1. Regression Analysis (40%)
   1. Graph the percent purchased against price (5%)
   2. Perform a regression using power regression to determine the predicted % column.
      1. Graph the new curve (5%)
      2. Estimate the equation of the line (5%)
      3. What does the R2 mean? (5%)
   3. Assuming there are 100,000 customers who visit your website and the publisher cost is $5.00, estimate the number of books sold (predicted sales column) (5%)
   4. Calculate the revenue column (price \* predicted sales) (5%)
   5. Calculate the profit column ((price – book cost) \* predicted sales) (5%)
   6. Use conditional formatting to highlight the profit values for all prices (5%)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Price** | **% Purchased** | **Predicted %** | **Predicted Sales** | **Revenue** | **Profit** |
| $ 5.00 | 65% | 69% | 69,292 | $346,462.04 | $ - |
| $ 6.00 | 50% | 49% | 49,256 | $295,535.47 | $ 49,255.91 |
| $ 7.00 | 40% | 37% | 36,909 | $258,364.01 | $ 73,818.29 |
| $ 8.00 | 32% | 29% | 28,746 | $229,965.69 | $ 86,237.13 |
| $ 9.00 | 25% | 23% | 23,058 | $207,519.08 | $ 92,230.70 |
| $ 10.00 | 20% | 19% | 18,930 | $189,303.00 | $ 94,651.50 |
| $ 11.00 | 16% | 16% | 15,837 | $174,205.99 | $ 95,021.45 |
| $ 12.00 | 13% | 13% | 13,456 | $161,477.29 | $ 94,195.09 |
| $ 13.00 | 11% | 12% | 11,584 | $150,590.96 | $ 92,671.36 |
| $ 14.00 | 10% | 10% | 10,083 | $141,167.22 | $ 90,750.36 |
| $ 15.00 | 8% | 9% | 8,862 | $132,924.77 | $ 88,616.52 |
| $ 16.00 | 7% | 8% | 7,853 | $125,650.69 | $ 86,384.85 |
| $ 17.00 | 6% | 7% | 7,011 | $119,180.73 | $ 84,127.58 |
| $ 18.00 | 6% | 6% | 6,299 | $113,386.12 | $ 81,889.97 |
| $ 19.00 | 5% | 6% | 5,693 | $108,164.41 | $ 79,700.09 |
| $ 20.00 | 5% | 5% | 5,172 | $103,433.05 | $ 77,574.79 |
| $ 21.00 | 5% | 5% | 4,720 | $ 99,124.79 | $ 75,523.65 |
| $ 22.00 | 4% | 4% | 4,327 | $ 95,184.21 | $ 73,551.44 |
| $ 23.00 | 4% | 4% | 3,981 | $ 91,565.28 | $ 71,659.79 |
| $ 24.00 | 4% | 4% | 3,676 | $ 88,229.40 | $ 69,848.27 |
| $ 25.00 | 4% | 3% | 3,406 | $ 85,143.95 | $ 68,115.16 |

*(The Conditional Formatting highlights profit maximization when selling at a price point between $10.00 and $12.00 per unit. Although the demand at this price point isn’t in the higher ranges, the profit and cost are optimized between these price points.)*

*(The Power trendline is a close fit to the scatterplot data but isn’t a perfect match. The R-Squared value of 0.9908 explains that the fit of the trendline is at 99.08% in relation to the data points.)*

*(After running a Power Regression and applying the scatterplot, the Power trendline becomes an exact match to the data. The R-Squared value of 1 explains the fit of the trendline is a 100% match in relation to the data points.)*

1. Optimization analysis (with constraints) (30%)
   1. Calculate the price point for the highest profit possible
      1. The publisher will sell the books to you at $5.00 each with no minimum order (10%)
      2. The publisher has agreed to sell you the books at $4.50 each if you sell at least 30,000 (10%)
      3. The publisher has agreed to sell you the books at $4.00 each if you sell at least 50,000 (10%)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Optimal Price - No Constraints** | | **Optimal Price - Sales >= 30,000** | | **Optimal Price - Sales >= 50,000** | |
| Predicted % | 17% | Predicted % | 30% | Predicted % | 50% |
| Predicted Sales | 16580 | Predicted Sales | 30000 | Predicted Sales | 50000 |
| **Price** | **$10.73** | **Price** | **$7.82** | **Price** | **$5.95** |
| Demand | 100000 | Demand | 100000 | Demand | 100000 |
| Unit Cost | $ 5.00 | Unit Cost | $ 4.50 | Unit Cost | $ 4.00 |
| Revenue | $ 177,965.30 | Revenue | $ 234,586.48 | Revenue | $ 297,606.75 |
|  |  |  |  |  |  |
| **Profit** | **$ 95,066.94** | **Profit** | **$ 99,586.50** | **Profit** | **$ 97,606.79** |
| Profit Margin | 53% | Profit Margin | 42% | Profit Margin | 33% |

* 1. Run a constrained optimization for each of the above situations to determine which cost point (from the publisher) and price (to your customer) maximizes your profit. Which cost point should you accept the publisher?

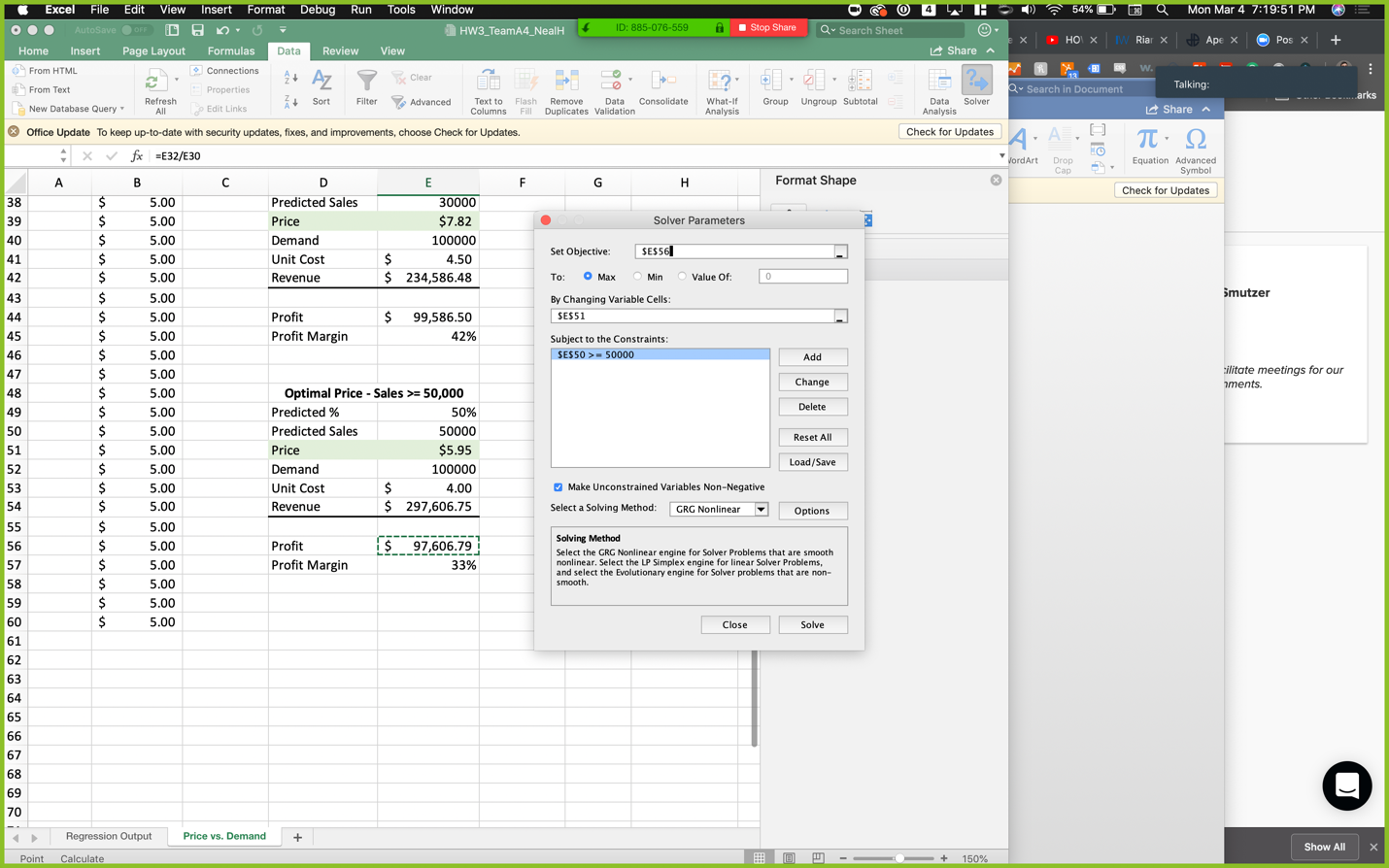
*(We achieve the highest profit margins with the $10.73 price point with no constraints on volume sold. Historically the ten-dollar-range has been the most profitable for books from this series (see the profit column highlighted in the table under question 1. Although this strategy means the highest unit / book cost, we are passing this extra cost onto the customer and expect demand to support our predicted sales figures.)*

1. Discussion (30%)
   1. What are the risks of using Harry Potter 7 data in predicting your new demand curve for the Harry Potter sequel? (15%)
   2. What are the other data you would like to have to perform your analysis? (15%)

*(Harry Potter has been a very popular series, but there is no guarantee the new sequel can match that popularity. This could have either a positive or negative impact. If the book is more popular than Harry Potter 7 you may have been able to take advantage of the minimum sales constraints and been able to purchase at a lower cost from the publisher. However, if you underestimated the popularity of the book because of using data from Harry Potter 7, you may not have done this.*

*It is also possible that the new sequel is less popular than Harry Potter 7. If this is the case, your sales forecast would have been inflated, leading to decisions on how to purchase from the publisher when demand would not have met the minimum requirement.*

*To counter the risk of using Harry Potter 7 data for the new sequel, it would be nice to have data the publisher likely collected to determine whether they wanted to move forward with the sequel. This data could have been scaled, which would have led to more accurate sales predictions. It would also be good to understand the content of the sequel to determine if the book would appeal to the same demographic as Harry Potter 7. This information would be useful when predicting sales if comparisons are being made between the two.*

**