|  |  |
| --- | --- |
| **C:\Users\ADMIN\Desktop\j.png** | **JAIPURIA INSTITUE OF MANAGEMENT, INDORE**  Post Graduate Diploma in Management (Batch 2024-26) |
| **Course Title: Operations Research, (Course Code: 40521)**  **End Term Examination, Term - III (April-May, 2025)** | |
| **Time Duration: 2 Hours Total Marks: 40** | |

*Use MS Excel Solver to answer all the questions. Students can use one book and personal Laptop in the examination hall for reference, but the answers should be attempted on Institute’s Lab desktop and submitted as an Excel file with file name as “student name and enrolment number”.*

Madhura Oils Limited (MOL) is a manufacturer of edible oil in India under brand name “Madhura”. Company currently has three manufacturing units at Rajkot (Gujarat), Indore (MP) and Sikar (Rajasthan). The company produces three types of oils: Mustered seed oil, Soyabeans oil and Groundnut oil with manufacturing capacity in all the three plants. The company markets these products in 1-liter pouches and 15-liter cans across the country. It has five major regional offices in Mumbai, NCR, Kolkata, Chennai and Nagpur which caters to respective regional demands. All these oils go through a process of cold pressing seeds to extract oil, filtering and packing. The company runs all three plants 26 days a month and in 3 shifts. Each manufacturing plant has one unit each of Cold Pressing seeds, Filtering and Packing.

Their plants require 1.5 seconds of cold pressing for soyabeans seeds, 1.3 seconds of cold pressing for groundnut seeds and one seconds of cold pressing for mustard seeds, for each liter of oil respectively. Filtering units have different timings due to different thickness of oils. For one-liter soyabean oil 1.5 seconds of filtering is required whereas for ground nut oil it is 1.2 seconds and for mustard seeds it is 1.1 seconds. The packing time is same for all type of oils which is one seconds per liter of oil.

For each liter of groundnut oil, 2.5 Kgs. of groundnuts are required. For every one liter of mustard seed oil, 2.7 Kgs. of mustard seeds are required. To produce one liter of soyabean oil, the company requires 7.8 Kgs. of soyabeans. The company procures these raw materials from local markets across the country from “Krish Upaj Mandis” markets in Gujarat Madhya Pradesh and Rajasthan. The raw materials are seasonal in nature, so, in the year 2024, the company purchased 3,000,000 Kg. soyabeans; 8,400,000 Kg. groundnuts and 6,000,000 Kg. mustard seeds.

Each liter of mustard seed oil costs Rs. 68/- to the company and is sold at price of Rs. 110/- per liter. Each liter of groundnut oil costs Rs. 122 and is sold at Rs. 210 per liter. Each liter of soyabeans oil costs the company Rs. 72 per liter and is sold at Rs. 125/- per liter. The regional demands of these oils in east, west, north, south and central regions are tabulated in Table 1. The per liter transportation costs are tabulated in table 2. The company has made a commitment for supply of minimum 300,000 liters of soyabeans oil to the market.

The portion of oil production (Out of the total edible oil produced for each type of oil by all the three plants of Madhura Oil Limited) is as below: -

Ground nut oil : - Rajkot 50 %, Indore 30 % and Sikar 20 %

Mustard seed oil : - Rajkot 10 %, Indore 20 % and Sikar 70 %

Soyabeans oil : - Rajkot 10 %, Indore 80 % and Sikar 10 %

The company has five regional managers who were rotated in the past in all these regions. Their performance is tabulated in Table 3. Any gap in sales was directly routed to market through online platforms.

In year 2024, company decided to export edible oil to a small island nation located in the Indian Ocean where only one brand of edible oil (Fortune) was present. By the end of year 2024, market share of Fortune and Madhura in this small island nation was 70:30 respectively. “Accurate Research Limited” estimated change in market share for three promotional methods which Madhura and Fortune are currently engaged in this small nation. These results are tabulated in Table 4.

Currently, the company is facing a stiff competition from competitors and is also worried about changes in customer preferences of main product i.e. mustard seed oil. The two main competitor brands are Fortune and Dhara. So, the company engaged “Accurate Research Limited” a market research organization to study customer preferences for these three brands. The company submitted its report of brand preference in December 2024, which is tabulated in Table 5.

Analyze current situation for “Madhura Oil Limited”. Apply relevant Operations Research concepts and suggest further course of action for the year 2025.

Table 1: - Oil demand in India for Madhura Oils Limited in the year 2024

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Oil Type / Region** | **Kolkata (East)** | **Mumbai (West)** | **NCR (North)** | **Chennai (South)** | **Nagpur (Central)** | **Total (Kg.)** |
| **Ground Nut oil** | 30,000 | 19,40,000 | 4,00,000 | 90,000 | 9,00,000 | 33,60,000 |
| **Mustard seed oil** | 1,50,000 | 75,000 | 15,00,000 | 46,200 | 1,50,000 | 19,21,200 |
| **Soyabeans oil** | 30,000 | 50,000 | 50,000 | 1,00,000 | 70,000 | 3,00,000 |

Table 2: - Transportation costs (Rs. Per Kg of oil)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Plant / Market** | **Kolkata** | **Mumbai** | **NCR** | **Chennai** | **Nagpur** |
| **Rajkot** | 6.48 | 2.34 | 3.62 | 5.43 | 3.24 |
| **Indore** | 4.68 | 2.16 | 2.88 | 5.56 | 1.62 |
| **Sikar** | 5.76 | 4.32 | 1.08 | 7.57 | 3.96 |

Table 3: - Past performance of regional managers (Sale of 000 Liters of all the oils combined)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Region / Manager** | **Shubham** | **Rohit** | **Hemant** | **Jaspreet** | **Shivam** |
| **East** | 10,50,000 | 12,50,000 | 9,30,000 | 12,00,000 | 11,50,000 |
| **West** | 12,00,000 | 13,50,000 | 13,30,000 | 10,80,000 | 6,00,000 |
| **North** | 9,50,000 | 15,70,000 | 14,50,000 | 9,00,000 | 7,00,000 |
| **South** | 1,90,000 | 2,70,000 | 16,00,000 | 16,60,000 | 18,60,000 |
| **Central** | 13,00,000 | 12,50,000 | 13,40,000 | 13,50,000 | 3,40,000 |

Table 4: - Promotional methods study by Accurate Research Limited

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Estimated market share**  **for**  **Madhura** | | **Fortune’s Promotional Strategy** | | |
| **Advertisement** | **Sales Promotion** | **Events Sponsorship** |
| **Madhura’s Promotional Strategy** | **Advertisement** | 37 | 27 | 35 |
| **Sales Promotion** | 27 | 35 | 34 |
| **Events Sponsorship** | 25 | 34 | 34 |

Table 5: - Market research result by Accurate Research Limited

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer No.** | **Brand used in year 2024** | **Brand preference in year 2025** |  | **Customer No.** | **Brand used in year 2024** | **Brand preference in year 2025** |
| 1 | Madhura | Fortune |  | 26 | Madhura | Dhara |
| 2 | Madhura | Madhura |  | 27 | Dhara | Fortune |
| 3 | Madhura | Madhura |  | 28 | Madhura | Madhura |
| 4 | Dhara | Madhura |  | 29 | Dhara | Dhara |
| 5 | Madhura | Fortune |  | 30 | Fortune | Madhura |
| 6 | Fortune | Madhura |  | 31 | Fortune | Dhara |
| 7 | Fortune | Fortune |  | 32 | Madhura | Madhura |
| 8 | Dhara | Dhara |  | 33 | Madhura | Dhara |
| 9 | Madhura | Dhara |  | 34 | Dhara | Dhara |
| 10 | Dhara | Madhura |  | 35 | Fortune | Fortune |
| 11 | Dhara | Fortune |  | 36 | Madhura | Fortune |
| 12 | Madhura | Fortune |  | 37 | Dhara | Fortune |
| 13 | Dhara | Madhura |  | 38 | Madhura | Madhura |
| 14 | Fortune | Fortune |  | 39 | Dhara | Dhara |
| 15 | Fortune | Fortune |  | 40 | Fortune | Fortune |
| 16 | Madhura | Madhura |  | 41 | Fortune | Dhara |
| 17 | Fortune | Fortune |  | 42 | Dhara | Fortune |
| 18 | Dhara | Madhura |  | 43 | Madhura | Fortune |
| 19 | Fortune | Fortune |  | 44 | Madhura | Madhura |
| 20 | Fortune | Madhura |  | 45 | Madhura | Madhura |
| 21 | Madhura | Dhara |  | 46 | Dhara | Dhara |
| 22 | Madhura | Madhura |  | 47 | Fortune | Dhara |
| 23 | Dhara | Dhara |  | 48 | Madhura | Fortune |
| 25 | Madhura | Dhara |  | 49 | Dhara | Dhara |
| 25 | Madhura | Madhura |  | 50 | Fortune | Dhara |

**The following table should NOT be given to the students**

Students are expected to perform the following analysis for Madhura Oils Limited: -

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Expectation** | **Marks** | **CLO mapped** |
| Q1 | Student is able to use LPP to find optimum production of three different type of oils for Madhura Oil Limited using MS Solver. | 10 | CLO 2 |
| Q2 | Student is able to design a transportation pattern from three factories to five markets with minimum cost using MS Solver. | 05 | CLO 2 |
| Q3 | Student is able to assign sales territories to different sales managers for maximization of sales using BIP and MS Solver. | 10 | CLO 2 |
| Q4 | Student is able to design a promotional strategy for Madhura Oils Limited using game theory model using MS Solver. | 07 | CLO 3 |
| Q5 | Student is able to analyze brand switching behavior and suggest action using Markov Chain analysis in MS Excel. | 08 | CLO 3 |