**Module 5 Project 5**

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**By**

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**Title: Project 5 Report**

**ALY 6050 – Introduction to Enterprise Analytics**

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**Introduction**

In this assignment, I am using MS Excel to work on 2 different problems as given. It helps us to identify and develop a model with the total profit and maximization of it. This gives an idea about the profit optimization models, excel solver, data table, and implementation of the model. Linear Programming is a technique used in solving the allocation problems and has become a usual tool for businesses and organizations.

In Problem 1 & 2 I have used optimization techniques to maximize the efficiency of the model. In Excel, we can simply access it by clicking on Solver in Analyze tab under the Data tab. I will also tend to determine the type of evaluations for each problem and showcase the results, and findings. In this report, I have implemented 2 Problems and their related questions.

**Analysis**

**Problem 1:**

Let, Small, Medium, Large are the compressors given. As, the quantiites are positive in nature we assume that S, M, L are greater than 0.

As per the question given, there is 23400 mins – Bending Time. So, here the restraint is 0.4S + 0.7M + 0.8L <= 23400. Similarly, for Welding Time is 23400 mins. So, the restraint is 0.6S + M + 1.2L <= 23400. And, for Painting Time is 46800 mins. So, the constraint is 1.4S + 2.6M + 3.1L <= 46800

Also, there are monthly sales min and max restrictions on Small, Medium, and Large. They are S lies in between <= 14000 to 21000, M in between <= 6200 to 12500, and L is in <= 2600 to 4200. The profit per compressors types are $20.50, $34.00, and $42.00. So, the Objective function is 20.5S + 34M + 42L.

In this way, let’s setup the Excel Sheet and click on the Solver to give the objective function, to define constraints, and solving model to derive the results. After this step, I have observed that Klein Industries has to manufacture 16517 control valves, 6200 metering pumps, and 2600 hydraulic cylinders to maximize their profits. The profit that can be maximized with these things is 651221.4286. I also generated a Sensitivity Report in which I have observed the Allowable Increase and Decrease values. The values that can be increased for the M and L are $4.07 and $3.39. Likewise, the allowable decrease for S are $1.53.

The lower limits for M and L can get decreased to 2607 and 2187. The lower limits of S, M, L can be increased by 2157, 1161, 974. The upper limits that can be reduced to 4842, 6300, 1600. The shadow price shown in the table with the lower limits for M and L are -$4.08 and -$3.39. -$14.64 is the restraint on the Painting.

**Problem 2(A):**

In this problem, the Shafer Office Supplies has 4 distribution centers namely Atlanta, Cincinnati, Chicago, and Salt Lake City. It also ships to 12 various locations. It is aiming to decrease its monthly transportation of shipping cost by using the optimization models. For this, I have clicked on the Data tab and clicked on the solver. After that, I have set the objective function to maximize the profits. Selected the decision variables and defined the constraints. In this, I had chosen Simplex Linear model to solve and obtained the optimal solution.

The minimum cost that can be associated with it is **$56335**

**Problem 2(B):**

The Milwaukee and Salt Lake City distribution centers are equal and operating to their fullest capacities. For more Analysis, I have opted to view it in a Sensitivity Report.

**Problem 2(C):**

As per the question, I need to find the distribution center which requires extra 500 units that to be supplied. After observing the Sensitivity Report, I got to found the Shadow price that is increased by 1. For Salt Lake City, it is -1.45 and it is clearly in loss so this center requires extra 500 supply units to recover.

**Problem 2(D):**

From the Sensitivity Report, we can see the Allowable Increase and Allowable Decrease columns, where it tells us the objective function that can be changed or altered if the optimal value is changed. AS given in the question, if the cost of shipping is increased to $0.3 that means it is a decrease of $0.05 i.e., $0.3 – $0.35. This value which got decreased is not in the Allowable Increase/ Decrease column. So, the optimal value for this model will get changed/ modified.

**Conclusion**

From this project, I have gained a lot of knowledge and got familiar with the optimization techniques, MS Excel Solver, Linear Programming, Optimization Models, and decision modeling. I used Solver to predict the best value (Maximizing the profits or minimizing the shipping costs) for the decision to take and showcase the optimal solutions. The solver function is very much useful and I found it a good resource to play on and experiment with. Now, I am clear and will work on these concepts very well with deep understanding. Also, I have worked on the calculations to find the best solutions. So, I used these analyses and models to define and predict the prices and forecasted them. Also, working on MS Excel allowed me to work on these techniques. I previously did not work on these aspects, but from this Assignment, I had a great time learning them. In the coming days and assignments, I will make sure to use this knowledge and apply it to the problems.