Avinashilingam Institute for Home Science and Higher Education for Women,
(Deemed to be University), Coimbatore – 641 043

Master's Degree Examination – November 2018

Semester I

Class : I PG

Major: Mathematics

Time : 3 hrs

Max. Marks: 60

17MMAC04 Optimization Techniques

Part A

Circle the correct Answer. **10 x ½ = 5 marks**

1. The cost of maintaining inventory in stock is known as _____ cost

   a) setup b) holding c) shortage d) purchase

2. In classic EOQ models, the reorder point occurs when the inventory level drops to _____ units

   a) $L+D$ b) $L-D$ c) LD d) L/D

3. In Silver-Meal heuristic model, the unit production costs are _____

   a) constant b) identical c) constant or identical d) constant and identical

4. In no setup model, the unit holding cost is _____

   a) constant b) increasing c) decreasing d) increasing or decreasing

5. The size of the buffer in probabilistic EOQ model is determined such that the probability of running out of stock during lead time _____ a prespecified value

   a) exceeds b) does not exceed c) equals d) is less than

6. The setup cost per unit time in probabilistic EOQ model is _____

   a) $\frac{D}{y}$ b) $\frac{y}{D}$ c) $\frac{KD}{y}$ d) $\frac{D}{Ky}$

7. Given $\lambda = 4$ customers per hour and R = 0.9, the time period until the next arrival occurs is _____

   a) 0.577 minutes b) 0.557 minutes c) 35.4 minutes d) 34.5 minutes

8. The variance of a uniform (0, 1) random number R is _____

   a) $\frac{1}{12}$ b) $\frac{1}{2}$ c) 1 d) $\frac{1}{4}$

9. One of the sufficient conditions for a stationary point X_0 to be an extremum is that the Hessian matrix H is positive definite if X_0 is a _____ point

   a) maximum b) minimum c) maximum or minimum d) None of these

10. The bordered Hessian matrix H^B = _____

    a) $\begin{pmatrix} 0 & P^T \\ P & Q \end{pmatrix}$ b) $\begin{pmatrix} 0 & P \\ Q & P^T \end{pmatrix}$ c) $\begin{pmatrix} 0 & P \\ P^T & Q \end{pmatrix}$ d) $\begin{pmatrix} 0 & P \\ P^T & Q^T \end{pmatrix}$

Part B

Answer ALL questions. **5 X 4 = 20 marks**

Each question should not exceed 200 words or one page.

11.a) Write the steps to determine the optimum quantity y^* in EOQ with price breaks model.

(or)

b) List the steps to solve multi-item EOQ with storage limitation.

12. a) What are the general assumptions to be made in no-setup model?

(or)

b) Write the recursive formula to compute TC(i,t) in Silver-Meal Heuristic model.

13. a) Describe the three important elements of the cost function of a probabilistic inventory model with shortage.

(or)

b) In s-S Policy setup model, state three conditions to investigate how much should be ordered, given that the amount on hand before an order is placed is x units.

14. a) Discuss two types of simulation models.

(or)

b) Generate three random numbers based on the multiplicative congruential method using the initial values $b = 9$; $c = 5$; $u_0 = 11$ and $m = 12$.

15. a) State the necessary and sufficient conditions for X_0 to be an extremum point of a n-variable function $f(x)$.

(or)

b) State the Karush-Kuhn-Tucker necessary conditions for the maximization problem.

Part C

Answer ALL questions. **5 X 7 = 35 marks**

Each question should not exceed 600 words or three pages.

16.a) Neon lights are placed at the rate of 100 units per day. The physical plant orders the neon lights periodically. It costs Rs.100 to initiate a purchase order. A neon kept in storage is estimated to cost about 2 paise per day. The lead time between placing and receiving an order is 12 days. Determine the optimal inventory policy for ordering the neon lights.

(or)

b) Honda specializes in fast automobile oil change. The garage buys car oil in bulk at Rs.3 per gallon. A price discount of Rs.2.50 per gallon is available if Honda purchases more than 1000 gallons. The garage services approximately 150 cars per day, and each oil change requires 1.25 gallons. Honda stores bulk oil at the cost 2 paise per gallon per day. Also, the cost of placing an order for bulk oil is Rs.20. There is a 2-day lead time for delivery. Determine the optimal inventory policy.

17. a) A company produces draft deflectors for use in home fireplaces during the months of December to March. The demand starts slow, peaks in the middle of the season, and tapers off toward the end. Because of the popularity of the product, the company may use overtime to satisfy the demand. The following table provides the production capacities and the demands for the four winter months:

Month	Capacity		Demand (units)
	Regular (units)	Overtime (units)	
1	90	50	100
2	100	60	190
3	120	80	210
4	110	70	160

Unit production cost in any period is Rs.6 during regular time and Rs.9 during overtime. Holding cost per unit per month is Rs.10. Evaluate the optimum solution and the associated total cost when no shortages is allowed.

(or)

b) Find the optimal inventory policy for the following 6-period inventory situation, given that the unit production cost is Rs.2 for all the periods:

Period i	D_i units	K_i (in Rs.)	h_i (in Rs.)
1	10	20	1
2	15	17	1
3	7	10	1
4	20	18	3
5	13	5	1
6	25	50	1

18. a) In Question No. 16 (a), if the daily demand is normal with $N(100, 10)$, determine the buffer size so that the probability of running out of stock is below $\alpha = 0.05$.

(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 50 paise and the unit penalty cost for running out of stock is Rs.4.50. The unit purchase cost is 50 paise. A fixed cost of Rs.25 is incurred each time an order is placed. Calculate the optimal inventory policy for the item.

19. a) Estimate the area of the circle $(x-1)^2 + (y-2)^2 = 25$ using Monte Carlo technique.

(or)

b) Apply the acceptance-rejection method to the beta distribution $f(x) = 6x(1-x),\ 0 \le x \le 1$.

20. a) Minimize $f(x) = x_1^2 + x_2^2 + x_3^2$ subject to

$$g_1(x) = x_1 + x_2 + 3x_3 - 2 = 0$$
$$g_2(x) = 5x_1 + 2x_2 + x_3 - 5 = 0.$$

(or)

b) Maximize $z = -(2x_1 - 5)^2 - (2x_2 - 1)^2$ subject to

$$x_1 + 2x_2 \le 2$$
$$x_1, x_2 \ge 0.$$

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