Module 4 Case

Team 3

BUS2 194B

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Members

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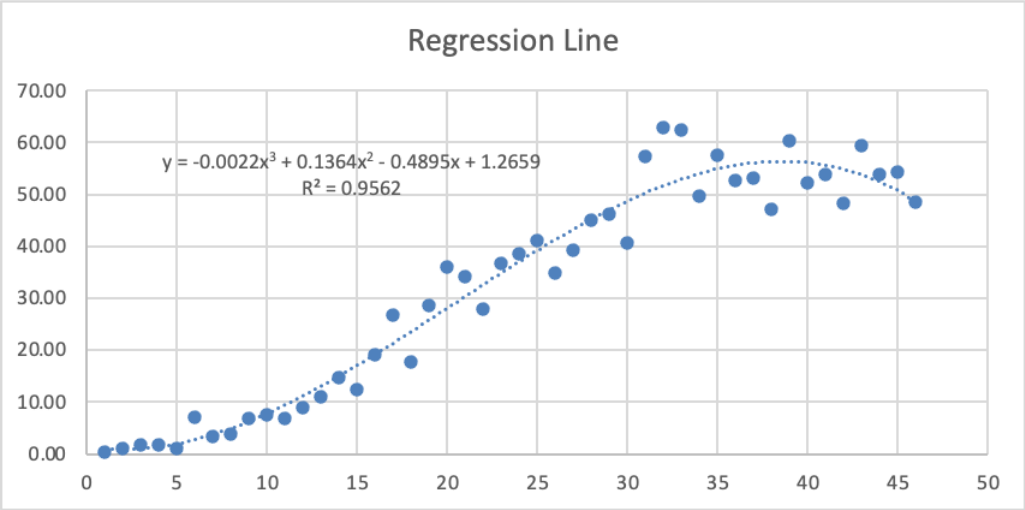
Part B.



Q1 '19: $y = -0.0022(47)^3 + 0.1364(47)^2 - 0.4895(47) + 1.2659 = 51.16$

We can predict that Q1 '19 unit sales will be 51.16 (in thousands).

Q2 '19: $y = -0.0022(48)^3 + 0.1364(48)^2 - 0.4895(48) + 1.2659 = 48.73$

We can predict that Q2 '19 unit sales will be 48.73 (in thousands).

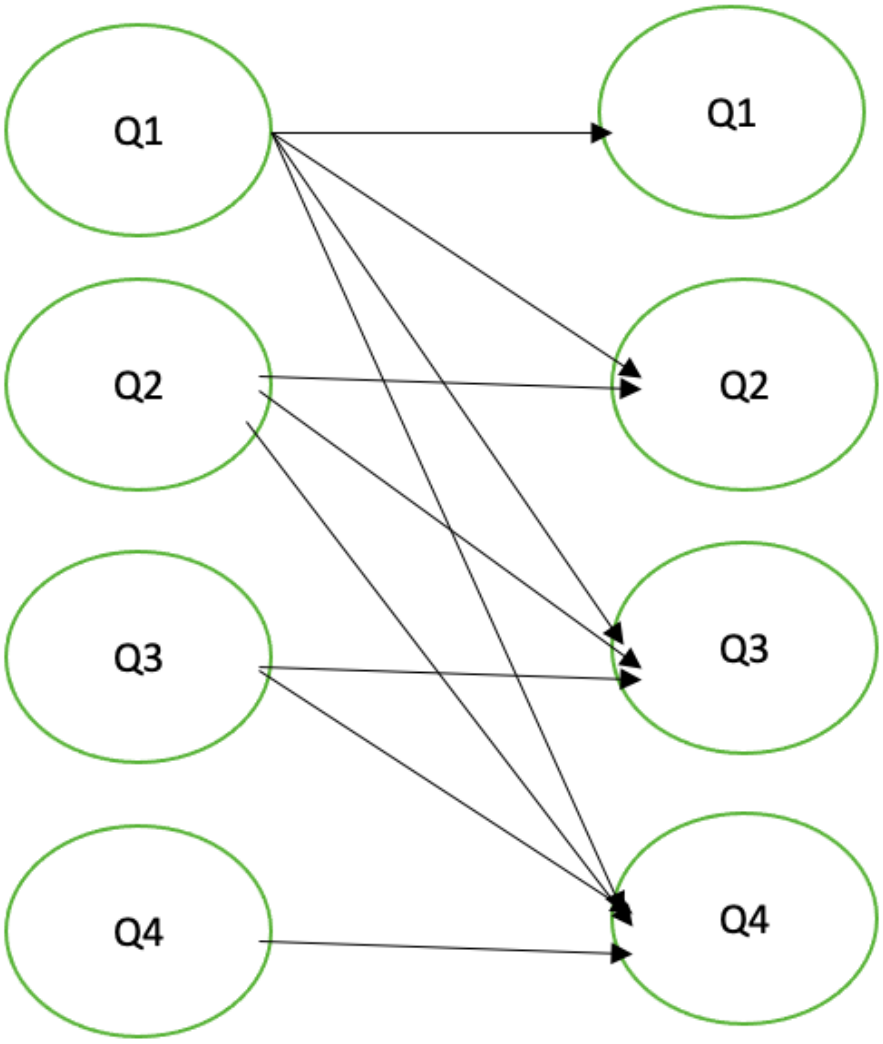
Q3 '19: $y = -0.0022(49)^3 + 0.1364(49)^2 - 0.4895(49) + 1.2659 = 45.95$

We can predict that Q3 '19 unit sales will be 45.95 (in thousands).

Q4 '19: $y = -0.0022(50)^3 + 0.1364(50)^2 - 0.4895(50) + 1.2659 = 42.79$

We can predict that Q4 '19 unit sales will be 42.79 (in thousands).

Part C.



Modeling Process

Step 1: goal

To minimize operational costs (in-house & subcontract production cost, initial payment, inventory cost, and opportunity cost) while meeting consumer demand for each quarter.

Step 2: parameters

1. Revenue per solar panel sold: $2,500
2. Production capacity:
    a. In-house: $45,000
    b. Subcontractor: $10,000
3. Production cost:
    a. In-house production cost: $1,000
    b. Subcontractor cost: $1,200
4. Inventory cost: $100/quarter
5. Fixed initial payment: $1 million
6. Opportunity cost for not selling each panel (i.e. not meeting demand): $2,500

Step 3 & 4: decision variables & constraints

1. P11,12,13,14: solar panels manufactured in our facilities in quarter 1 for use in quarter 1,2,3,4
2. S11,12,13,14: solar panels produced by the subcontractor in quarter 1 for use in quarter 1,2,3,4
3. P22,23,24: solar panels manufactured in our facilities in quarter 2 for use in quarter 2,3,4
4. S22,23,24: solar panels produced by the subcontractor in quarter 2 for use in quarter 2,3,4
5. P33,34: solar panels manufactured in our facilities in quarter 3 for use in quarter 3,4
6. S33,34: solar panels produced by the subcontractor in quarter 3 for use in quarter 3,4
7. P44: solar panels manufactured in our facilities in quarter 4 for use in quarter 4
8. S44: solar panels produced by the subcontractor in quarter 4 for use in quarter 4
9. B1,2,3,4 are binary variables (0 if we don't hire subcontractors and 1 if we do hire)

In general, production + subcontract + give up >= demand

Production:

1. P11 + P12 + P13 + P14 <= 45000 (quarter 1)
2. P22 + P23 + P24 <= 45000 (quarter 2)
3. P33 + P34 <= 45000 (quarter 3)
4. P44 <= 45000 (quarter 4)

Subcontractor:

1. S11 + S12 + S13 + S14 <= 10000 * B1 (quarter 1, B1 is binary)
2. S22 + S23 + S24 <= 10000 * B2 (quarter 2)
3. S33 + S34 <= 10000 * B3 (quarter 3)
4. S44 <= 10000 * B4 (quarter 4)

Give up:

1. G1 <= 51160 (quarter 1)
2. G2 <= 48730 (quarter 2)
3. G3 <= 45950 (quarter 3)
4. G4 <= 42790 (quarter 4)

Demand nodes:

5. P11 + S11 + G1 >= 51160 (quarter 1)
6. P12 + P22 + S12 + S22 + G2 >= 48730 (quarter 2)
7. P13 + P23 + P33 + S13 + S23 + S33 + G3 >= 45950 (quarter 3)
8. P14 + P24 + P34 + P44 + S14 + S24 + S34 + S44 + G4 >= 42790 (quarter 4)

Pij >= 0, Sij >= 0, Gj >= 0, Bj belongs to {0,1}

Step 5: objective function: we want to maximize profit:

Max z = 1500P11 + 1400P12 + 1300P13 + 1200P14 + 1500P22 + 1400P23 + 1300P24 +

1500P33 + 1400P34 + 1500P44 + 1300S11 + 1200S12 + 1100S13 + 1000S14 + 1300S22 +

1200S23 + 1100S24 + 1300S33 + 1200S34 + 1300S44 – 1000000(B1 + B2 + B3 + B4)

Step 6: optimization model

Objective function:

Max z = 1500P11 + 1400P12 + 1300P13 + 1200P14 + 1500P22 + 1400P23 + 1300P24 + 1500P33 + 1400P34 + 1500P44 + 1300S11 + 1200S12 + 1100S13 + 1000S14 + 1300S22 + 1200S23 + 1100S24 + 1300S33 + 1200S34 + 1300S44 – 1000000(B1 + B2 + B3 + B4)

Pij >= 0, Sij >= 0, Gj >= 0, Bj belongs to {0,1}

Production:

1. P11 + P12 + P13 + P14 <= 45000 (quarter 1)
2. P22 + P23 + P24 <= 45000 (quarter 2)
3. P33 + P34 <= 45000 (quarter 3)
4. P44 <= 45000 (quarter 4)

Subcontractor:

5. S11 + S12 + S13 + S14 <= 10000 * B1 (quarter 1, B1 is binary)
6. S22 + S23 + S24 <= 10000 * B2 (quarter 2)
7. S33 + S34 <= 10000 * B3 (quarter 3)
8. S44 <= 10000 * B4 (quarter 4)

Give up:

9. G1 <= 51160 (quarter 1)
10. G2 <= 48730 (quarter 2)
11. G3 <= 45950 (quarter 3)
12. G4 <= 42790 (quarter 4)

Demand nodes:

13. P11 + S11 + G1 >= 51160 (quarter 1)
14. P12 + P22 + S12 + S22 + G2 >= 48730 (quarter 2)
15. P13 + P23 + P33 + S13 + S23 + S33 + G3 >= 45950 (quarter 3)
16. P14 + P24 + P34 + P44 + S14 + S24 + S34 + S44 + G4 >= 42790 (quarter 4)

Excel Solver: (the screenshot is too large for me to put in the Word document)

Interpretation

SunFlora would generate a profit of $257,250,000. SunFlora facilities will produce 45000 solar panels in quarter 1 for use in quarter 1, 45000 panels in quarter 2 for use in quarter 2, 45000 panels in quarter 3 for use in quarter 3, and 45000 panels in quarter 4 for use in quarter 4. The subcontractors will produce 10000 solar panels in quarter 1 for use in quarter 1, 10000 panels in quarter 2 for use in quarter 2, 10000 panels in quarter 3 for use in quarter 3, and 10000 panels in quarter 4 for use in quarter 4. We are not giving up any customers to the competitors because all the G values are zero.

Member Evaluation

Name	Evaluation
Anna Nguyen	3
Arnoldo Sianez-Torres	3
Christopher Vargas	3
Kyle Kim	3
Neeraj Nair	3