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| --- | --- |
| **SESSION** | **AUG-Sep’23** |
| **PROGRAM** | **MASTER OF BUSINESS ADMINISTRATION (MBA)** |
| **SEMESTER** | **II** |
| **course CODE & NAME** | **DMBA205 OPERATIONS RESEARCH** |
|  |  |
|  |  |

**Assignment Set – 1**

**1. What is Operations Research? Write the nature and scope of Operations Research. 10**

**Ans 1.**

Operations Research (OR) is a scientific approach to decision-making, which seeks to determine the best course of action in complex scenarios. It applies analytical methods to help make better decisions, and is commonly used in a variety of fields including business, engineering, and public services.

**Nature of Operations Research**

The nature of

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**2. Solve the following linear programming problem using Two Phase Method:**

**Minimize Z = x1 - 2x2 -3x3**

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

**2x1+3x2+ 4x3 =1**

**wherex1, x2, x3 ≥ 0**

Ans 2.

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

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Min *Z* | = |  |  | *x*1 | - | 2 | *x*2 | - | 3 | *x*3 | |

**3.a) Find the total transportation cost using Vogel’s Approximation Method when the unit transportation costs, demands and supplies are as given below:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Destination**  **Origins** | **D1** | **D2** | **D3** | **D4** | **Supply** |
| **O1** | **6** | **1** | **9** | **3** | **70** |
| **O2** | **11** | **5** | **2** | **8** | **55** |
| **O3** | **10** | **12** | **4** | **7** | **70** |
| **Demand** | **85** | **35** | **50** | **45** |  |

**Answer**

**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 |
| *O*1 | 6 | 1 | 9 | 3 |  | 70 |
| *O*2 | 11 | 5 | 2 | 8 |  | 55 |
| *O*3 | 10 | 12 | 4 | 7 |  | 70 |
|  | | | | | | |
| Demand | 85 | 35 | 50 | 45 |  |  |

Here

**b) There are four jobs to be assigned to five machines. Only one job can be assigned to one machine. The amount of time in hours required for the jobs per machine are given in the following matrix:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Machines**  **Jobs** | **A** | **B** | **C** | **D** | **E** |
| **1** | **4** | **3** | **6** | **2** | **7** |
| **2** | **10** | **12** | **11** | **14** | **16** |
| **3** | **4** | **3** | **2** | **1** | **5** |
| **4** | **8** | **7** | **6** | **9** | **6** |

**Find an optimum assignment of jobs to the machines to minimize the total processing time and also find out for which machine no job is assigned. What is the total processing time to complete the jobs?**

**Answer**

**Solution:**

opporunity cost table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |  |
| A | 2 | 0 | 3 | 3 | 1 |  |
| B | 0 | 1 | 1 | 1 | 0 |  |
| C | 3 | 0 | 0 | 0 | 0 |  |
| D | 0 | 4 | 0 | 4 | 1 |  |
| E | 4 | 5 | 3 | 0 | 0 |  |
|  |  |  |  |  |  |  |

Step-3: Make

**Assignment Set – 2**

**1a. In a supermarket, the average arrival rate of customers is 10 every 30 minutes, following Poisson process. The average time taken by a cashier to list and calculate the customer’s purchase is two and a half minutes following exponential distribution. What is the probability that the queue length exceeds six? What is the expected time spent by a customer in the system? 5**

**Ans 1a.**

To solve this problem, we first identify that the supermarket queue system can be modeled as an M/M/1 queue. This is because the arrivals follow a Poisson process and the service times follow an exponential distribution.

In an M/M/1 queue:

1. The average arrival rate of customers (*λ*) is 10 customers every 30 minutes, which translates to 10/30=1/3 customers

**b) A project schedule has the following characteristics:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity** | **Time(Weeks)** | **Activity** | **Time(Weeks)** |
| **1-2** | **4** | **5-6** | **4** |
| **1-3** | **1** | **5-7** | **8** |
| **2-4** | **1** | **6-8** | **1** |
| **3-4** | **1** | **7-8** | **2** |
| **3-5** | **6** | **8-10** | **5** |
| **4-9** | **5** | **9-10** | **7** |

1. **Compute earliest start time (Es) and latest finish time (Lf) foreachevent.**
2. **Compute Total float and critical path.**

**Ans 1b.**

Let us draw AOA network diagram:

**2. What is Monte Carlo Simulation? Write in brief about the Monte Carlo Simulation Procedure. 4+6**

**Ans 2.**

Monte Carlo Simulation:

Monte Carlo simulation, named after the famous Monaco gambling resort, is a statistical technique used to understand the impact of risk and uncertainty in prediction and modeling processes. This method, often employed in fields as diverse as finance, engineering, supply chain, and science, uses randomness to solve problems that might

**3. Write short note on Tow-Person Zero Sum Game. Reduce the following game by dominance property and find optimal strategies for each player. Also find the value of game.:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **Player B** | | | | |
|  |  | **1** | **2** | **3** | **4** | **5** |
| **Player A** | **I** | **1** | **3** | **2** | **7** | **4** |
| **II** | **3** | **4** | **1** | **5** | **6** |
| **III** | **6** | **5** | **7** | **6** | **5** |
| **IV** | **2** | **0** | **6** | **3** | **1** |
|  |  |  |  |  |  |  |

**Ans 3.**

**Two-Person Zero-Sum Game Analysis**

**Reduction by Dominance:**−

1. **Row Dominance:** Compare the payoffs for Player A in each row.

* Row II is dominated by Row I for Player A because the payoffs in Row I are always at least as good as those in Row II for all strategies of Player B.
* Therefore, we can