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B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2012.

Fourth Semester

Computer Science — Allied

Paper IV — RESOURCE MANAGEMENT
TECHNIQUES

(For those who joined in July 2008 and afterwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Operations Research techniques are not applicable in the following situation
 - (a) Resources available are unlimited
 - (b) Objective can be defined for maximization or minimization
 - (c) Sufficient input data is available for formulating the problem
 - (d) Scientific methods, techniques and tools may be applied

2. A necessary and sufficient condition for a basic feasible solution to a L.P.P. to be an optimum (minimum) is
 - (a) $Z_j - C_j \leq 0$
 - (b) $Z_j - C_j \geq 0$
 - (c) $Z_j - C_j = 0$
 - (d) $Z_j - C_j < 0$ or $Z_n - C_j > 0$
3. Choose the correct statement
 - (a) A game does not have more than one saddle point
 - (b) A two person game cannot be converted to a linear programming problem
 - (c) If the strategies are mixed, the value of the game for both players need not be the same
 - (d) Dominance property is applied when there is no saddle point
4. Games involve more than two players are called
 - (a) Biased games (b) Negotiable games
 - (c) Conflicting games (d) n -person games

5. Economic Order Quantity (EOQ) results in
 - (a) Equalization of carrying cost and procurement cost
 - (b) Minimization of set up cost
 - (c) Favourable procurement price
 - (d) Reduced chances of stock outs
6. If orders are placed with size determined by EOQ, then the re-order cost component is
 - (a) greater than the holding cost component
 - (b) equal to the holding cost component
 - (c) less than the holding cost component
 - (d) either greater than or less than the holding cost component
7. In the context of network, which is the following is not correct?
 - (a) A network is a graphic representation of activities and nodes
 - (b) A project network cannot have multiple initial and final nodes
 - (c) An arrow diagram is essentially a closed network
 - (d) An arrow diagram representing an activity may not have a length and shape

8. In critical path analysis, CPM is
- Event oriented
 - Probabilistic in nature
 - Deterministic in nature
 - Dynamic in nature
9. The calling population is assumed to be infinite when
- Arrivals are independent of each other
 - Capacity of the system is infinite
 - Service rate is faster than the arrival rate
 - Arrivals are dependent
10. For a "Poisson exponential, single server and infinite population" model
- the system has a single server facility
 - the arrivals occur in a Poisson facility
 - the service rate is according to exponential distribution
 - all the above

PART B — (5 × 5 = 25 marks)

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

11. (a) Describe briefly the Simplex method procedure to solve LPP.

Or

- (b) Find all the basic feasible solutions of the equations :

$$2x_1 + 6x_2 + 2x_3 + x_4 = 3;$$

$$6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$$

12. (a) Explain the maxi min and mini max principles in game theory.

Or

- (b) A firm is considering replacement of a machine whose cost price is Rs. 12,200 and the scrap value is only Rs. 200. The operating costs (in rupees) are found from experience as follows.

Year : 1 2 3 4 5 6 7 8

Operating Cost : 200 500 800 1,200 1,800 2,500 3,200 4,000

When should the machine be replaced?

13. (a) The annual demand of a product is 10,000 units. Each unit costs Rs. 100 if orders placed in quantities are below 200 units, but for orders of 200 and above, the unit price is Rs. 95. The annual inventory holding cost is 10% of the value of the item and the ordering cost is Rs. 5 per order. Find the economic lot size.

Or

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

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

14. (a) Explain the procedure of determining the critical path for the given network.

Or

- (b) Consider a project with five jobs A, B, C, D and E with the following job sequence. Job A precedes C and D; Job B precedes D, Job C and D precede E. Draw the network diagram.

15. (a) 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 average queue length.

Or

- (b) A T.V. repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repair sets in the order in which they come in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is the repairman's idle time each day? How many jobs are ahead of the average set just brought in?

PART C — (5 × 8 = 40 marks)

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

16. (a) A diet conscious housewife wishes to ensure certain minimum intake of vitamins A, B and C for the family. the minimum daily needs of the vitamins A, B and C for the family are 30, 20 and 16 units respectively. For the supply of these minimum requirements, the housewife

relies on two-fresh foods. The first one provides 7, 5, 2 units of these vitamins per gram respectively and the second provides 2, 4, 8 units of the same three vitamins per gram of the foodstuff respectively. The first foodstuff costs Rs. 3 per gram and the second costs Rs. 2 per gram. How many grams of each foodstuff should the housewife buy everyday to keep her food bill as low as possible? Formulate the problem as an L.P.P. model and solve graphically.

Or

- (b) Use the simplex method to

$$\begin{aligned} \text{Maximize } Z &= 2x_1 + 3x_2 \\ \text{subject to the constraints} \\ -x_1 + 2x_2 &\leq 4 \\ x_1 + x_2 &\leq 6 \\ x_1 + 3x_2 &\leq 9 \text{ and} \end{aligned}$$

x_1, x_2 are unrestricted in sign

17. (a) A and B play a game as follows : They simultaneously and independently write one of three numbers 1, 2, 3. If the sum of the numbers written is even, B pays to A this sum in rupees. If it is odd, A pays the sum to B in rupees. Form the matrix of the game for A and solve it.

Or

- (b) A manufacturer is offered two machines A and B. A is priced at Rs. 5,000 and the running costs are estimated to be Rs. 800 for each of the first five years, increasing by Rs. 200 per year in the sixth and subsequent years. Machine B, which has the same capacity as A, costs Rs. 2,500 but will have running costs Rs. 1,200 per year for six years, increasing by Rs. 200 per year thereafter. If the money is worth 10% per year, which machine should be purchased? Assume that the machine will eventually be sold for scrap of a negligible price.

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

Quantity	Unit cost (Rs.)
$0 \leq Q_1 \leq 800$	1.00
$800 \leq Q_2$	0.98

The yearly demand for the product is 1,600 units per year, the cost of placing an order is Rs. 5.00 and the carrying charge fraction is 10% per year.

Or

- (b) Data relevant to component A used by Engineering India Private Limited in 20 different assemblies includes : Purchase price = Rs. 15 per 1000, annual usage = 100,000 units, cost of buying office (fixed Rs. 15,575

per annum, set-up cost = Rs. 12 per order, interest = 25% per annum, insurance = 0.05% per annum based on total purchases, depreciation as 1% per annum of all items purchase. Calculate (i) EOQ for component A (ii) The percentage changes in total annual costs relating to component A if the annual usage was (1) equal to 125000 units and (2) equal to 75000 units.

19. (a) A project consists of the following activities :

Activity :	A	B	C	D	E	F	G
Immediate predecessor :	-	-	A	B, C	B, C	D	E, F
Duration :	6	9	9	3	12	6	3

- (i) Draw the network
- (ii) What is the project completion time? Which of the activities must be completed in time so that the project may be completed in time?

Or

(b) Consider the following project activities and their duration :

Activity :	A	B	C	D	E	F	G	H	I	J	K	L	M	M	O	P	Q
Preceding" activity :	-	-	-	A	A	B	B	C	C	D	E	F	G	H	I	J, K, L	M, N, O
Duration (months) :	4	8	5	4	5	7	4	8	3	6	5	4	12	7	10	5	8

- (i) Construct the CPM network
- (ii) Determine the critical path
- (iii) Compute the total floats and free floats for non-critical activities.

20. (a) A departmental store has a single cashier. During the rush hours, customers arrive at a rate of 20 customers per hour. The Average number of customers that can be processed by the cashier is 24 per hour. Assume that the conditions for the use of the single channel queuing model apply.

- (i) What is the probability that the cashier is idle?
- (ii) What is the average time a customer spends in the system?
- (iii) What is the average time customer spends in the queue waiting for service?
- (iv) What is the average number of customers in the queue?

Or

(b) Derive the formula of L_s , L_q for $(M/M/1) : (\infty/FCFS)$ model.