8B1H1 + 9B1H2 +11B1H3 + 16B1H4 +12B2H1 + 7B2H2 + 5B2H3 + 8B2H4 + 14B3H1 + 10B3H2 + 6B3H3 + 7B3H4

subject to:

B1H1 + B2H1 + B3H1 = 90

B1H2 + B2H2 + B3H2 = 70

B1H3 + B2H3 + B3H3 = 40

B1H4 + B2H4 + B3H4 = 50

B1H1 + B1H2 + B1H3 + B1H4 < 50

B2H1 + B2H2 + B2H3 + B2H4 < 80

B3H1 + B3H2 + B3H3 + B3H4 < 120

{All variables} ≥ 0