**INDIAN STATISTICAL INSTITUTE**

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B. Stat. III Year : 2018-2019

SQC & OR

**Assignment No. : 1 Full Marks : 40 Due Date :**

1. This problem is known in the literature as ***Diet Problem***. Dieticians tell us that a balanced diet must contain quantities of nutrients such as fats, vitamins, minerals etc. The medical experts and dieticians tell us that it is necessary for an adult to consume at least 75 g of proteins, 85 g of fats, and 300 g of carbohydrate daily. Table 1 below gives the food items (which are readily available in the market), analysis and their respective cost.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Food**  **Type** | **Food Value (g) per 100 g** | | | **Cost per kg (Rs)** |
| **Proteins** | **Fats** | **Carbohydrates** |
| 1 | 8.0 | 1.5 | 35.0 | 1.00 |
| 2 | 18.0 | 15.0 | - | 3.00 |
| 3 | 16.0 | 4.0 | 7.0 | 4.00 |
| 4 | 4.0 | 20.0 | 2.5 | 2.00 |
| 5 | 5.0 | 8.0 | 40.0 | 1.50 |
| 6 | 2.5 | - | 25.0 | 3.00 |
| Minimum daily requirements | 75 | 85 | 300 |  |

Find out the food that should be recommended from a large number of alternative sources of these nutrients so that the total cost of food satisfying the minimum requirements of balanced diet is the lowest.

[15]

1. Two alloys, *A* and *B* are made from four different metals, I, II, III and IV, according to the following specifications:

|  |  |  |
| --- | --- | --- |
| **Alloy** | **Specifications** | **Selling price ($)/ton** |
| *A* | At most 80% of I | 200 |
|  | At least 30% of II |  |
|  | At least 50% of IV |  |
| *B* | Between 40% & 60% of II | 300 |
|  | At least 30% of III |  |
|  | At most 70% of IV |  |

The four metals, in turn, are extracted from three different ores with the following data:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Ore** | **Max. Quantity (tons)** | **Constituents (%)** | | | | | **Purchase Price ($)/ton** |
| **I** | **II** | **III** | **IV** | **others** |
| 1 | 1000 | 20 | 10 | 30 | 30 | 10 | 30 |
| 2 | 2000 | 10 | 20 | 30 | 30 | 10 | 40 |
| 3 | 3000 | 5 | 5 | 70 | 20 | 0 | 50 |

How much of each alloy should be produced to maximize the profit. Formulate the problem as a LP model.

[25]