ALY6050-Introduction to Enterprise Analytics

Prescriptive Model for Strategic decision making

19 march 2023

**INTRODUCTION:**

This project is primarily concerned with advising businesses on how to maximize their inventory management decisions. The aim is to discover the ideal time to order goods in order to reduce total inventory costs. To do this, the project will include Excel tabulations and R simulations. The project is divided into two sections. Consequently, the company's inventory will be carried out at the lowest feasible cost. The following inventory details are provided:

• Yearly demand: 15,000 pieces

• Unit cost: $80

• Stock-keeping cost: 18%

• Supplier cost: $220

PART 1(excel):

To begin, data is classified as uncontrolled inputs, model parameters, and decision variables.

Unit cost and supplier cost are uncontrollable inputs.

Yearly holding cost % is one of the model factors.

Order amount, double quantity, and number of orders are decision factors.

After that, I computed the yearly ordering and holding costs using mathematical formulae, and then the overall cost.

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| --- | --- | --- | --- | --- |
| ANNUAL DEMAND | UNIT COST | HOLDING PERCENT | HOLDING COST | SUPPLIER COST |
| 15000.00 | $80.00 | 18% | $14.40 | $220.00 |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | SOLVER | CALCULATED |
| DECISION VARIABLES | EOQ | 338.50159 | 677 |
| DOUBLE ORDER QUANTITY | 677.00319 | 338.5 |
| NUMBER OF ORDER | 22.16 | 22 |

A one-way tabulation was performed in Excel by assuming the inventory level was 100 and increasing it by 25 up to 800. Then I calculated the total cost for each value to see which had the lowest cost. The highlighted total cost is the most affordable of all. A plot of inventory vs total cost was also created.

|  |  |  |
| --- | --- | --- |
| INVENTORY | DOUBLE INVENTORY | TOTAL COST |
| 100 | 200 | $17,940.00 |
| 125 | 250 | $15,000.00 |
| 150 | 300 | $13,160.00 |
| 175 | 350 | $11,948.57 |
| 200 | 400 | $11,130.00 |
| 225 | 450 | $10,573.33 |
| 250 | 500 | $10,200.00 |
| 275 | 550 | $9,960.00 |
| 300 | 600 | $9,820.00 |
| 325 | 650 | $9,756.92 |
| 350 | 700 | $9,754.29 |
| 375 | 750 | $9,800.00 |
| 400 | 800 | $9,885.00 |

The graph below demonstrates the connection between inventory level and cost. The cost appears to reduce at the first inventory level to a minimum of 350 and then grow as inventory increases.

The unit cost data is subjected to a what-if analysis by varying the beginning cost per unit from 70 to 80 and the supplier cost from 210 to 230. With a total cost of 80 and a supplier cost of 220, we can see that figure, 9754.2 is close to the minimal cost determined above using mathematical functions.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9754.29 | 210.00 | 211.00 | 212.00 | 213.00 | 214.00 | 215.00 | 216.00 | 217.00 | 218.00 | 219.00 | 220.00 |
| 70.00 | 8910.00 | 8931.43 | 8952.86 | 8974.29 | 8995.71 | 9017.14 | 9038.57 | 9060.00 | 9081.43 | 9102.86 | 9124.29 |
| 71.00 | 8973.00 | 8994.43 | 9015.86 | 9037.29 | 9058.71 | 9080.14 | 9101.57 | 9123.00 | 9144.43 | 9165.86 | 9187.29 |
| 72.00 | 9036.00 | 9057.43 | 9078.86 | 9100.29 | 9121.71 | 9143.14 | 9164.57 | 9186.00 | 9207.43 | 9228.86 | 9250.29 |
| 73.00 | 9099.00 | 9120.43 | 9141.86 | 9163.29 | 9184.71 | 9206.14 | 9227.57 | 9249.00 | 9270.43 | 9291.86 | 9313.29 |
| 74.00 | 9162.00 | 9183.43 | 9204.86 | 9226.29 | 9247.71 | 9269.14 | 9290.57 | 9312.00 | 9333.43 | 9354.86 | 9376.29 |
| 75.00 | 9225.00 | 9246.43 | 9267.86 | 9289.29 | 9310.71 | 9332.14 | 9353.57 | 9375.00 | 9396.43 | 9417.86 | 9439.29 |
| 76.00 | 9288.00 | 9309.43 | 9330.86 | 9352.29 | 9373.71 | 9395.14 | 9416.57 | 9438.00 | 9459.43 | 9480.86 | 9502.29 |
| 77.00 | 9350.65 | 9372.43 | 9393.86 | 9415.29 | 9436.71 | 9458.14 | 9479.57 | 9501.00 | 9522.43 | 9543.86 | 9565.29 |
| 78.00 | 9409.15 | 9432.23 | 9455.31 | 9478.29 | 9499.71 | 9521.14 | 9542.57 | 9564.00 | 9585.43 | 9606.86 | 9628.29 |
| 79.00 | 9467.65 | 9490.73 | 9513.81 | 9536.88 | 9559.96 | 9583.04 | 9605.57 | 9627.00 | 9648.43 | 9669.86 | 9691.29 |
| 80.00 | 9526.15 | 9549.23 | 9572.31 | 9595.38 | 9618.46 | 9641.54 | 9664.62 | 9687.69 | 9710.77 | 9732.86 | 9754.29 |
| 81.00 | 9584.65 | 9607.73 | 9630.81 | 9653.88 | 9676.96 | 9700.04 | 9723.12 | 9746.19 | 9769.27 | 9792.35 | 9815.42 |
| 82.00 | 9643.15 | 9666.23 | 9689.31 | 9712.38 | 9735.46 | 9758.54 | 9781.62 | 9804.69 | 9827.77 | 9850.85 | 9873.92 |
| 83.00 | 9701.65 | 9724.73 | 9747.81 | 9770.88 | 9793.96 | 9817.04 | 9840.12 | 9863.19 | 9886.27 | 9909.35 | 9932.42 |
| 84.00 | 9760.15 | 9783.23 | 9806.31 | 9829.38 | 9852.46 | 9875.54 | 9898.62 | 9921.69 | 9944.77 | 9967.85 | 9990.92 |
| 85.00 | 9818.65 | 9841.73 | 9864.81 | 9887.88 | 9910.96 | 9934.04 | 9957.12 | 9980.19 | 10003.27 | 10026.35 | 10049.42 |
| 86.00 | 9877.15 | 9900.23 | 9923.31 | 9946.38 | 9969.46 | 9992.54 | 10015.62 | 10038.69 | 10061.77 | 10084.85 | 10107.92 |
| 87.00 | 9935.65 | 9958.73 | 9981.81 | 10004.88 | 10027.96 | 10051.04 | 10074.12 | 10097.19 | 10120.27 | 10143.35 | 10166.42 |
| 88.00 | 9994.15 | 10017.23 | 10040.31 | 10063.38 | 10086.46 | 10109.54 | 10132.62 | 10155.69 | 10178.77 | 10201.85 | 10224.92 |
| 89.00 | 10052.65 | 10075.73 | 10098.81 | 10121.88 | 10144.96 | 10168.04 | 10191.12 | 10214.19 | 10237.27 | 10260.35 | 10283.42 |
| 90.00 | 10110.00 | 10134.23 | 10157.31 | 10180.38 | 10203.46 | 10226.54 | 10249.62 | 10272.69 | 10295.77 | 10318.85 | 10341.92 |

PART 1(r):

The same modeling was performed in R with identical parameters, and the results can be tallied with excel.

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Chart, line chart

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PART 2:

This section involves simulating 1000 events in order to compute the overall cost for each occurrence. Triangular distribution:

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To do so, first compute the statistics of the triangular distribution K, M, N, x, and y. The yearly demand simulation is summarized here. The anticipated yearly number of orders is 2523.

After this simulation the data frame is created which stores the simulation values from which I found the value of minimum cost.

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After this calculation, t-test was done with 95% Confidence interval to test the validity of above values.

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Conclusion:

Based on the discussion, I believe that the lowest overall inventory cost is roughly 9750 usd. This is the lowest overall cost determined and confirmed using hypothetical excel modelling. I can see from simulated model in R that our anticipated value and minimal total cost are not as meaningful as the model suggested, because all p values are less than critical value of 0.05, which is evident for 95% confidence levels.

**Reference:**

Real Statistics Using Excel. (n.d.). Retrieved from [https://www.real-statistics.com/](mailto:https://www.real-statistics.com/)

Microsoft. (n.d.). Excel functions by category. Retrieved from [https://support.microsoft.com/en-us/office/excel-functions-by-category-5f91f4e9-7b42-46d2-9bd1-63f26a86c0eb](mailto:https://support.microsoft.com/en-us/office/excel-functions-by-category-5f91f4e9-7b42-46d2-9bd1-63f26a86c0eb)

Real Statistics Using Excel. (n.d.). Triangular Distribution. Retrieved from [https://www.real-statistics.com/probability-distributions/triangular-distribution/](mailto:https://www.real-statistics.com/probability-distributions/triangular-distribution/)

*What-if analysis in Excel*. Excel Tutorial. (n.d.). Retrieved March 17, 2023, from https://www.excel-easy.com/data-analysis/what-if-analysis.html

Tarver, E. (2022, July 8). *How is the Economic Order Quantity Model used in inventory management?* Investopedia. Retrieved March 17, 2023, from https://www.investopedia.com/ask/answers/052715/how-economic-order-quantity-model-used-inventory-management.asp