MG-GY 9753: Business Analytics

<<<Fall-2017 >>>

Short Case 3 Report

Submitted by

<<<Rushi Thakar>>>

1. **Production Mix:**
2. **Number of Drones to be produced:**
3. Albatross: 22.5806
4. Crane: 103.2258
5. Eagle: 77.4194
6. Hawk: 22.5807
7. **Total Monthly Revenue**: $3,235,484
8. **Monthly Operating Profit**: Total Monthly Revenue – Total Production Cost

= 3,235,484-3004516.129

= $230,967.7

1. **Three Premier Solver Report:**
2. **Answer Report:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Objective Cell (Max) | | |  |  |  |  |  |
|  | **Cell** | **Name** | **Original Value** | **Final Value** |  |  |  |
|  | $C$56 | Profit Albatross | -1850000 | 230967.7419 |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Decision Variable Cells | | |  |  |  |  |  |
|  | **Cell** | **Name** | **Original Value** | **Final Value** | **Type** |  |  |
|  | $C$17 | Quantity Produced Albatross | 0 | 22.58064516 | Normal |  |  |
|  | $D$17 | Quantity Produced Crane | 0 | 103.2258065 | Normal |  |  |
|  | $E$17 | Quantity Produced Eagle | 0 | 77.41935484 | Normal |  |  |
|  | $F$17 | Quantity Produced Hawk | 0 | 22.58064516 | Normal |  |  |
|  |  |  |  |  |  |  |  |
| Constraints | | |  |  |  |  |  |
|  | **Cell** | **Name** | **Cell Value** | **Formula** | **Status** | **Slack** |  |
|  | $G$18 | Production Hours Used | 16064.51613 | $G$18<=$G$8 | Not Binding | 1535.483871 |  |
|  | $G$19 | Assembly Hours Used | 20032.25806 | $G$19<=$G$9 | Not Binding | 6367.741935 |  |
|  | $G$23 | Market Mixture Excess Deercrest | 0 | $G$23>=0 | Binding | 0 |  |
|  | $G$24 | Excess Deercrest | 80.64516129 | $G$24>=0 | Not Binding | 80.64516129 |  |
|  | $G$25 | Excess Deercrest | 54.83870968 | $G$25>=0 | Not Binding | 54.83870968 |  |
|  | $G$26 | Excess Deercrest | 0 | $G$26>=0 | Binding | 0 |  |
|  | $I$36 | Albatross Total Motor | 1200 | $I$36<=$H$36 | Binding | 0 |  |
|  | $I$42 | Total Batteries | 1400 | $I$42<=$H$42 | Binding | 0 |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

1. **Sensitivity Report:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Objective Cell (Max) | | |  |  |  |  |  |  |
|  | **Cell** | **Name** | **Final Value** |  |  |  |  |  |
|  | $C$56 | Profit Albatross | 230967.7419 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| Decision Variable Cells | | |  |  |  |  |  |  |
|  |  |  | **Final** | **Reduced** | **Objective** | **Allowable** | **Allowable** |  |
|  | **Cell** | **Name** | **Value** | **Cost** | **Coefficient** | **Increase** | **Decrease** |  |
|  | $C$17 | Quantity Produced Albatross | 22.58064516 | 0 | 12600 | 1896.551724 | 15100 |  |
|  | $D$17 | Quantity Produced Crane | 103.2258065 | 0 | 10500 | 686.3636364 | 2272.727273 |  |
|  | $E$17 | Quantity Produced Eagle | 77.41935484 | 0 | 7600 | 2900 | 503.3333334 |  |
|  | $F$17 | Quantity Produced Hawk | 22.58064516 | 0 | 5500 | 1562.5 | 15100 |  |
|  |  |  |  |  |  |  |  |  |
| Constraints | | |  |  |  |  |  |  |
|  |  |  | **Final** | **Shadow** | **Constraint** | **Allowable** | **Allowable** |  |
|  | **Cell** | **Name** | **Value** | **Price** | **R.H. Side** | **Increase** | **Decrease** |  |
|  | $G$18 | Production Hours Used | 16064.51613 | 0 | 17600 | 1E+30 | 1535.483871 |  |
|  | $G$19 | Assembly Hours Used | 20032.25806 | 0 | 26400 | 1E+30 | 6367.741935 |  |
|  | $G$23 | Market Mixture Excess Deercrest | 0 | -1774.193548 | 0 | 62.96296296 | 24.13793103 |  |
|  | $G$24 | Excess Deercrest | 80.64516129 | 0 | 0 | 80.64516129 | 1E+30 |  |
|  | $G$25 | Excess Deercrest | 54.83870968 | 0 | 0 | 54.83870968 | 1E+30 |  |
|  | $G$26 | Excess Deercrest | 0 | -1612.903226 | 0 | 108.6956522 | 21.875 |  |
|  | $I$36 | Albatross Total Motor | 1200 | 1450 | 1200 | 109.6774194 | 161.2903226 |  |
|  | $I$42 | Total Batteries | 1400 | 243.5483871 | 1400 | 217.3913043 | 117.2413793 |  |
|  |  |  |  |  |  |  |  |  |

1. **Limits Report:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  | **Objective** |  |  |  |  |  |  |  |  |
|  | **Cell** | **Name** | **Value** |  |  |  |  |  |  |  |
|  | $C$56 | Profit Albatross | 230967.7419 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  | **Decision Variable** |  |  | **Lower** | **Objective** |  | **Upper** | **Objective** |  |
|  | **Cell** | **Name** | **Value** |  | **Limit** | **Result** |  | **Limit** | **Result** |  |
|  | $C$17 | Quantity Produced Albatross | 22.58064516 |  | 22.58064516 | 230967.7419 |  | 22.58064516 | 230967.7419 |  |
|  | $D$17 | Quantity Produced Crane | 103.2258065 |  | 13.62007168 | -709892.4731 |  | 103.2258065 | 230967.7419 |  |
|  | $E$17 | Quantity Produced Eagle | 77.41935484 |  | 16.4874552 | -232114.6953 |  | 77.41935484 | 230967.7419 |  |
|  | $F$17 | Quantity Produced Hawk | 22.58064516 |  | 22.58064516 | 230967.7419 |  | 22.58064516 | 230967.7419 |  |
|  |  |  |  |  |  |  |  |  |  |  |

**Formulas:**

**Objective:**

Maximize the profit, where profit = Total revenue – operation cost

**Constrains:**

* Total Number of hours used in production department should not exceed 17,600
* Total Number of hours used in assembly department should not exceed 26,400
* Quantity of Albatross should not be less than 10% of Total Production.
* Quantity of Crane should not be less than 10% of Total Production.
* Quantity of Eagle should not be less than 10% of Total Production.
* Quantity of Hawk should not be less than 10% of Total Production.
* Total motor consumption in a month should not exceed 1200.
* Total Battery consumption in a month should not exceed 1400.

**Costing:**

Drone Cost: 300\*Motor+200\*Batteries + Other Accessories

Labor Cost: Number of Labor \* Monthly salary

Number of Hours: Total number of workers \* (Hours/Day) \* (Days/Months)

Operation Cost: Labor cost + Drone Cost

Total revenue: Quantity of Drone \* Selling cost of Drone

Profit : Total Revenue – Operation Cost

**Constrains:**

* Total Number of hours used in production <=17,600
* Total Number of hours used in Assembly <=26,400
* Quantity produced of Albatross drone – 0.10 \*(Total quantity of drones) > 0
* Quantity produced of Crane drone – 0.10 \*(Total quantity of drones) > 0
* Quantity produced of Eagle drone – 0.10 \*(Total quantity of drones) > 0
* Quantity produced of Hawk drone – 0.10 \*(Total quantity of drones) > 0
* Total Motor consumption <= 1200
* Total Battery Consumption <= 1400

1. **Profit:**

Monthly Operating Profit: Total Monthly Revenue – Total Production Cost

= 3,235,484-3004516.129

= $230,967.7

1. **What-If Analysis:**
2. **In your optimum production mix, do some production workers remain unused? If so, how many? If they are not hired, will the company’s operating profit increase? If so, how much?**

* Unused Production Workers/month: 8

Hours Unused: 1535.4839/8 \*22

Yes, By not hiring 8 workers company’s profit increases by $64,000.

1. **In your optimum production mix, do some assembly workers remain unused? If so, how many? If they are not hired, will the company’s operating profit increase? If so, how much?**

* Unsued Assembly Worker/month: 36

Yes, By not hiring 36 assembly worker company’s profit increases by $252,000.

1. **The motor supplier, which is based in Louisiana, faced an unexpected hurricane last month and is able to deliver only 1100 motors instead of the scheduled 1200 motor. Will this problem affect your optimum production mix? What will be the loss in operating profit incurred by the company?**

* If supplier supply only 1100 motors if will incur in $144,999.96 loss. And It will affect production mix by increasing slack of hours by 1000 in production and 1500 in assembly.

1. **Although most of the battery supplier’s customers request more batteries, due its long-term relationship with the company, it has offered to the company to provide additional 100 batteries beyond the scheduled 1400 this month. Should the company buy additional 4 battery? If yes, will it affect your optimum production mix? How much additional operating profit the company will be able to earn due to these additional batteries?**

* If company buys 100 more batteries it improves profit by $24,354.9 and in production mix it decreases slack hours by 290.3226 in production and 145.1613 in assembly. So yes Company should take additional 100 batteries.

1. **The high-end Albatross model faces little competition. If the company is able to increase the price of Albatross to $21,000 without affecting its demand, will your optimum production mix change? What will be the new total operating profit?**

* If company increases the selling price of high-end drone model Albatross from $20,000 to $21,000 it increases the profit by $22,580.7 and it does not affect production mix.

1. **A new competitor has recently entered the market with cheaper low–capacity drones. The company wants to reduce the price of Hawk to $7,000 to ensure that they remain in high demand. Will your optimum production mix change? What will be the new total operating profit?**

* If company lower the price of Hawk drone from $9000 to $7000 it will decrease the profit by $45161.2. But it will not affect the production mix.

1. **Find Ideal Supply Combination:**

**All Possible combination of motor and Battery:**

|  |  |  |  |
| --- | --- | --- | --- |
| $C$56 | $I$8 |  |  |
| $I$7 | 1400 | 1700 | 2000 |
| 1200 | 230967.7419 | 283913.0435 | 283913.0435 |
| 1300 | 375967.7419 | 421492.5373 | 421627.1186 |
| 1400 | 390000 | 0 | 0 |
| 1500 | 0 | 0 | 0 |
| 1600 | 0 | 0 | 0 |
| 1700 | 0 | 0 | 0 |

**Maximum Operating Profit that company can achieve** : $421627.1186

**Company should purchase 1300 motors/month.**

**Company should purchase 2000 Battery/month.**

1. **Scheduling Production over time:**
2. **January:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Albatross** | **Crane** | **Eagle** | **Hawk** |
| **Quantity Produced** | 25 | 70 | 75 | 70 |

1. **February:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Albatross** | **Crane** | **Eagle** | **Hawk** |
| **Quantity Produced** | 35 | 56.6667 | 65 | 80 |

1. **March: (Feasible solution)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Albatross** | **Crane** | **Eagle** | **Hawk** |
| **Quantity Produced** | 30 | 65 | 52.5 | 90 |

* **Inventory at the end of every month:**

1. January:

Crane: 30

Eagle: 25

1. February:

Crane: 1

1. March:

Total Inventory: Not actual solution.

Total Inventory in terms of Dollar:

January: $6000

February: $200

**Quarterly revenue of the company: $12,572,151**

**Quarterly profit of the company: $610,467.7**

**Formulas:**

**Objective:**

Maximize the profit, where profit = Total revenue – operation cost

**Constrains:**

* Total Number of hours used in production <=17,600
* Total Number of hours used in Assembly <=26,400
* Total Motor consumption <= 1200
* Total Battery Consumption <= 1400
* Production of every drone model >= monthly demand forecasted.

**Revenue:**

December: $3235483

January: $3150000

February: $3106667

March: $3080000

**Profit:**

December: $230967.7

January: $155000

February: $120000

March: $3080000

|  |
| --- |
|  |
|  |
|  |
|  |