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Question Paper Code: 55704

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Fifth Semester

Mechanical Engineering

15UME504 - OPERATIONS RESEARCH

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. Operations Research (OR) , which is a very powerful tool for ----- CO1 -R
(a) Research (b) Decision – Making (c) Operations (d) None of the above
2. The value of M in the Big M method is assumed to be CO1 -R
(a) Zero (b) Negative (c) Very small (d)Very large
3. The problems concerning number of origins and destinations are dealt by using CO2- R
(a) Transportation model (b) Two phase method
(c) Simple method (d) Linear program
4. Which of the following method is used to find shortest route? CO2 -R
(a) Travelling salesman problem (b) Simplex method
(c) Transportation problem (d) Assignment problem
5. CPM is a CO3 -R
(a) Critical path method (b) Critical path management
(c) Critical project method (d) Critical project management

6. In the project network, dummy activities and events are represented by CO3- R
- (a) Line and Circle (b) Circle and Arrow
- (c) Line and Arrow (d) Dotted line and Circle
7. Which of the following is an indirect inventory? CO4- R
- (a) Production inventory (b) Finished goods inventory
- (c) Buffer inventories (d) MRO inventory
8. Which of the following model finds its applications in electrical bulbs, TV parts or car parts CO4- R
- (a) Replacement model (b) Inventory model
- (c) Queuing model (d) Assignment model
9. Queuing theory was developed by CO5- R
- (a) Kendall (b) A.K.Erlang (c) Molins (d) Hungarien
10. Identify the situation where game theory can be applied CO5- R
- (a) Condition of uncertainty (b) Condition of risk
- (c) Condition of certainty (d) Condition of conflict

PART – B (5 x 2= 10Marks)

11. Define Operations Research (OR). CO1- R
12. Write the methods available to find out starting solution in transportation algorithm. CO2 -R
13. Distinguish between PERT and CPM. CO3- R
14. Identify the situations where replacement of item is necessary. CO4 -R
15. List the three major constituents of a queuing system CO5 -R

PART – C (5 x 16= 80Marks)

16. (a) (i) Describe the steps to be followed in formulation of Linear Programming Problems (LPP). CO1- App (6)

(ii) Solve the following L.P. problem by graphical method.

CO1 - App (10)

Maximize $Z = 2x_1 + x_2$,

subject to $x_1 + 2x_2 \leq 10$,

$x_1 + x_2 \leq 6$,

$x_1 - x_2 \leq 2$,

$x_1 - 2x_2 \leq 1$

$x_1, x_2 \geq 0$.

Or

(b) Use simplex method to solve the following problem.

CO1- App (16)

Maximize $Z = 2x_1 + 5x_2$,

subject to $x_1 + 4x_2 \leq 24$,

$3x_1 + x_2 \leq 21$,

$x_1 + x_2 \leq 9$,

$x_1 + x_2 \geq 0$

17. (a) A product is produced by four factories *A, B, C* and *D*. The unit production cost in them are Rs.2, Rs.3, Rs.1 and Rs.5 respectively. Their production capacities are: factory *A* – 50 units, *B* -70 units, *C* – 30 units and *D* – 50 units. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 units respectively. Unit transportation cost in rupees from each factory to each store is given in the table below.

CO2 -App (16)

		Stores			
		1	2	3	4
Factories	A	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum.

Or

- (b) A manufacturer of complex electronic equipment has just received a sizable contract and plans to subcontract part of the job. He has solicited bids for 6 subcontracts from 3 firms. Each job is sufficiently large and any firm can take only one job. The table below shows the bids as well as the cost estimate (in lakhs of rupees) for doing the job internally. Not more than three jobs can be performed internally.

CO2 -Ana (16)

Find the optimal assignment that will result in minimum total cost.

Job Firm \	1	2	3	4	5	6
1	44	67	41	53	48	64
2	46	69	40	45	45	68
3	43	73	37	51	44	62
Internal	50	65	35	50	46	63

18. (a) A Project schedule has the following characteristics :

CO3- Ana (16)

Activity	1-2	1-3	2-4	3-4	3-5	4-9
Time (weeks)	4	1	1	1	6	5
Activity	5-6	5-7	6-8	7-8	8-10	9-10
Time (weeks)	4	8	1	2	5	7

- (i) Construct the network.
- (ii) Compute E and L for each event, and
- (iii) Find the critical path.

Or

(b) A civil engineering firm has to bid for the construction of a dam. CO3-Ana (16)
The activities and their time estimates are given below.

Activity	Optimistic	Most likely	Pessimistic
1-2	14	17	25
2-3	14	18	21
2-4	13	15	18
2-8	16	19	28
3-4 (dummy)	0	0	0
3-5	15	18	27
4-6	13	17	21
5-7 (dummy)	0	0	0
5-9	14	18	20
6-7 (dummy)	0	0	0
6-8 (dummy)	0	0	0
7-9	16	20	41
8-9	14	16	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 Rs.9,000 every day spent working on the project. The duration is in days and the costs are in rupees.

What amount should the firm bid under this policy? (You may perform the calculations on duration etc., up to two decimal places).

19. (a) (i) Explain the following terms in inventory management CO4- U (6)
 1. Carrying cost 2. Shortage of cost 3. Ordering cost
 (ii) ABC manufacturing company purchases 9,000 parts of a machine for its annual requirement, ordering one month's usage at a time. Each part costs Rs.20. The ordering cost per order is Rs.15, and the carrying charges are 15% of the average inventory per year. You have been asked 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? CO4 -U (10)

Or

- (b) The maintenance cost and resale value per year of a machine whose CO4 -Ana (16)

Year	1	2	3	4	5	6	7	8
Maintenance cost ₹	900	1200	1600	2100	2800	3700	4700	5900
Resale value ₹	4000	2000	1200	600	500	400	400	400

purchase price is Rs.7000 is given below.

When should the machine be replaced?

20. (a) A self service stores employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time. Find CO5 -U (16)
 (i) Average number of customers in the system.
 (ii) Average number of customers in the queue. (or) Average queue length.
 (iii) Average time a customer spends in the system.

Average time a customer waits before being served.

Or

- (b) Reduce the following game by dominance and find the game value. CO5- U (16)

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

