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Question Paper Code: 55704

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

Fifth Semester

Mechanical Engineering

15UME504 - OPERATIONS RESEARCH

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The mathematical technique for finding the best use of limited resources in an optimum manner is called CO1- R
(a) Operation research (b) Linear programming (c) Network analysis (d) Queuing theory
2. In the simplex method for solving of LPP, the number of variables can be CO1- R
(a) Not more than three (b) At least two (c) At least three (d) None of them
3. North- west corner refers to CO2- R
(a) Top left corner (b) Top right corner (c) Both of them (d) None of them
4. The _____ method used to obtain optimum solution of travelling salesman problem. CO2- R
(a) Simplex (b) Dominance (c) Hungarian (d) Graphical
5. CPM is CO3- R
(a) Time oriented (b) Event oriented (c) Activity oriented (d) Target oriented
6. _____ event represents beginning of more than one activities. CO3- R
(a) Burst (b) Dummy (c) Merge (d) None of them

7. An example of shrinkage costs includes CO4- R
 (a) Income freight (b) Storage costs (c) Insurance (d) Clerical errors
8. The time period between placing an order its receipt in stock is known CO4- R
 as
 (a) Lead time (b) Carrying time (c) Shortage time (d) Over time
9. In a M | M | 1 queue, the service rate is CO5- R
 (a) Poisson (b) Exponential (c) Linear (d) None of these
10. Simulation is basically a technique which is used for CO5- R
 (a) Optimisation (b) Testing alternatives (c) Cost minimization (d) Computerisation

PART – B (5 x 2= 10 Marks)

11. What are the basic components of a LP model? CO1-U
12. What is degenerate basic feasible solution in transportation problem? CO2-U
13. Differentiate between CPM and PERT. CO3-U
14. What is buffer stock? CO4-U
15. What is Queue discipline? Write its types. CO5-U

PART – C (5 x 16= 80 Marks)

16. (a) Maximize $Z = 2X_1 + X_2$ CO1- App (16)
 subject to $4X_1 + 3X_2 \leq 12,$
 $4X_1 + X_2 \leq 8,$
 $4X_1 - X_2 \leq 8,$
 $X_1, X_2 \geq 0.$

Or

- (b) Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paise per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B per gram and costs 12 paise per gram. The daily minimum requirement of vitamin A and vitamin B is 100 units and 120 units respectively. Find the minimum cost of product mix by the simplex method. CO1- App (16)

17. (a) Four factories supply the products to four stores. Unit transportation cost in rupees from each factory to each store is given in the table. Find out the Optimum transportation cost. (Use VAM and MODI methods). CO2- App (16)

| | Stores | | | | Production Capacity |
|-------------|--------|----|-----|----|---------------------|
| | 1 | 2 | 3 | 4 | |
| Factory - A | 04 | 06 | 08 | 13 | 50 |
| Factory - B | 13 | 11 | 10 | 08 | 70 |
| Factory - C | 14 | 04 | 10 | 13 | 30 |
| Factory - D | 09 | 11 | 13 | 08 | 50 |
| Demand | 25 | 35 | 105 | 20 | |

Or

- (b) A small garment making unit has five tailors stitching five different types of garments. All the five tailors are capable of stitching all the five types of garments. The output per day per tailor and the Profit (Rs.) for each type of garment are given below: CO2- App (16)

| Tailors | Garments | | | | |
|--------------------------|----------|---|----|----|----|
| | 1 | 2 | 3 | 4 | 5 |
| A | 7 | 9 | 4 | 8 | 6 |
| B | 4 | 9 | 5 | 7 | 8 |
| C | 8 | 5 | 2 | 9 | 8 |
| D | 6 | 5 | 8 | 10 | 10 |
| E | 7 | 8 | 10 | 9 | 9 |
| Profit (Rs.) per garment | 2 | 3 | 2 | 3 | 4 |

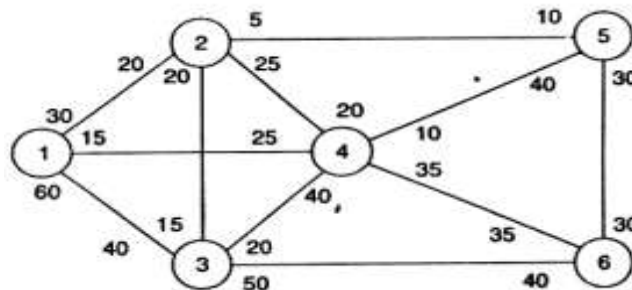
Which type of garment should be assigned to which tailor in order to maximize profit, assuming that there are no other constraints?

18. (a) A project involves 14 activities. Construct a network. Find out the critical path and project duration. CO3 Ana (16)

| S.No | Activity | Immediate Predecessor (s) | Duration (Months) |
|------|----------|---------------------------|-------------------|
| 1 | A | - | 2 |
| 2 | B | - | 6 |
| 3 | C | - | 4 |
| 4 | D | B | 3 |
| 5 | E | A | 6 |
| 6 | F | A | 8 |
| 7 | G | B | 3 |
| 8 | H | C,D | 7 |
| 9 | I | C,D | 2 |
| 10 | J | E | 5 |
| 11 | K | F,G,H | 4 |
| 12 | L | F,G,H | 3 |
| 13 | M | I | 13 |
| 14 | N | J,K | 7 |

Or

- (b) Consider the pipe network shown in figure which shows the flow CO3- Ana (16) capacities between various pairs of locations in both ways. Find the maximal flow from Node-1 to Node-6.



19. (a) The annual demand for a component is 7200 units. The carrying cost is Rs.500/unit/year, the ordering cost is Rs.1500 per order and shortage cost is Rs.2000/unit/year. Find the optimal values of economic order quantity, maximum inventory, maximum shortage quantity, cycle time (t), inventory period (t₁) and shortage period (t₂). CO4- App (16)

Or

- (b) The maintenance cost and resale value per year of a machine whose purchase price is Rs. 7000 is given below CO4 Ana (16)

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

When should the machine be replaced?

20. (a) Customers arrive at the first class ticket counter of a theatre at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour. CO5-App (16)
- (i) What is the probability that there is no customer in the counter?
- (ii) What is the probability that there are more than two customers in the counter?
- (iii) What is the probability that there is no customer waiting to be served?
- (iv) What is the probability that a customer is being served and nobody is waiting?

Or

- (b) Reduce the following game by dominance and find the game value: CO5-App (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 |

