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| **SESSION** | **JUL - AUG 2024** |
| **PROGRAM** | **MASTER OF BUSINESS ADMINISTRATION (MBA)** |
| **SEMESTER** | **II** |
| **COURSE CODE & NAME** | **DMBA205 OPERATIONS RESEARCH** |
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|  |  |

**Assignment Set – 1**

**1. What is Operations Research? Write in brief the advantages and limitations of Operations Research. 3+4+4**

**Ans 1.**

**Meaning of Operations Research**

Operations Research (OR) is a scientific approach to problem-solving and decision-making that uses mathematical models, statistics, and algorithms to optimize outcomes. It focuses on analyzing complex situations to provide efficient and effective solutions to problems in business, engineering, and other fields. OR integrates various disciplines like mathematics, economics, and computer science to enhance productivity and reduce costs. It is often used in

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**2. Solve the given linear programming problem:**

**Maximize Z = 3x1 + 2x2 + x3**

**Subject to: -3x1 + 2x2 + 2x3 = 8**

**-3x1 + 4x2 + x3 = 7**

**where x1, x2, x3 ≥ 0**

**Ans 2.**

**Problem is**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Max Z | = |  | 3 | x1 | + | 2 | x2 | + |  | x3 | |
| subject to |
| |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | - | 3 | x1 | + | 2 | x2 | + | 2 | x3 | = | 8 | | - | 3 | x1 | + | 4 | x2 | + |  | x3 | = | 7 | |
| and x1,x2,x3≥0; |

The problem is converted to canonical form by adding slack, surplus and artificial variables as appropiate  
  
1. As the constraint-1 is of type '=' we should add artificial variable A1  
  
2. As the constraint-2 is of type '=' we should add artificial variable A2  
  
**After introducing artificial variables**

**3. Find the Initial Basic Feasible Solution (IBFS) using VAM and Optimal solution using MODI method for the given transportation problem.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **D4** | **Supply** |
| **S1** | **21** | **16** | **25** | **13** | **11** |
| **S2** | **17** | **18** | **14** | **23** | **13** |
| **S3** | **32** | **27** | **18** | **41** | **19** |
| **Demand** | **6** | **10** | **12** | **15** |  |

**Ans 3.**

To solve the transportation problem using Vogel's Approximation Method (VAM) to find the Initial Basic Feasible Solution (IBFS) and then optimize it using the MODI method, follow these steps:

### Step 1: Set up the Transportation Table

| Source/ Destination | D1 | D2 | D3 | D4 | Supply |
| --- | --- | --- | --- | --- | --- |
| S1 | 21 | 16 | 25 | 13 | 11 |
| S2 | 17 | 18 | 14 | 23 | 13 |
| S3 | 32 | 27 | 18 | 41 | 19 |
| Demand | 6 | 10 | 12 | 15 |  |

### Step 2: Solve Using VAM

#### Step 2.1: Calculate Penalty Values

**Assignment Set – 2**

**4. A company has four zones open and four salesmen available for assignments. The zones are not equally rich in their sales potentials. It is estimated that a typical salesman operating in each zone would bring in the following annual sales:**

|  |  |
| --- | --- |
| **Zone A** | **Rs. 126000** |
| **Zone B** | **Rs. 105000** |
| **Zone C** | **Rs. 84000** |
| **Zone D** | **Rs. 63000** |

**The four salesmen are also considered to differ in ability. It is estimated that working under the same conditions their yearly sales would be proportionately as follows:**

**Salesman P:7; Salesman Q: 5; Salesman R:5; Salesman S:4**

**If the criterion is maximum expected total sales, it is expected to assign the best salesman to the richest zone and the next best to the second richest zone and so on. Solve the given assignment problem using Hungarian Method.**

**Ans 4.**

**To solve the assignment problem using the Hungarian Method, follow these steps:**

**Step 1: Formulate the Assignment Table**

The annual sales for each salesman in each zone can be calculated by multiplying the zone's sales potential with the salesman's proportional ability:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Zone/Salesman** | **P (7)** | **Q (5)** | **R (5)** | **S (4)** |
| A (126000) | 882000 | 630000 | 630000 | 504000 |
| B (105000) | 735000 | 525000 | 525000 | 420000 |
| C (84000) | 588000 | 420000 | 420000 | 336000 |
| D (63000) | 441000 | 315000 | 315000 | 252000 |

This table represents the expected annual sales for each combination of salesman and zone.

**Step 2: Apply the Hungarian Method**

The Hungarian method involves minimizing cost, so we convert the problem into a

**5a. What is Queuing system? Briefly explain the important Operating characteristics of Queuing system.**

**b. A self-service store employs one cashier at its counter. An average of 9 customers arrives every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service rate, find**

**i. Average number of customers in the system.**

**ii. Average number of customers in queue or average queue length.**

**iii. Average time a customer spends in the system.**

**iv. Average time a customer waits before being served.**

### Ans 5.

### a. Queuing System and Its Operating Characteristics

A **queuing system** refers to a process where entities (customers, data packets, vehicles, etc.) arrive at a service facility, wait if necessary, and receive service. Queuing systems are widely used in areas like customer service counters, telecommunications, traffic management, and computer networks to analyze and optimize operations. A typical queuing system involves th

**6. What is Simulation? Write in detail the steps used in simulation processes. 4+6**

**Ans 6.**

**Meaning of Simulation**

Simulation is a technique used to model and analyze real-world systems and processes in a controlled virtual environment. It involves creating a digital representation of a system to study its behavior under various conditions without affecting the actual system. This method is widely used in operations research, engineering, and management to predict outcomes, improve processes, and support decision-making.

Simulation is particularly beneficial for studying systems that are complex, dynamic, or too costly and time-consuming to experiment with directly. For example, it can be used to optimize