

(6 pages)

MAY 2015

P/ID 4519/XDG

Time : Three hours

Maximum : 100 marks

SECTION A — (4 × 20 = 80 marks)

Answer ALL questions.

1. (a) Solve the following integer programming problem.

$$\text{Maximize } z = 5x_1 + 4x_2$$

Subject to

$$x_1 + x_2 \leq 5$$

$$10x_1 + 6x_2 \leq 45$$

$$x_1, x_2 \geq 0 \text{ and integers.}$$

Or

- (b) Solve the following linear programming problem by dynamic programming.

$$\text{Maximize } z = 2x_1 + 5x_2$$

Subject to

$$2x_1 + x_2 \leq 430$$

$$x_2 \leq 230$$

$$x_1, x_2 \geq 0.$$

2. (a) Solve the following problem by Lagrangian method.

$$\text{Maximize } z = x_1^2 + x_2^2 + x_3^2$$

subject to

$$4x_1 + x_2^2 + 2x_3 - 14 = 0.$$

Or

- (b) Solve the problem by quadratic programming technique.

$$\text{Maximize } z = 6x_1 + 3x_2 - 4x_1x_2 - 2x_1^2 - 3x_2^2$$

subject to

$$x_1 + x_2 \leq 1$$

$$2x_1 + 3x_2 \leq 4$$

$$x_1, x_2 \geq 0.$$

3. (a) (i) Derive the EOQ for the multi item model with storage limitations.
- (ii) Lube cars specializes in fast automobile oil change. The garage buys car oil in bulk at \$ 3 per gallon. A price discount

of \$ 2.50 per gallon is available if Lube car purchases more than 1000 gallons. The garage services approximately 1500 cars per day and each oil change requires 1.25 gallons. Lube cars stores bulk oil at the cost of \$ 0.02 per gallon per day. Also, the cost of placing an order for bulk oil is \$ 20. There is a 2-day lead time for delivery. Determine the optimal inventory policy.

Or

- (b) The daily demand for an item during a single period occurs instantaneously at the start of the period. The pdf of the demand is uniform between 0 and 10 units. The unit holding cost of the item during the period is \$ 0.50 and the unit penalty cost for running out of stock is \$ 4.50. The unit purchase cost is \$ 50. A fixed cost of \$ 25 is incurred each time an order is placed. Determine the optimal inventory policy for the item.

4. (a) (i) For the $(M/M/1) (GD/N/\infty)$ queueing model, determine p_n and L_q .
- (ii) For the $(M/M/c) (GD/N/\infty)$, $c \leq N$ queueing model, determine p_n , p_0 and L_q .

Or

- (b) A product arrives according to a Poisson distribution at the rate of one every 45 minutes. The product requires two tandem operations attended by one worker. The first operation uses a semi automatic machine that completes its cycle in exactly 28 minutes. The second operation makes adjustments and minor changes and its time depends on the condition of the product when it leaves operation 1. Specifically, the time of operation 2 is uniform between 3 and 6 minutes. Because each operation requires the complete attention of the worker, a new item cannot be loaded on the semi automatic machine until the current item has cleared operation 2.
- (i) Determine the number of items that are awaiting processing on the semiautomatic machine.
- (ii) What is the percentage of time the worker will be idle?
- (iii) How much time is needed, on the average, for an arriving item to clear operation 2?

SECTION B — (10 × 2 = 20 marks)

Answer any TEN questions.

5. What are the requirements of zero-one implicit enumeration algorithm?
6. Define fractional cut.
7. Define the curse of dimensionality.
8. Define the principle of optimality.
9. Define stationary point.
10. Define bordered Hessian matrix.
11. Write the normality conditions in geometric programming.
12. Define purchase cost
13. Define holding cost.
14. Define lead time.
15. Define shortage cost.

16. State planning horizon theorem.
 17. Define jockeying.
 18. Define time horizon.
 19. What are the service disciplines?
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