

Reg. No. :

Code No. : 30591 E Sub. Code : SEMA 6 D

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2020.

Sixth Semester

Mathematics

Major Elective – IV : OPERATIONS RESEARCH–II

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

SECTION A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. When maxmin and minmax values of the game are same, than _____
 - (a) There is a saddle point
 - (b) Solution does not exist
 - (c) Strategies are mixed
 - (d) Infinite solution

2. Games which involve more than, two players are called _____
- (a) Biased games (b) Negotiable games
(c) Conflicting games (d) n-person games
3. The problem of replacement is not concerned about the _____
- (a) Items are deteriorate graphically
(b) Items that fails suddenly
(c) Determination of optimum replacement interval
(d) Maintenance of an item to work out profitability
4. When time value of money is considered _____
- (a) Cost need to be discounted
(b) Timing of incurrence of costs in important
(c) The present value factors serve as the weights
(d) All of the above

5. Which of the following is not correct?
- (a) Queuing theory deals with situations where customers arrive, wait for the service, get the service and leave the system
 - (b) Customers, in queuing theory might include humans, machines, ships, letters and so on
 - (c) A queue refers to physical presence of the customers waiting to be served.
 - (d) A study of queuing theory help the manager to establish an optimum level of service
6. Multiple serves may be _____
- (a) In parallel
 - (b) In series
 - (c) In combination of parallel and series
 - (d) All of the above
7. In critical path analysis, the word CPM means
- (a) Critical Path Method
 - (b) Crash Project Management
 - (c) Critical Project Management
 - (d) Critical Path Management

8. The term commonly used for activity slack time is

- (a) Free float (b) Independent float
- (c) Total float (d) All of the above

9. Inventories in general are build up

- (a) Satisfy demand during period of replenishment
- (b) Carry reserve stocks to avoid shortages
- (c) Keep place with changing market conditions
- (d) All of the above

10. Which cost can vary with order quantity?

- (a) Unit cost only (b) Holding cost only
- (c) Re-order cost only (d) All of these

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Consider the game with the following payoff matrix

$$\begin{array}{c} \text{Player A} \end{array} \begin{array}{c} \text{Player B} \\ \left(\begin{array}{cc} 5 & 0 \\ 0 & 2 \end{array} \right) \end{array}$$

Show that the game is strictly determinable.
Also find the value of the game.

Or

- (b) For the game with the following payoff matrix determine the optimum strategies and the value of the game

$$\begin{matrix} & P_2 \\ P_1 & \begin{pmatrix} 5 & 1 \\ 3 & 4 \end{pmatrix} \end{matrix}$$

12. (a) Machine A costs Rs.9,000. Annual operating cost are Rs.200 for the first year, and the increase by Rs.2,000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine?

Or

- (b) Explain individual replacement policy.
13. (a) A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can service 12 customers on an average per hour. After stating your assumptions, answers the following.

- (i) What is the average number of customers waiting for the service of the clerk?
- (ii) What is the average time a customer has to wait before getting service?

Or

- (b) Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter arrival times follow 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 (there being 10 lines, one of which is reserved for shunting purpose), calculate the probability that the yard is empty and find the average queue length.

14. (a) Find the critical path and duration of project:

Activity :	A	B	C	D	E	F	G	H	I	J
Predecessor :	—	—	A	B	C,D	C,D	E	E	F,G	H,I
Duration (days)	4	6	9	7	4	4	3	6	9	4

Or

(b) A project has the following time schedule :

Activity	1-2	1-3	1-4	2-5	3-6	3-7
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Time in week	2	2	1	4	8	5
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Activity	4-6	5-8	6-9	7-8	8-9
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Time in week	3	1	5	4	3
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Construct PERT network and compute the critical path and its duration.

15. (a) An oil engine manufacturer purchases lubricants at the rate of Rs.42 per piece from a vender. The requirements of these lubricants is Rs.1,800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs.16 and inventory carrying charge per rupee per year is only 20 paise.

Or

- (b) A contractor has to supply 10,000 bearing per day to an automobile manufacturer. He find that, when he starts a production run, he can produce 25,000 bearing per day. The cost of holding a bearing in stock for one year is Rs.2 and the set up cost of a production run is Rs.1,800. How frequently should production run be made?

SECTION C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Solve the following 2×4 game graphically :

Player B

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

Or

- (b) Solve the game whose payoff matrix is given below :

	B_1	B_2	B_3	B_4
A_1	$\begin{pmatrix} 4 & -2 & 3 & -1 \end{pmatrix}$			
	$\begin{pmatrix} -1 & 2 & 0 & 1 \end{pmatrix}$			
	$\begin{pmatrix} -2 & 1 & -2 & 0 \end{pmatrix}$			

17. (a) Let the value of money be assumed to be 10% per year and suppose that machine A is replaced after 3 years whereas machine B is replaced after every six years. The yearly costs of both the machines are given below :

Year :	1	2	3	4	5
Machine A :	1000	200	400	1000	200
Machine B :	1700	100	200	300	400

Determine which machine should be purchased.

Or

- (b) The following failure rates have been observed for a certain type of transistors in a digital computer:

End of the week :	1	2	3	4	5	6	7	8
Probability of failure rate :	0.05	0.13	0.25	0.43	0.68	0.88	0.96	1.00

The cost of replacing an individual failed transistor is Rs.1.25. The decision is made to replace all these transistors simultaneously at fixed intervals and to replace the individual transistors as they fail in service. If the costs of group replacement in 30 paise per transistor, what is the best interval between group replacement?

18. (a) The rate of arrival of customers at a public telephone both follows Poisson distribution with an average time of 10 minutes between one customer and the next. The duration of a phone call is assumed to follow exponential distribution, with mean time of 3 minutes.
- What is the probability that a person arriving at the both will have to wait?
 - What is the average length of the non-empty queues that form from time to time?
 - The Mahanagar telephone Nigam Ltd. will install a second booth when it is convinced that the customers would

except waiting for at last 3 minutes for their turn to make a call. By how much time should the flow of customers increase in order to justify a second booth estimate the fraction of a day the phone will be in.

- (iv) What is the probability that it will take him more than 10 minutes altogether to wait for phone and complete his call?

Or

- (b) A super market has two girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 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.

19. (a) A small project consists of seven activities for which the relevant data are given below:

Activity	Preceding activity	Activity duration (Days)
A	—	4
B	—	7

Activity	Preceding activity	Activity duration (Days)
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C	—	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	4

- (i) Draw the network and find the project completion time.
- (ii) Calculate total float for each of the activities and highlight the critical path.

Or

- (b) A project consists of eight activities with the following relevant information.

Activity	Immediate	Estimated duration (days)		
		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

- (i) Draw the PERT and find out the expected project completion time.
 - (ii) What duration will have 95% confidence for project completion?
 - (iii) If the average duration for activity F increase to 14 days, what will be its effect on the expected project completion time which will have 95% confidence? (For $z=1.465$, $p(0 \leq z \leq 1.645) = 0.45$)
20. (a) Determine an optimum economic order quantity (EOQ) when the total inventory cost is minimized for the deterministic inventory problem with no shortages. Also obtain its characteristics.

Or

- (b) Determine an optimum economic order quantity (EOQ) for the problem with finite replenishment production. Also obtain its characteristic.