7E1748

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B. Tech. VII - Sem. (Main) Exam., Feb.- March - 2021
PEC Mechanical Engineering
7ME5 – 12 Operations Research

Time: 2 Hours

[To be converted as per scheme]
Max. Marks: 82
Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Give any one definition of operations research.

Q.2 Why is the study of operations research important to the decision maker?

Q.3 State clearly the basic assumptions that are made in LPP.

Q.4 Give a general mathematical formulation of L. P. problem. Indicate all terms.

Q.5 What is an artificial variable and why it is necessary to introduce it?

Q.6 What are the useful aspects of duality in LPP?

Q.7 What is degeneracy problem in transportation?

Q.8 Define 'pure strategy' and 'mixed strategy' in a game.

Q.9 What are the different types of inventory in industries?

Q.10 What are the main characteristics of queuing system?

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 A firm manufacturing headache pills in two sizes A and B. Size A contain 2 grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonates and 6 grains of codeine. It is found by users that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as a standard LPP.

Q.2 Solve the LPP given below by graphical method and shade the region representing the feasible solution: Minimize $Z = 2X_1 - 10X_2$

Subject to $X_1 - X_2 \geq 0$, $X_1 - 5X_2 \geq -5$, and $X_1, X_2 \geq 0$.

Q.3 Define slack and surplus variables as involved in the LPP. How are these variables useful in solving a LPP?

Q.4 Explain the concept involved in the Gomory's cutting plane method.

Q.5 What is an inventory system? Explain clearly the different costs that are involved in Inventory problems.

Q.6 Describe any two methods used for decision making with uncertainty. Explain each method with example.

Q.7 Explain Monte Carlo simulation method and give the situations where this method is useful.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 A manufacturing company has just developed new product. On the basis of past experience, a product such as this will either be successful, with an expected gross return of rupees 100,000, or unsuccessful with an expected gross return of rupees 20,000. Similar products manufactured by company have a record of being successful about 50% of the time. The production and marketing costs of new product are expected to be rupees 50,000.

The company is considering whether to market this new product or to drop it. Before making its decision, however, a test marketing effort can be conducted at a cost of rupees 10,000. Based on the past experience, test marketing results have been favorable about 70% of time. Furthermore, products favorably tested have been successful 80% of the time. However, when the test marketing results has been unfavorable, the product has only been successful 30% of the time. What course of action should the company pursue?

Q.2 Describe a general transportation problem. Explain how to determine an initial basic feasible solution to the problem using Vogel's method.

Q.3 Show how to solve a 2×2 two person zero-sum game without any saddle point.

Q.4 Arrival rate of telephone calls booth are according to Poisson distribution with an average time of 9 minutes between two consecutive arrivals. The length of telephone call is assumed to be exponentially distributed, with mean 3 minutes.

(a) Determine the Probability that a person arriving at the booth will have to wait.

(b) Find the average queue length that is formed from time to time.

(c) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least four minutes for the phone. Find the increase in flow rate of arrival which will justify a second booth.

(d) What is the probability that an arrival will have to wait for more than 10 minutes before the phone is free?

(e) What is the probability that he will have to wait for more than 10 minutes before the phone is available and the call is also complete?

Q.5 A stockiest has to supply 400 units of a product every Monday to his customers. He gets the product at ₹ 50 per unit from manufacturer. The cost of ordering and transportation from the manufacturer is ₹ 75 per order. The cost of carrying inventory is 7.5% per year of the cost of the product. Find –

(a) The economic lot size

(b) The total optimal cost (including the capital cost)

(c) The total weekly profit if the item is sold for ₹ 55 per unit

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