(b) The arrival rate of customers at petrol pump distribution, with an average time of 10 minutes between one customer and the next. The duration of a fill up of vehicle is assumed to follow exponential distribution with a mean time of three minutes : 5

(i) What is the average length of the queue ?

(ii) What is the probability that a person arriving at the both will have to wait ?

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May 2024

B.Tech. (IT/CE(DS)/CSE(AIML))

(Sixth Semester)

Operation Research (OEC-CS-602-V)

Time : 3 Hours] *[Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Discuss the significance and scope of Operations Research. 1.5

(b) How the unbounded solution be recognized in the graphical method ? 1.5

(c) Define artificial variable and its need. 1.5

(d) Define optimal feasible solution and basic feasible solution. 1.5

(e) Write a short note on sensitivity analysis. 1.5

(f) Write a short note on transportation problem. **1.5**

(g) Explain PERT and its importance in network analysis. **1.5**

(h) Explain the economic order quantity model. **1.5**

(i) What is the waiting line problem ? **1.5**

(j) Why must the service rate be greater than the arrival rate in a single channel queuing system ? **1.5**

Part B

2. (a) A marketing manager wishes to allocate this annual advertising budget Rs. 20,000 in two medias A and B. The unit cost of a message in media A is Rs. 1,000 and in media B is Rs. 1,500. Media A is monthly magazine and not more then one insertion is desired in the issue. At least five ménages should appear in media B. The expected effective audience for one message in media A is Rs. 40,000 and for media B is Rs. 50,000. Formulate it and solve graphically. 7

(b) Solve the following LPP : 8

Max. $Z = 2x_1 + x_2 - 3x_3 + 5x_4$

Subject to constraints

$$x_1 + 2x_2 + 2x_3 + 4x_4 \leq 40$$
$$2x_1 - x_2 + x_3 + 2x_4 \leq 8$$
$$4x_1 - 2x_2 + x_3 - x_4 \leq 10$$
$$x_1, x_2, x_3, x_4 \geq 0$$

3. (a) Solve the following LPP : 8

Min. $Z = 4x_1 + 2x_2$

Subject to constraints

$$3x_1 + x_2 \geq 27$$
$$-x_1 - x_2 \leq 21$$
$$x_1 + 2x_2 \geq 30$$

Where x_1, x_2 are unrestricted in sign.

(b) Apply Two-phase method, solve the following LPP : 7

Min. $Z = 40x_1 + 24x_2$

Subject to the constraints

$$20x_1 + 50x_2 \geq 4800$$
$$80x_1 + 50x_2 \geq 7200$$
and $x_1, x_2 \geq 0$

4. (a) Apply dual simplex method, solve the following LPP : 7

Min. $Z = 5x_1 + 6x_2$

Subject to the constraints :

$$x_1 + x_2 \geq 2$$

$$4x_1 + x_2 \geq 4$$

and $x_1, x_2 \geq 0$

(b) Find the optimal solution of the LPP given by : 8

Max. $Z = 3x_1 + 5x_2$

Subject to the constraints

$$x_1 + x_2 \leq 1$$

$$2x_1 + 3x_2 \leq 1$$

and $x_1, x_2 \geq 0$

Obtain the variation in c_1 (= 3) and c_2 (= 5) without affecting the above optimal solution.

5. (a) Explain the Hungarian method to solve an assignment problem. Also, discuss the difference between a transportation problem and an assignment problem. 10

(b) The demand for a certain product is random. It has been estimated that the monthly demand of the product has a normal distribution with a mean of 390 units. The unit price of product is Rs. 25. Ordering cost is Rs. 40 per order and inventory carrying cost is estimated to be 35 per cent per year. Calculate Economic Order Quantity (EOQ). 5

6. (a) Differentiate between PERT and CPM. Explain the following terms : 10

(i) Critical Path

(ii) Slack Time

(iii) Dummy activities.

(b) What is Dynamic Programming ? Give its various applications. 5

7. (a) Give some applications of queuing theory and explain the following terms : 10

(i) Queue

(ii) Traffic intensity

(iii) Service channel

(iv) Queue discipline.