

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
SBA2102

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF STATISTICS AND OPERATIONS RESEARCH

SBA2102: INVENTORY CONTROL AND MANAGEMENT

DECEMBER 2024 EXAMINATION

Time : 3 hours

Candidates should attempt **ALL** questions from Section A and **ANY THREE** questions from Section B. Each question should start on a fresh page.

SECTION A: Answer all questions in this section (40 marks).

A1. Define the following terms

- (a) Inventory control, [2]
- (b) Inventory management. [2]

A2. Define the terms as used in inventory control and management:

- (a) In-process inventory [2]
- (b) Safety stock inventory [2]
- (c) Economic order quantity [2]
- (d) Annual demand [2]
- (e) Seasonal inventory [2]

A3. Given the following cost parameters for inventory management:

- D : Annual demand (units per year)
- C : Cost per unit
- C_o : Ordering cost per order
- C_h : Holding cost per unit per year

Use calculus to determine the Economic Order Quantity (EOQ), Q^* , that minimizes the total inventory cost. [10]

A4. Which type of inventory system would you use in the following situations?

- (a) Supplying your kitchen with fresh food. [2]
- (b) Obtaining a daily newspaper. [2]
- (c) Buying fuel for your car. [2]

A5. (a) State only 3 assumptions of a basic Economic order quantity (EOQ) model. [3]

(b) The demand for a product is 600 units per week, and the items are withdrawn at a constant rate. The setup cost for placing an order to replenish inventory is \$25. The unit cost of each item is \$3, and the inventory holding cost is \$0.05 per item per week.

- (i) Assuming shortages are not allowed, determine how often to order and what size the order should be. [4]
- (ii) If shortages are allowed but cost \$2 per item per week, determine how often to order and what size the order should be. [3]

SECTION B: Answer any three questions in this section (60 marks).

- B6.** Itel is a manufacturer of personal handsets. All its personal handsets use a 1.5-inch high-density disk drive which it purchases from Toshiba. Itel operates its factory 52 weeks per year, which requires assembling 100 of these disk drives into handsets per week. Itel's annual holding cost rate is 20 percent of the value (based on purchase cost) of the inventory. Regardless of order size, the administrative cost of placing an order with Toshiba has been estimated to be \$50. A quantity discount is offered by Toshiba for large orders as shown below, where the price for each category applies to every disk drive purchased

Table 1: Discounting options

Discount category	Quantity purchased	Price(per disk drive)
1	1 to 99	\$100
2	100 to 499	\$95
3	500 or more	\$90

- (a) Determine the optimal order quantity according to the EOQ model with quantity discounts. What is the resulting total cost per year? [15]
- (b) With this order quantity, how many orders need to be placed per year? What is the time interval between orders? [5]
- B7.** (a) State and briefly explain the four common approaches to batching or lot sizing. [8]
- (b) An MRP schedule gives the following pattern of demand for an item. If the reorder cost is \$150 and the holding cost is \$2 a week, find the costs of different batching policies over the 10 weeks. [12]

Table 2: Pattern of weekly demand

Week	1	2	3	4	5	6	7	8	9	10
Demand	20	10	20	25	0	15	10	20	0	30

- B8. The master schedule of Treger is designed to meet demands of 90 units of a electric jugs in week 7 of a cycle, 120 units in week 8 and 80 units in week 11. They currently have 20 units of the product in stock, but the company always keeps 10 units in reserve to cover emergency orders. Each unit of the product takes two weeks to assemble from 2 units of component B and 3 units of component C. Each unit of component B is made in one week from 1 unit of part D and three units of part E. Component C is assembled in 2 weeks from two units of material F. Lead times for D, E and F are 1, 2 and 3 weeks respectively. Current stocks are 100 units of B, 200 of C, 80 of D, 720 of E and 200 of F. Treger keep minimum stocks of 40 units of D, 200 of E and 100 of F. The minimum order size for E is 600 units, while F can only be ordered in discrete batches of 200 units. Outstanding orders for 20 units of D will arrive in week 4, 600 units of E will arrive in week 5, 400 units of F will arrive in week 4, and 40 units of C will arrive in week 6. Design a timetable of activities for the company. [20]
- B9. Rugare, the owner and manager of the Masters Hardware Store, is reassessing his inventory policy for drilling machines. He sells an average of 50 drilling machines per month, so he has been placing an order to purchase 50 drilling machines from a wholesaler at a cost of \$20 per drilling machines at the end of each month. However, Steve does all the ordering for the store himself and finds that this is taking a great deal of his time. He estimates that the value of his time spent in placing each order for drilling machines is \$75.
- What would the unit holding cost for drilling machines need to be for Steves current inventory policy to be optimal according to the basic EOQ model? What is this unit holding cost as a percentage of the unit acquisition cost? [5]
 - What is the optimal order quantity if the unit holding cost actually is 20 percent of the unit acquisition cost? What is the corresponding value of TVC (total variable inventory cost) per year (holding costs plus the administrative costs for placing orders)? What is TVC for the current inventory policy? [5]
 - If the wholesaler typically delivers an order of drilling machines in 5 working days (out of 25 working days in an average month), what should the reorder point be (according to the basic EOQ model)? [5]
 - Steve does not like to incur inventory shortages of important items. Therefore, he has decided to add a safety stock of 5 drilling machines to safeguard against late deliveries and larger-than usual sales. What is his new reorder point? How much does this safety stock add to TVC? [5]

END OF QUESTION PAPER