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**D.K.M. COLLEGE FOR WOMEN (AUTONOMOUS), VELLORE-1**  
**SEMESTER EXAMINATIONS**  
**APRIL – 2016**                      **15CPMA2E**  
**ELECTIVE : OPERATIONS RESEARCH**

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Time : 3 Hours

Max. Marks : 75

**SECTION – A (5 x 6 = 30)**

Answer ALL the questions.

1. (a) Explain the types of decision making environments.

(Or)

- (b) Given the following payoff function for each act  $a_1$  and  $a_2$ .

$$Q_{a_1} = -25 + 40x, \quad Q_{a_2} = -80 + 29x,$$

- i) Find the break even value of  $x$ ?
  - ii) If  $x = 5$ , which is the better act?
  - iii) If  $x = 5$ , what is the regret of the poor strategy?
  - iv) If  $x = -10$ , which is the better act?
  - v) If  $x = -10$ , what is the regret of the poor strategy?
2. (a) Define total float, free float and independent floats.

(Or)

- (b) Tasks A, B, C, ... H, I constitute a project. 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 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

Also identify the critical path.

3. (a) Explain inventory cost components.

(Or)

- (b) The probability distribution of monthly sale of a certain item is as follows:

Monthly Sales	0	1	2	3	4	5	6
Probability	0.001	0.06	0.25	0.35	0.20	0.03	0.10

The cost of carrying inventory is Rs.30 per unit per month and the cost of unit shortage is Rs.70 per month. Determine the optimum stock level that minimizes the total expected cost.

4. (a) Discuss queue discipline.

(Or)

- (b) Consider a single server queuing system with Poisson input and exponential service times. Suppose the mean arrival rate is 3 calling units per hour, the expected service time is 0.25 hour and the maximum permissible calling units in the system is two. Derive the steady state probability distribution of the number of calling units in the system and then calculate the expected number in the system.

5. (a) Explain the types of failure in replacement models.

(Or)

- (b) The data collected in running a machine, the cost of which is Rs.60,000 are given below:

Year	1	2	3	4	5
Resale value (Rs.)	42,000	30,000	20,400	14,400	9,650
Cost of spare (Rs.)	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs.)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

### SECTION – B ( 3 x 15 = 45 )

Answer any THREE of the following questions.

6. A business has two independent investment portfolios A and B, available to him, but he lacks the capital to undertake both of them simultaneously. He can either choose A first and then stop, or if A is

not successful, then take, B or vice versa. The probability of success of A is 0.6, while for B it is 0.4. Both investment schemes require an initial capital outlay of Rs.10,000 and both return nothing if the venture proves to be unsuccessful. Successful completion of A will return Rs.20,000 (over cost) and successful completion of B will return Rs.24,000 (over cost). Draw a decision tree in order to determine the best strategy.

7. A civil engineering firm has to bid for the construction of a dam. The activities and their time estimation are given below:

Activities	1-2	2-3	2-4	2-8	3-4(dummy)	3-5	4-6
Optimistic	14	14	13	16	0	15	13
Most likely	17	18	15	19	0	18	17
Pessimistic	25	21	18	28	0	27	21

Activities	5-7(dummy)	5-9	6-7(dummy)	6-8(dummy)	7-9	8-9
Optimistic	0	14	0	0	16	14
Most likely	0	18	0	0	20	16
Pessimistic	0	20	0	0	41	22

The policy of the firm with respect to submitting bids is to bid the minimum amount that will provide a 95 % of probability of at best breaking – even. The fixed costs for the project are eight lakhs and the variable costs are 9000 ever day spent working on the project. The duration is in days and the costs are in rupees. Find the critical path, its duration and its variance.

8. A dealer supplies you the following information with regard to a product that he deals in:

Annual demand =10000 units; Ordering cost = Rs.10 per order;  
 Price = Rs.20 per unit, Inventory carrying cost = 20 per cent of the value of inventory per year. The dealer is considering the possibility of allowing

some backorder (stockout) to occur. He has estimated that the annual cost of backordering will be 25 percent of the value of inventory.

- (a) What should be the optimum number of units of the product he should buy in one lot?
  - (b) What quantity of the product should be allowed to be backordered, if any?
  - (c) What would be the maximum quantity of inventory at any time of the year?
  - (d) Would you recommend to allow backordering? If so, what would be the annual cost saving by adopting the policy of backordering.
9. A bank has two tellers working on the savings accounts. The first teller only handles withdrawals. The second teller only handles deposits. It has been found that the service time distribution for the deposits and withdrawals, both are exponential with mean service time 3 minutes per customer. Depositors are found to arrive in a Poisson fashion throughout the day with a mean arrival rate of 16 per hour. Withdrawers also arrive in a Poisson fashion with a mean arrival rate of 14 per hour. What would be the effect on the average waiting time for depositors and withdrawers if each teller could handle both the withdrawals and deposits? What would be the effect if this could only be accomplished by increasing the service time to 3.5 minutes?
10. A computer contains 10,000 resistors. When any resistor fails, it is replaced. The cost of replacing a resistor individually is Re.1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percentage of surviving resistors say  $S(t)$  at the end of month  $t$  and the probability of failure  $P(t)$  during the month  $t$  are as follows:

t	0	1	2	3	4	5	6
S(t)	100	97	90	70	30	15	0
P(t)	-	0.03	0.07	0.20	0.40	0.15	0.15

What is the optimal replacement plan?

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