SCM 651 Homework #2
Optimizing Product Pricing

Background

The Book Emporium wants to price books to optimize profits. The spreadsheet for this homework has sales data on Harry Potter book 7. For each week, the Book Emporium varied prices on Harry Potter 7 to determine a demand curve. The percent of customers who visited BookEmporium.com and purchased Harry Potter book 7 is shown in the spreadsheet. J.K. Rowling has announced a sequel to the Harry Potter series. Determine the price for the sequel.

Resources

Use the dataset SCM 651 Homework 2 Spring 2024 spreadsheet.

Definitions

Price	what you will charge each customer who purchases the new book
Book Cost	what you must pay the publisher for each book
% purchased	in your pricing test, the percent of people who bought at that price
Predicted %	your regression model estimate of the % of customers who buy the book
Predicted sales	estimate of number of customers who buy the book from you
Revenue	total revenue generated (price * predicted sales)
Profit	(price – book cost) * predicted sales

Assumptions

1. Assume that the demand for the book sequel will be like Harry Potter 7.
2. Assume that 100,000 customers will consider purchasing a book from you.
3. The data is not an entirely accurate prediction of the demand, but a regression on the data will give a reasonable prediction.
4. Assume that you pay the publisher $4.50 for each book.

Assignment

What's due:

For this assignment, you will enter your answers on BlackBoard. The assignment is due no later than 8:00 AM Friday, March 8, 2023.

The following instructions will step you through problems and list the questions that you will be asked on BlackBoard. Each problem will include several questions for that problem. Each question is worth 2 points. There are 50 questions for a total of 100 points.

This is a group assignment but will be scored individually. You may work with your group on the assignment, but each student must enter your answers into BlackBoard. You may not work with anyone outside of your group. Scores will be automatically posted after the deadline. Assignments that are submitted late will receive a score of zero. Note: you must enter answers exactly as requested. Misspelled answers or errors in numbers will be scored as wrong.

Questions:

Problem #1: Linear regression

Perform a linear regression on the data where Purchased % is the dependent variable (Y) and Price is the independent variable (X). Using a scatter plot, add a trend line for linear regression, add the equation and R^2. The formula will be in the form of Y = a*X + b

Problem #1 questions:

1. In the equation Y = a*X + b, what is a? Include four decimal places: x.xxxx −0.0229
2. In the equation Y = a*X + b, what is b? Include four decimal places: x.xxxx 0.5047
3. What is the R^2? Include four decimal places: x.xxxx 0.7021
4. At a price of $10.00, what is Predicted %? Enter two-digit number, no decimals, no % 28
5. At a price of $10.00, what is the Predicted Sales? Do not include decimals. 27,570
6. At a price of $10.00, what is the Revenue? Do not include decimals, no $ sign 275,700
7. At a price of $10.00, what is the Profit? Do not include decimals, no $ sign 151,635
8. What is the price that generates the highest profit in your table? No $ sign 13.00

Problem #2: Exponential regression

Perform an exponential regression on the data where Purchased % is the dependent variable (Y) and Price is the independent variable (X). Using a scatter plot, add a trend line for exponential regression, add the equation and R^2. The formula will be in the form of Y = a * exp(b*X)

Problem #2 questions:

9. In the equation Y = a * exp(b*X), what is a? Include four decimal places: x.xxxx 0.8471
10. In the equation Y = a * exp(b*X), what is b? Include three decimal places: x.xxx −0.139
11. What is the R^2? Include four decimal places: x.xxxx 0.9428
12. At a price of $10.00, what is Predicted %? Enter two-digit number, no decimals, no % 21
13. At a price of $10.00, what is the Predicted Sales? Do not include decimals. 21,099
14. At a price of $10.00, what is the Revenue? Do not include decimals, no $ sign 210,992
15. At a price of $10.00, what is the Profit? Do not include decimals, no $ sign 116,045
16. What is the price that generates the highest profit in your table? No $ sign 12.00

Problem #3: Power regression

Perform a power regression on the data where Purchased % is the dependent variable (Y) and Price is the independent variable (X). Using a scatter plot, add a trend line for power regression, add the equation and R^2. The formula will be in the form of Y = a * X ^ b where ^ means raised to the power.

Problem #3 questions:

17. In the equation Y = a * X ^ b, what is a? Include three decimal places: x.xxx 13.817
18. In the equation Y = a * X ^ b, what is b? Include three decimal places: x.xxx −1.865
19. What is the R^2? Include four decimal places: x.xxxx 0.9902
20. At a price of $10.00, what is Predicted %? Enter two-digit number, no decimals, no % 19
21. At a price of $10.00, what is the Predicted Sales? Do not include decimals. 18,854
22. At a price of $10.00, what is the Revenue? Do not include decimals, no $ sign 188,544
23. At a price of $10.00, what is the Profit? Do not include decimals, no $ sign 103,699
24. What is the price that generates the highest profit in your table? No $ sign 10.00

Problem #4: Logarithmic regression

Perform a logarithmic regression on the data where Purchased % is the dependent variable (Y) and Price is the independent variable (X). The log regression was not performed in class, but is an option for the trend line in the scatter plot. Using a scatter plot, add a trend line for logarithmic regression, add the equation and R^2. The formula will be in the form of Y = a * ln(X) + b.

Problem #4 questions:

25. In the equation Y = a * ln(X) + b, what is a? Include three decimal places: x.xxx -0.332
26. In the equation Y = a * ln(X) + b, what is b? Include four decimal places x.xxxx 1.0279
27. What is the R^2? Include four decimal places: x.xxxx 0.8697
28. At a price of $10.00, what is Predicted %? Enter two-digit number, no decimals, no % 19
29. At a price of $10.00, what is the Predicted Sales? Do not include decimals. 18,854
30. At a price of $10.00, what is the Revenue? Do not include decimals, no $ sign 188,544
31. At a price of $10.00, what is the Profit? Do not include decimals, no $ sign 103,699
32. What is the price that generates the highest profit in your table? No $ sign 10.00

Problem #5: Optimization #1, no constraints

Perform an optimization analysis to find the price that maximizes profit. Assume the following:

- Predicted % uses the power regression equation from problem #3
- Publisher cost of each book is $4.50; you must pay the publisher $4.50 for each book.
- 100,000 customers come to your website
- Predicted % regression prediction of the % of customers who buy the book
- Predicted sales estimate of number of customers who buy the book from you
- Revenue total revenue generated (price * predicted sales)
- Profit (price – book cost) * predicted sales

Problem #5 questions:

33. What is the selling price that maximizes profit? Include two decimal places, no dollar sign x.xx 9.70
34. What is the Predicted %? Include two digits, no decimal places, no % sign 20
35. What is the Predicted Sales (number of books sold)? Do not include decimals 19 948
36. What is the predicted Revenue? Do not include decimals, no $ sign 193,538
37. What is the predicted Profit? Do not include decimals, no $ sign 103,774

Problem #6: Optimization #2, reduced publisher cost when selling 30,000 or more books

Perform a constrained optimization analysis to find the price that maximizes profit. Assume:

- Predicted % uses the power regression results from problem #3
- Publisher has offered to lower the cost of each book to $4.25 if you sell 30,000 books or more; you must pay the publisher $4.25 for each book, but must sell 30,000 for this discount
- 100,000 customers come to your website
- Predicted % regression prediction of the % of customers who buy the book
- Predicted sales estimate of number of customers who buy the book from you
- Revenue total revenue generated (price * predicted sales)
- Profit (price – book cost) * predicted sales

Problem #6 questions:

38. What is the selling price that maximizes profit? Include two decimal places, no dollar sign x.xx — 7.80
39. What is the Predicted %? Include two digits, no decimal places, no % sign — 30
40. What is the Predicted Sales (number of books sold)? Do not include decimals — 30,000
41. What is the predicted Revenue? Do not include decimals, no $ sign — 233,866
42. What is the predicted Profit? Do not include decimals, no $ sign — 106,366

Problem #7: Optimization #3, reduced publisher cost when selling 50,000 or more books

Perform a constrained optimization analysis to find the price that maximizes profit. Assume:

- Predicted % uses the power regression results from problem #3
- Publisher has offered to lower the cost of each book to $4.00 if you sell 50,000 books or more; you must pay the publisher $4.00 for each book, but must sell 50,000 for this discount
- 100,000 customers come to your website
- Predicted % regression prediction of the % of customers who buy the book
- Predicted sales estimate of number of customers who buy the book from you
- Revenue total revenue generated (price * predicted sales)
- Profit (price – book cost) * predicted sales

Problem #7 questions:

43. What is the selling price that maximizes profit? Include two decimal places, no dollar sign x.xx — 5.93
44. What is the Predicted %? Include two digits, no decimal places, no % sign — 50
45. What is the Predicted Sales (number of books sold)? Do not include decimals — 50,000
46. What is the predicted Revenue? Do not include decimals, no $ sign — 296,389
47. What is the predicted Profit? Do not include decimals, no $ sign — 96,389

Problem #8: Summary of previous problems

Use the analyses performed earlier to answer these questions.

Problem #8 questions:

48. Which model had the highest R^2? (linear, exponential, power, logarithmic) — power
49. At what price should you sell books to earn the most profit across the three scenarios? Include two decimal places x.xx, no $ sign — 7.80
50. How much should you pay the publisher for each book to earn the most profit across the three scenarios? Include two decimal places x.xx, no $ sign — 4.25