# ALY6050 Module Five Project

**Project:** *Using Linear Programming Models to maximize profits*

The submission of each weekly project will consist of an Excel workbook (or an R script file if R has been used) and a Word document– a minimum of two submissions that have been submitted as attachments. For each weekly project, students should complete their analytic work in an Excel workbook and write a minimum of 1500 words in a Word document describing their findings. The Word document should be according to the APA standards, i.e., it consists of a title page (including student's name, assignment title, course number and title, the current academic term, instructor's name, and the assignment completion date), and a reference page. The Word submission of each project will consist of three sections:

(i) Introduction
(ii) Analysis
(iii) Conclusion

**Project:**

A northern hardware company is studying a plan to open a new distribution center in the northeast. The company plans to rent a warehouse and an adjacent office and distribute its main products to the local dealers. The company has decided initially to start with four of its main products: Pressure washers, Lawn mower, Snow blowers, and Water pumps. The table below describes how much each of the products will cost the company (including transportation costs):

| Item | Cost (in Dollars) |
|---|---|
| Pressure washer | 349.99 |
| Lawn mower | 379.99 |
| Snow blower | 529.99 |
| (Case of 4 Water pumps) | 500 |

Table 1: Costs of products in dollars

The company has set aside a purchasing monthly budget of $130,000 for the new location. The selling prices (per unit) for each item are given in the table below:

| Item | Selling Price (in Dollars) |
|---|---|
| Pressure washer | 569.99 |
| Lawn mower | 679.99 |
| Snow blower | 909.99 |
| Water pump | 259.99 |

Table 2: Revenues of products in dollars

Other than the budget, another of the company's concern is the available space in the warehouse. The warehouse has 70 shelves, and each shelf is 30 ft long and 5 ft wide. Pressure washers and snow blowers each are stored on 5 ft by 5 ft pallets whereas each lawn mower is stored on an 8 ft by 5 ft pallet. Furthermore, a 5 ft by 5 ft pallet is used to store **five cases** of water pumps.

For promoting its brand products, the company's marketing department has decided to allocate at least 35% of its inventory (by item numbers) to pressure washers and lawn mowers and sell snow blowers at least 1.5 times as many as water pumps.

Perform a monthly analysis using a linear programming model to maximize the company's net profit.

Complete the following in a Word document and in an Excel workbook (or R). Submit both the Word document and the Excel workbook (or R script file) as attachments.

1. In a Word document, write the mathematical formulation of the problem.
2. Set up the linear programming formulation in an Excel workbook or R.
3. Use the Excel Solver or R to solve the problem and generate a sensitivity report.
4. Describe the optimal solutions obtained in the Word document. These will consist of the inventory level for all four products and the optimal monthly profit.
5. One of the decision variables has an optimal value of zero. Use the Solver sensitivity report to determine the smallest selling price for that item so that this optimal zero solution value changes to a non-zero value.
6. In the word document explain whether, in addition to the $130,000 allocated to the purchasing budget during the first month, the company should allocate additional money. If yes, how much additional investment do you recommend, and how much should the company expect its net monthly profit to increase as a consequence of this increase? Round the result to the nearest dollar.
7. In the word document, explain whether you recommend that the company should rent a smaller or a larger warehouse. In any case, indicate the ideal size of your recommended warehouse in square feet, and indicate how much this change in the size of the warehouse will contribute to the monthly profit. Round the result to the nearest dollar.