# ASSIGNMENT

**OPT Course AMPBA Batch 19**

1. **Farm Owner (15 marks)**

A farm owner in Des Moines, Iowa, is interested in determining how to divide the farmland among the four different types of crops. The farmer owns two farms in separate locations and has decided to plant the following four types of crops in these farms: Corn, Wheat, Bean, and Cotton. The first farm consists of 1450 acres of land, while the second farm consists of 850 acres. Any of the four crops may be planted on either farm. However, after a survey of the land, based on the characteristics of the farmlands, the table below shows the maximum acreage restrictions the farm owner has placed for each crop.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Farm** | **Corn** | **Wheat** | **Bean** | **Cotton** |
| **Farm 1** | 550 | 450 | 350 | 400 |
| **Farm 2** | 250 | 300 | 200 | 350 |

The profit per acre for each crop is estimated as follows:

|  |  |
| --- | --- |
| **Crop** | **Profit/Acre** |
| **Corn** | $500 |
| **Wheat** | $400 |
| **Bean** | $300 |
| **Cotton** | $350 |

In determining the optimal land cultivation, the farm owner has to account for the cost of fertilizer estimate for each acre of land. Due to the different terrain and soil, the two farms have different costs of fertilizer per acre.

|  |  |
| --- | --- |
| **Farm** | **Cost Of Fertilizer/Acre** |
| **Farm 1** | $100 |
| **Farm 2** | $70 |

Seasonal demand for the four crops:

|  |  |
| --- | --- |
| **Crop** | **Seasonal demand (acres worth)** |
| **Corn** | 450 |
| **Wheat** | 550 |
| **Bean** | 400 |
| **Cotton** | 600 |

The farm owner has a storage facility that can store 100 acres of excess supply of different crops. In addition, the farm owner wants to ensure the total wheat and

bean cultivation must be proportionally equal to the maximum acreage restrictions of both the farms.

# Required:

1. Develop a linear programming model that will enable the farm owner to determine the optimal plantation of each crop on each farm to maximize the profit.
2. Formulate this problem as an LP problem and solve it by computer procedure.
3. Analyze the sensitivity report of the problem and describe the reduced cost, dual values, and allowable limits.

Create a managerial report for submission to the farm owner. Provide snapshots of your solutions in your report for more clarity.

1. **Reep Construction (25 marks)**

Reep Construction recently won a contract for the excavation and site preparation of a new rest area on the Pennsylvania Turnpike. In preparing his bid for the job, Bob Reep, founder and president of Reep Construction, estimated that it would take four months to perform the work and that 10, 12, 14, and 8 trucks would be needed in months 1 through 4, respectively.

The firm currently has 20 trucks of the type needed to perform the work on the new project. These trucks were obtained last year when Bob signed a long-term lease with PennState Leasing. Although most of these trucks are currently being used on existing jobs, Bob estimates that one truck will be available for use on the new project in month 1, two trucks will be available in month 2, three trucks will be available in month 3, and one truck will be available in month 4. Thus, to complete the project, Bob will have to lease additional trucks.

The long-term leasing contract with PennState has a monthly cost of $600 per truck. Reep Construction pays its truck drivers $20 an hour, and daily fuel costs are approximately $100 per truck. All maintenance costs are paid by PennState Leasing. For planning purposes, Bob estimates that each truck used on the new project will be operating eight hours a day, five days a week for approximately four weeks each month. Bob does not believe that current business conditions justify committing the firm to additional long-term leases. In discussing the short-term leasing possibilities with PennState Leasing, Bob learned that he can obtain short-term leases of 1–4 months. Short-term leases differ from long-term leases in that the short-term leasing plans include the cost of both a truck and a driver. Maintenance costs for short-term leases also are paid by PennState Leasing. The following costs for each of the four months cover the lease of a truck and driver:

|  |  |
| --- | --- |
| **Length of Lease** | **Cost per Month ($)** |
| **1** | **4400** |
| **2** | **4000** |
| **3** | **3500** |
| **4** | **3200** |

Bob Reep would like to acquire a lease that would minimize the cost of meeting the monthly trucking requirements for his new project, but he also takes great pride in the fact that his company has never laid off employees. Bob is committed to maintaining his no-layoff policy; that is, he will use his own drivers even if costs are higher.

**Managerial Report**

Perform an analysis of Reep Construction’s leasing problem and prepare a report for Bob Reep that summarizes your findings. Be sure to include information on and analysis of the following items:

1. The optimal leasing plan
2. The costs associated with the optimal leasing plan
3. Sensitivity analysis and a detailed managerial report for the same.

**Assignment Instructions**

**This is the group assignment and has 40% weightage in the course.**

**Deliverables:**

1. A .pdf file document. Include any material (table/figures) to support your answers as exhibits. **Maximum no of pages allowed is 6 excluding the exhibits.**
2. Excel or code files used to solve the assignment.

**General Instructions:**

1. Attach **Assignment Submission Form** on the first page of your submission. Your submission will not be accepted or penalized without the Assignment Submission form being submitted.
2. The word file should be named as “**Group-nn**” where **nn** is your group number.
3. Make sure that **only one person** from the group submits the assignment.
4. Type your group member full names and PGIDs on the first page of the Assignment. Marks will not be awarded if the name(s) are missing.
5. **Please do not copy the complete questions, just mention question number.**
6. Please do not submit .zip files, the submission will not be considered.
7. Late submission penalties are applicable according to the course outline.
8. The honor code for this assignment is **2N-a.** Please look through the honor code restrictions carefully before attempting the assignment as there will be strong consequences for breaking them.
9. Handwritten content will not be considered for evaluation.
10. Submission will not be considered if the instructions are not followed.
11. Kindly fill in the **Peer Evaluation form** available on LMS before **11.45 PM, May 15th , 2023.** You can refer to the Students Handbook to understand the calculations.

**Assignment Deadline: 14th May 2023, 11:55 pm**

**Peer Evaluation Form Link:** [**https://forms.office.com/r/6XyQrDJHks**](https://forms.office.com/r/6XyQrDJHks)

**Peer Evaluation Form Deadline: 15th May 2023, 11:45 pm**