MG-GY 9753: Business Analytics

<<<Fall-2017 >>>

Short Case 3 Report

Submitted by

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1) Production Mix:

1) Number of Drones to be produced:

1) Albatross: 22.5806
2) Crane: 103.2258
3) Eagle: 77.4194
4) Hawk: 22.5807

2) **Total Monthly Revenue**: $3,235,484

3) **Monthly Operating Profit**: Total Monthly Revenue – Total Production Cost

= 3,235,484-3004516.129

= $230,967.7

4) Three Premier Solver Report:

1) 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

2) Sensitivity Report:

Objective Cell (Max)

Cell	Name	Final Value
$C$56	Profit Albatross	230967.7419

Decision Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable 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

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable 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

3) Limits Report:

Cell	Objective Name	Value
$C$56	Profit Albatross	230967.7419

Cell	Decision Variable Name	Value	Lower Limit	Objective Result	Upper Limit	Objective 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.
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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

5) **Profit:**

Monthly Operating Profit: Total Monthly Revenue – Total Production Cost

= 3,235,484-3004516.129

= $230,967.7

2) What-If Analysis:

1) 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.

2) **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.
3) **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.
4) **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.
5) **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.
6) **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.

3) 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.

4) Scheduling Production over time:

1) January:

	Albatross	Crane	Eagle	Hawk
Quantity Produced	25	70	75	70

2) February:

	Albatross	Crane	Eagle	Hawk
Quantity Produced	35	56.6667	65	80

3) 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
  2) February:
     Crane: 1
  3) 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