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| **SESSION** | **JUL/AUG 2021** |
| **PROGRAM** | **MASTER OF BUSINESS ADMINISTRATION (MBA)** |
| **SEMESTER** | **II** |
| **COURSE CODE & NAME** | **DMBA205 – OPERATIONS RESEARCH** |
| **CREDITS** | **4** |
| **NUMBER OF ASSIGNMENTS &**  **MARKS** | **02**  **30 Marks each** |

**Q1. What is Operations Research (O.R.)? Discussed the significance and scope of O.R. 3+3+4 10**

**Ans.**

**Operations Research (O.R.):** Churchman, Aackoff, and Aruoff defined operations research as “the application of scientific methods, techniques and tools to the operation of a system with optimum solutions to the problems” where 'optimum' refers to the best possible alternative.

The objective of OR is to provide a scientific basis to the decision-makers for solving problems involving interaction with various components of the organisation. This can be achieved by employing a Its Half solved only

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**Q2. a) Solve the following linear programming problem:**

**Max. Z = 20x1 + 10x2**

**Subject to: x1 + x2 = 150**

**x1 ≤ 40**

**x2 ≥ 20**

**where x1, x2 ≥ 0 5 marks**

**Ans:**

**Solution:**  
**Problem is**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Max *Z* | = |  | 20 | *x*1 | + | 10 | *x*2 | |
| subject to |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  |  | *x*1 | + |  | *x*2 | = | 150 | |  |  | *x*1 |  |  |  | ≤ | 40 | |  |  |  |  |  | *x*2 | ≥ | 20 | |

**b) Discuss in brief “Duality” in linear programming problems. How to interpret the primal-dual relationship? 2+3**

**Ans:**

**Duality:** Every Linear Programming Problem (LPP) is associated with another linear programming problem involving the same data and optimal solutions. The two problems are said to be duals of each

**3. a) A car hire company has one car at each of the five depots D1, D2, D3, D4 & D5.**

**Customers in each of the five towns A, B, C, D & E requires a car. The distance (in miles)**

**between the depots (origins) and the towns (destinations) where customers are given in the following distance matrix:**

**Depots 5 10**

**D1 D2 D3 D4 D5**

**A 160 130 175 190 200**

**B 135 120 130 160 175**

**Person C 140 110 155 170 185**

**D 50 50 80 80 110**

**E 55 35 70 80 105**

**How should the cars be assigned to the customers so as to minimize the distance**

**travelled?**

**Ans 3a.**

This problem could be solved using the transportation technique. However, only five of the routes will be used and so an additional four routes would have to be included at zero level in order to determine shadow costs and thus test for optimality. The problem is to select five elements from the matrix of Table 1 such that there is one element in each row, one in each column, and the sum is the

**b) Solve the following transportation problem using Vogel’s Approximation Method:**

**Destination 5**

**D1 D2 D3 D4 Supply**

**Source S1 7 3 8 6 60**

**S2 4 2 5 10 100**

**S3 2 6 5 1 40**

**Demand 20 50 50 80**

**Ans:**

**Solution:**  
TOTAL number of supply constraints : 3  
TOTAL number of demand constraints : 4  
Problem Table is

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *D*1 | *D*2 | *D*3 | *D*4 |  | Supply |
| *S*1 | 7 | 3 | 8 | 6 |  | 60 |
| *S*2 | 4 | 2 | 5 | 10 |  | 100 |
| *S*3 | 2 | 6 | 5 | 1 |  | 40 |
|  | | | | | | |
| Demand | 20 | 50 | 50 | 80 |  |  |

Table-1

**Set – II**

**Q4.a) Solve the following Integer programming problem using Gomory’s Fractional**

**Algorithms:**

**Maximize Z = 5x1 + 7x2**

**Subject to: -2x1 + 3x2 ≤ 6**

**6x1 + x2 ≤ 30**

**where x1, x2 ≥ 0 are integers.**

**Answer:**

**Solution:**  
**Problem is**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Max *Z* | = |  | 5 | *x*1 | + | 7 | *x*2 | |
| subject to |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | - | 2 | *x*1 | + | 3 | *x*2 | ≤ | 6 | |  | 6 | *x*1 | + |  | *x*2 | ≤ | 30 | |

**b) Solve the following game using Dominance rule:**

**Player B**

**B1 B2 B3**

**A1 5 20 -10**

**Player A A2 10 6 2**

**A3 20 15 18**

**Solution:**

**Q5. Write short notes on the following concepts:**

**a) Erlang M/M/1: ∞/FCFS Queuing Model**

**b) Program Evaluation and Review Technique [PERT] 5+5 10**

**Ans:**

**a) Erlang M/M/1: ∞/FCFS Queuing Model:**

The queueing system where the distribution of arrival and the departure both are assumed to be Poisson or the distribution of inter-arrival time and service time are assumed to be Exponentially distributed are called as the Poisson queuing system. The main Poisson queuing

**Q 6. The Cargo Honda Ltd. Manufactures around 150 scooters. The daily production**

**varies from 146 to 154 depending upon the availability of raw materials and other working conditions:**

**Production 146 147 148 149 150 151 152 153 154**

**Per day**

**Probability 0.04 0.09 0.12 0.14 0.11 0.10 0.20 0.12 0.08**

**The finished scooters are transported in a specially arranged lorry accommodating**

**150 scooters. Using following random numbers: 80, 81, 76, 75, 64, 43, 18, 26, 10,**

**12, 65, 68, 69, 61, 57. Simulate the process to find out:**

**i) the average number of scooters waiting in the factory. ii) the average number of empty spaces on the lorry. 10**

**Ans:**

The random numbers are given in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| Production per day | Probability | Cumulative  Probability | Random Numbers Assigned |
| 146 | .04 | 0.04 | 00-03 |
| 147 | .09 | 0.13 | 04-12 |