TKN/KS/16/5978

Bachelor of Computer Application (B.C.A.) Part—II
Semester—IV (C.B.S.) Examination

OPERATIONS RESEARCH—II

Paper—IV

Time : Three Hours] [Maximum Marks : 50

Note :— (1) **ALL** questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

EITHER

1. (a) Define :

(i) Two person zero sum game.

(ii) Value of the game. 5

(b) Use graphical method to solve the following game and find the value of game :

	Player B			
Player A	B_1	B_2	B_3	B_4
A_1	2	2	3	–2
A_2	4	3	2	6

5

(ii) Average number of passengers waiting to be served. 5

OR

(c) What are the transient and steady states of the queuing systems ? Also explain Kendall's notation for representing queuing models. 5

(d) A television repairman finds that the time spent on his jobs has an exponential distribution with a mean of 30 minutes. If he repairs the sets in the order in which they came in, and if the arrival of the sets follows a Poisson distribution with an approximate average rate of 10 per 8-hour day, what is the repairman's expected idle time each day ? How many jobs are ahead of the average set just brought in ? 5

5. (a) Explain the following terms concerned with game theory :

(i) Saddle point

(ii) Payoff matrix. 2½

(b) An assembly is to be made from two parts X and Y. Both parts must be turned on a lathe. Y must be polished whereas X need not be polished. The sequence of activities, together with their predecessors, is given below :

Task	Time (in days)
A	8
B	9
C	7
D	10
E	11
F	9
G	10
H	8
I	7

5

(b) Discuss the role of Network construction. 5

OR

(c) Explain the following terms concerned with network techniques :

(i) Numbering the events

(ii) Activity. 5

(d) A small project is composed of 9 activities whose time estimates are listed in the following table :

Activities	Estimated duration in weeks		
	Optimistic	Most likely	Pessimistic
1—2	5	10	8
1—3	18	22	20

Activities	Estimated duration in weeks		
	Optimistic	Most likely	Pessimistic
1—4	26	40	33
2—5	16	20	18
2—6	15	25	20
3—6	6	12	9
4—7	7	12	10
5—7	7	9	8
6—7	3	5	4

Determine the following :

(i) The critical path

(ii) The earliest and latest expected completion times of each event. 5

EITHER

3. (a) What is inventory problem ? Explain the necessity of maintaining Inventory. 5

(b) A stockiest has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed to be infinite. The inventory holding cost is Rs. 0.20 per unit per month and the ordering cost per order is Rs. 350. Determine the optimal lot size, optimal scheduling period and minimum total variable yearly cost. 5

OR

(c) Explain the roles of different costs in modelling inventory problems. 5

(d) Find the optimal order quantity of a product for which the price breaks are as follows :

Quantity (Units)	Price per unit (Rs.)
$0 \leq Q_1 < 100$	20
$100 \leq Q_2 < 200$	18
$200 \leq Q_3$	16

The monthly demand for the product is 400 units. The storage cost is 20 % of the unit cost of the product and the cost of ordering is Rs. 25 per month. 5

EITHER

4. (a) Explain the following terms :

(i) Input process of queuing

(ii) Queue discipline. 5

(b) A railway booking office has 3 counters to receive request for reservation of tickets. On an average 48 persons arrive in an 8-hour day. Each reservation clerk spends 15 minutes on an average on an arrival. If the arrivals are Poissonally distributed and service times are according to exponential distribution, find :

(i) Average number of passengers in the system.

OR

(c) Solve the following game without saddle point and find strategies for Player A and Player B :

	Player B	
Player A	B_1	B_2
A_1	6	1
A_2	–3	2

5

(d) Obtain optimum strategies for player A and Player B. Also find the value of game for the following game by Dominance Principle :

	Player B			
Player A	B_1	B_2	B_3	B_4
A_1	1	2	3	–1
A_2	2	2	1	5
A_3	3	4	0	–2
A_4	4	3	2	6

5

EITHER

2. (a) Construct the network diagram and obtain the minimum time for completion of project for the following task :

A < B ; B, C < E ; D < E, F ; F < I ; G < H

Activity	Description	Predecessor Activity
A	Open work order	—
B	Get material for X	A
C	Get material for Y	A
D	Turn X on lathe	B
E	Turn Y on lathe	B, C
F	Polish Y	E
G	Assemble X and Y	D, F
H	Pack	G

Draw a network diagram of activities for the project. 2½

(c) Explain the following terms in Inventory :

(i) Lead time

(ii) Order cycle. 2½

(d) Draw and explain structure of a queuing system. 2½

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Bachelor of Computer Application (B.C.A) Semester–IV Examination

OPERATIONS RESEARCH–II

Paper–IV

Time : 3 Hours] [Maximum Marks : 50

N.B. :— (1) All questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

EITHER

1. (A) State the rules for determining a saddle point.

Write down the conditions for :

(i) A game is said to be fair

(ii) A game is strictly determinable. 5

(B) Solve the following game using dominance properties.

		Player B			
		I	**II**	**III**	**IV**
	I	3	2	4	0
Player A	**II**	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

5

OR

(C) Solve the following game graphically :

Player B

$$\textbf{Player A} \begin{bmatrix} 3 & -3 & 4 \\ -1 & 1 & -3 \end{bmatrix}$$

5

(D) Explain decision tree with suitable example. 5

EITHER

2. (A) Define :

(i) Event

(ii) Activity

(iii) Looping

(iv) Dangling 5

(B) Draw the network and find the project completion time for following data :

Activity	**Preceding Activities**	**Activity Duration (in days)**
A	—	4
B	—	7
C	—	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

5

OR

(C) Explain different time estimates made for each activity for PERT Network. Also write formula for standard deviation and variance. 5

(D) State the differences between CPM and PERT. 5

EITHER

3. (A) Define order cycle. Explain types of inventory review system. 5

(B) Find the optimum order quantity for a product for which the price break are as follows :

Quantity	**Unit cost (Rs.)**
$0 \leq Q1 < 500$	10.00
$500 \leq Q_2 < 750$	9.25
$750 \leq Q_3$	8.75

The monthly demand for the product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs. 350. 5

OR

(C) A contractor has to supply 12000 bearings per day to an automobile manufacturer. He finds that, when he starts a production run, he can produce 25000 bearings per day. The cost of holding a bearing in stock for one year is Rs. 2 and the set-up cost of production run is Rs. 1800. How frequently should production run can be made ? 5

(D) Derive an EOQ formula for deterministic inventory problems with no shortages. 5

EITHER

4. (A) Explain operating characteristics of queuing system. 5

(B) Customer arrive at a sales counter managed by a single person according to a Poisson process with a mean rate of 20 per hours. The time required to serve a customer has an exponential distribution with a mean of 100 seconds. Find the average waiting time of a customer. 5

OR

(C) A barber shop has two barbers and three chairs for waiting customers. Assume that customer arrive in a Poisson fashion at a rate of 5 per hour and that each barber services customers according to an exponential distribution with mean of 15 minutes. Further, if a customer arrives and there are no empty chain in the shops he will leave. Find the steady-state probabilities. What is the probability that the shop is empty ? What is the expected number of customers in the shop ? 5

(D) Explain Kendall's notation for representing queuing models with transient state and steady states of the system. 5

5. (A) Define :

(i) Two person zero sum game

(ii) Value of the game 2½

(B) Write down the rules for network construction. 2½

(C) Write a note on Economic Order Quantity. 2½

(D) Explain Queuing system with a suitable diagram. 2½

Bachelor of Computer Application (B.C.A.) Semester—IV (C.B.S.) Examination

OPERATIONS RESEARCH—II

Paper—IV

Time : Three Hours] [Maximum Marks : 50

Note :— (1) **All** questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagram wherever necessary.

EITHER

1. (a) Discuss the different types of criterion used for decision making under the condition of uncertainty. 5

(b) Obtain the optimum strategies for the following game by Dominance Principle : 5

Player B

		B_1	B_2	B_3	B_4
Player A	A_1	3	2	4	0
	A_2	3	4	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

OR

(c) Use the graphical method for solving the game and find the value of game : 5

Player B

		B_1	B_2	B_3	B_4
Player A	A_1	2	2	3	-2
	A_2	4	3	2	6

(d) What is Decision Tree Analysis ? Explain. 5

EITHER

2. (a) Define the following :

(i) Activity

(ii) Event

(iii) Dummy activity

(iv) Looping

(v) Dangling. 5

(b) Tasks A, B, C ...., H, I constitute a project and find the minimum time of completion of the project when time, in days, of each task is as follows :

Task	A	B	C	D	E	F	G	H	I
Time	8	10	8	10	16	17	18	14	9

The precedence relationships are A < D; A < E; B < F; D < F; C < G; C < H; F < I; G < I.

Draw a network to represent the project. 5

OR

(c) Explain time-cost trade off aspects in network technique with example. 5

(d) Following table gives the activities in a construction project and time duration :

Activity	Preceding Activity	Normal time
1–2	–	20
1–3	–	25
2–3	1–2	10
2–4	1–2	12
3–4	1–3, 2–3	5
4–5	2–4, 3–4	10

(i) Draw the Activity Network of the project.

(ii) Determine Project duration. 5

EITHER

3. (a) A manufacturing company purchases 9000 parts of a machine for its annual requirements ordering one month usage at a time. Each part costs Rs. 20. The ordering cost per order is Rs. 15. The carrying costs are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year ? 5

(b) Define the following :

(i) Set-up Cost

(ii) Ordering Cost

(iii) Shortage Cost

(iv) Holding Cost. 5

OR

(c) Derive EOQ formula for the manufacturing model without shortage. 5

(d) Find the optimum order quantity for a product for which price breaks are as follows :

Quantity	Unit Cost (Rs.)
$0 \leq Q_1 < 500$	10.00
$500 \leq Q_2 < 750$	9.25
$750 \leq Q_3$	8.75

The monthly demand for the product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs. 350. 5

EITHER

4. (a) At a certain health care centre, patients arrive at a mean rate of 4 per hour and they are checked by doctor at a mean rate of 5 per hour. The centre feels that service times have some unspecified positive skewed unimodel two tailed distribution with a standard deviation of 0.05 hour (3 minutes) :

(i) Determine the queueing characteristics for health care center

(ii) How much the assumption of exponential service times would distort these values ? 5

(b) Explain service mechanism of Queuing System. 5

OR

(c) A barber with a one-man takes exactly 25 minutes to complete one haircut. If customers arrive in a Poisson fashion at an average rate of one every 40 minutes, how long on the average must, a customer wait for service ? Also find the average time a customer spends in a barber's shop. 5

(d) Write note on multi-channel queuing theory model with properties. 5

5. Attempt **all** :

(a) What is dominance property ? Give the general rules of dominance. 2½

(b) Distinguish between PERT and CPM. 2½

(c) Discuss the types of Inventory. 2½

(d) Write a note on Queue Disciplines. 2½

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Bachelor of Computer Application (B.C.A.) Semester—IV (C.B.S.) Examination

OPERATIONS RESEARCH—II

Paper—IV

Time : Three Hours] [Maximum Marks : 50

Note :— (1) All questions are compulsory and carry equal marks.

(2) Assume suitable data wherever necessary.

(3) Draw the neat and labelled diagram wherever necessary.

EITHER

1. (a) What do you mean by decision analysis ? Explain the concept of decision under risk and decision tree with suitable example. 5

(b) Obtain the optimum strategies for the following game by Dominance Principle :

	B_1	B_2	B_3	B_4
A_1	1	2	3	–1
A_2	2	2	1	5
A_3	3	4	0	–2
A_4	4	3	2	6

5

OR

(c) Explain the decision criteria under uncertainty and certainty with example. 5

(d) Solve the following 2 × 5 game by graphical method :

	B_1	B_2	B_3	B_4	B_5
A_1	–5	5	0	–1	8
A_2	8	–4	–1	6	–5

5

2. (a) Explain the Fulkerson's rule for numbering the events in network diagram. 5

(b) Construct the network diagram and find the project completion time for the following task :

A < B; B, C < E; D < F; E, F < I; G < H

Tasks	:	A	B	C	D	E	F	G	H	I
Time (in days)	:	8	9	7	10	11	9	10	8	7

5

OR

(c) A small project is composed of 8 activities whose time estimates are listed in the following table :

Activities :	1–2	2–3	2–4	2–5	3–6	4–6	5–7	6–7
t_o :	1	8	3	3	4	7	6	1
t_m :	2	10	4	5	5	8	8	4
t_p :	3	12	6	7	6	9	10	7

(i) Construct the network diagram of activities in the project.

(ii) Find the expected duration and variance for each activity. What is expected project length ? 5

(d) Explain the following terms with example :

(i) Activity

(ii) Event

(iii) Dummy activity

(iv) Looping

(v) Dangling. 5

EITHER

3. (a) What is inventory problem ? Explain the necessity for maintaining inventory. 5

(b) A stockist has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed to be infinite. The inventory holding cost is Rs. 0.20 per unit per month and the ordering cost per order is Rs. 350. Determine the optimal lot size, optimal scheduling period and minimum total variable yearly cost. 5

OR

(c) What do you mean by ABC Analysis ? Explain the advantages and limitations of it. 5

(d) Find the optimal order quantity for a product for which the price breaks are as follows :

Quantity	Unit cost (Rs.)
$0 < 9 < 500$	Rs. 10
$500 \leq 9 < 750$	Rs. 9.25
$750 \leq 9$	Rs. 8.75

The monthly demand for the product is 200 units. Storage cost is 2% of unit cost and cost of ordering is Rs. 100. 5

EITHER

4. (a) Explain the structure of queuing system in detail. 5

(b) In a bank, 20 customers on the average are served by a cashier in an hour. If the service time has exponential distribution, what is the probability that :

(i) It will take more than 10 minutes to serve a customer.

(ii) A customer shall be free within 4 minutes ? 5

OR

(c) What are the transient and steady states of queuing system ? Also explain Kendall's notation for representing the queuing model. 5

(d) A branch of Punjab National Bank has only one typist. Since the typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8-hour work day. If the typewriter is valued at Rs. 1.50 per hour, determine :

(i) Equipment utilization

(ii) The percent time that an arriving letter has to wait. 5

5. Attempt **ALL** :—

(a) Explain the following terms in Game theory :

(i) Two person zero-sum game

(ii) Saddle point.

Give the examples. 2½

(b) Construct the network diagram for the following activities :

Activities :	1–2	2–3	2–4	3–5	4–6	5–6	5–7	6–7
Time :	3	6	4	6	6	0	4	5

2½

(c) Explain the different costs involved in inventory control. 2½

(d) What do you mean by cost-profit model in queuing system ? Explain. 2½

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Bachelor of Computer Application (B.C.A.) Semester–IV (C.B.S.) Examination

OPERATIONS RESEARCH–II

Paper–IV

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) **All** questions are compulsory and carry equal marks.

(2) Draw neat and well labelled diagrams wherever necessary.

EITHER

1. (A) Solve the following game graphically :

Player B ⟶

↓		B_1	B_2	B_3	B_4
Players	A_1	2	2	3	–2
A	A_2	4	3	2	6

5

(B) Define :

(i) Two person zero sum game

(ii) Value of game. 5

OR

(C) Explain Decision Tree Analysis with an example. 5

(D) Explain the term decision making under uncertainty. Hence give the algorithms of maximax criterian. 5

EITHER

2. (A) Define :

(i) Activity

(ii) Critical path

(iii) Total float of an activity. 5

(B) A project consists of eight activities with the relevant information :

Activity	I.B.	Estimated Duration (days)		
		Optimistic	Most likely	Pessimestic
A	—	1	1	7
B	—	1	4	7
C	—	2	8	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

Draw the PERT network and find out the expected project completion time. 5

OR

(C) Define :

(i) Event (ii) Activity

(iii) Looping (iv) Dangling 5

(D) Construct the network for the following activity data :

Activity	Preceded by	Activity	Preceded by
A	—	F	E
B	—	G	B, C
C	A	H	F
D	B, C	I	F, G
E	D	J	H, I
		K	B
		L	F, G, K

5

EITHER

3. (A) How different factors affect inventory control ? Explain. 5

(B) An item is produced at the rate of 128 units per day. The annual demand is 6400 units. The set-up cost for each production run is Rs. 24 and inventory carrying cost is Rs. 3 per unit per year. There are 250 working days for production each year. Develop an inventory policy for this item. 5

OR

(C) Find the optimal order quantity for a product for which the price breaks as follows :

Quantity	**Unit, Cost (Rs.)**
$0 \leq Q_1 \leq 50$	10.00
$50 \leq Q_2 \leq 100$	9.00
$100 <= Q_3$	8.00

The monthly demand for the product is 200 units, the cost of storage is 25% of the unit cost and ordering cost is Rs. 20.00 per order. 5

(D) Develop EOQ formula for deterministic inventory problems with no shortages. 5

EITHER

4. (A) Define a queue and explain the various queue disciplines. 5

(B) On an average, 6 customers reach a telephone booth every hour to make calls. Determine the probability that exactly 4 customers will reach in 30 min period, assuming that arrival follow Poisson distribution. 5

OR

(C) Explain in brief the queuing system and draw the labelled diagram of it. 5

(D) State three applications of waiting line theory in business enterprises. 5

5. (A) What is Dominance Property ? Explain with an example. 2½

(B) Give the difference between CPM and PERT. 2½

(C) What are the different types of Inventories ? 2½

(D) Explain the Transient and Steady States. 2½

Bachelor of Computer Application (B.C.A.) Semester—IV (C.B.S.) Examination
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Paper—IV

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Note :— (1) **ALL** questions are compulsory and carry equal marks.
(2) Draw neat, labelled diagrams wherever necessary.

EITHER

1. (A) Define the following terms with example :
(i) Saddle point
(ii) Two-person zero sum game
(iii) Value of the game. 5

(B) Reduce the following game by dominance property and solve it :

		Player B				
		I	II	III	IV	V
	1	1	3	2	7	4
Player A	2	3	4	1	5	6
	3	6	5	7	6	5
	4	2	0	6	3	1

5

OR

(C) Solve the following 2 × n game graphically :

Player B

$$\textbf{Player A} \quad \begin{matrix} & B_1 & B_2 & B_3 & B_4 \\ A_1 \\ A_2 \end{matrix} \begin{bmatrix} 2 & 1 & 0 & -2 \\ 1 & 0 & 3 & 2 \end{bmatrix}$$

5

(D) Explain decision tree with suitable example. 5

EITHER

2. (A) Define Activity. Explain different types of activities giving suitable example. 5

(B) Following table gives the activities in a construction project and time duration :

Activity	**Preceding Activity**	**Normal Time (days)**
1—2	—	20
1—3	—	25
2—3	1—2	10
2—4	1—2	12
3—4	1—3, 2—3	5
4—5	2—4, 3—4	10

(a) Draw the activity network of the project.
(b) Determine the project path and the project duration. 5

OR

(C) Explain time-cost trade-off aspects in network technique with example. 5

(D) A project consists of a series of tasks labelled A, B,.....,H, I with the following relationship. (W< X, Y means X and Y can not start until W is completed ; X, Y < W means W cannot start until both X and Y are completed.) With this notation construct the network diagram having following constraints :

A < D, E ; B, D < F ; C < G ; B < H ; F, G < I. 5

EITHER

3. (A) An automobile factory manufactures a particular type of gear within the factory. This gear is used in final assembly. The particulars of these gears are demand rate r = 14000 units/year, production rate K = 35000 units/year. Set up and carrying cast Cc = Rs. 15/unit/year. Find the Economic Batch Quantity (EBQ). 5

(B) Explain inventory review system in detail. 5

OR

(C) Find the optimum order quantity for a product for which the price breaks are as follows :

Quantity	**Purchasing Cost per unit (Rs.)**
$0 < Q_1 < 100$	20
$100 < Q_2 < 200$	18
$200 < Q_3$	16

The monthly demand for the product is 400 units. The storage cost is 20% of the unit cost of the product and the cost of ordering is Rs. 25 per month. 5

(D) What is meant by Inventory Control ? Explain the factors affecting inventory control. 5

EITHER

4. (A) Explain service mechanism of Queuing System. 5

(B) A supermarket has 2 girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 per/hr. The service time for each customer is exponential with mean 6 minutes. Find :

(i) The probability that an arriving customer has to wait for service.

(ii) The average number of customers in the system. 5

OR

(C) Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that inter arrival time follows an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time, calculate the probability that the yard is empty and find the average queue length. 5

(D) Discuss multi-channel queuing theory model with properties. 5

5. Attempt ***all*** :

(A) Explain Laplace criteria with an example. 2½

(B) Write down the rules for network construction. 2½

(C) Define the following terms :

(i) Set-up Cost

(ii) Purchase Cost

(iii) Ordering Cost. 2½

(D) Write a note on Queue disciplines. 2½

Bachelor of Computer Application (B.C.A.) Semester—IV Examination

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Paper—IV

Time : Three Hours] [Maximum Marks : 50

Note :— (1) **All** questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

EITHER

1. (A) For the game with pay off matrix determine optimum strategy and value of the game :

	Player B	
Player A	1	2
	5	4
	−7	9
	−4	−3
	2	1

5

(B) Explain dominance rules with example. 5

OR

(C) Explain Savage Criterion. 5

(D) A Manager has a choice between :

(i) A risky contract promising Rs. 7 lakhs with probability 0.6 and Rs. 4 lakhs with probability 0.4 and

(ii) A diversified portfolio consisting of two contracts with independent outcomes each promising Rs. 3.5 lakhs with probability 0.6 and Rs. 2 lakhs with probability 0.4

Construct decision tree for using EMV criteria. What is the decision using EMV criteria ? 5

EITHER

2. (A) Write rules for Network Construction. 5

(B) Draw a network diagram for :

Project Activity	Preceding Activity
A	–
B	–
C	–
D	–
E	A, B
F	E
G	F
H	D
I	G, H
J	C, I

5

OR

(C) Explain the basic difference between PERT and CPM. 5

(D) Draw the PERT network and find out expected project completion time :

Activity	Immediate Predecessor	Estimated duration		
		Optimistic	Most Likely	Pessimistic
A	–	1	1	7
B	–	1	4	7
C	–	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

5

EITHER

3. (A) What are the various costs associated with inventory ? Explain. 5

(B) Explain EOQ Model with constant rate of demand. 5

OR

(C) A contractor has to supply 20,000 units per day. He can produce 30,000 units per day. The cost of holding a stock per unit is Rs. 3 per year and set up cost per run is Rs. 50. How frequently and of what size, the production runs be made ? 5

(D) Find the optimal order quantity for a product for which price breaks are as follows :

Quantity	Unit Cost (Rs.)
$0 \leq Q_1 < 500$	10.00
$500 \leq Q_2 < 750$	9.25
$750 \leq Q_3$	8.75

The monthly demand for the product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs. 350. 5

EITHER

4. (A) What are the elements of Queuing System ? 5

(B) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following :

(i) The mean queue size

(ii) The probability that the queue size exceeds 10

(iii) Expected waiting time in the system. 5

OR

(C) What do you mean by queuing control ? 5

(D) A supermarket has two girls servicing at the counters. The customers arrive in a Poisson fashion at the rate of 12 per hour. The service time for each customer is exponential with mean 6 minutes. Find :

(i) The probability that an arriving customer has to wait for service.

(ii) The average number of customers in the system and

(iii) The average time spent by a customer in the super-market. 5

5. Attempt **ALL** :

(A) Write rules for determining saddle point. 2½

(B) Give the iterative procedure of determining the critical path. 2½

(C) What is buffer stock ? How will you calculate buffer stock ? 2½

(D) Explain Kendal's notation for representing queuing models. 2½