Problem Solving with Spreadsheets

CSS 305, Spring 2006

http://courses.washington.edu/css305/sp06/

Overview

- So far, we’ve looked at spreadsheets as glorified calculators
  » Arithmetic
  » Graphing data
- Spreadsheets can be a powerful tool for solving everyday problems

References

- Spreadsheets in Education
  » http://sunsite.univie.ac.at/Spreadsite/
- Making Effective Charts
  » http://www.cs.indiana.edu/classes/a106/Graphs/chart.html
- Algebraic problem-solving using spreadsheets
  » http://mathforum.org/workshops/sum98/participants/sinclair/problem/intro.html

Outline

- Problem solving
  » Optimization problems
  » Comparison problems
- Proving a point with charts
  » Using charts effectively
  » Deceptive charts
Problem solving

- Spreadsheets are a versatile tool for solving many types of problems
- We’ll look at two today
  - Optimization problems (“getting the most of X”)
  - Comparison problems (“which is the best Y?”)

Consider this problem

- You’ve decided to hold a party at a local Vietnamese restaurant
  - Each person will have a bowl of pho ($4.50)
  - Every two people can share an order of spring rolls ($2.50)
  - Your budget is $100.00
- Excluding tax and tip, how many people can you invite?

Algebraic solution

- $4.5x + \left\lceil \frac{x}{2} \right\rceil \times 2.5 = 100$
- Solve for $x$
- Round down

Spreadsheet solution

- Set up the basic formula
  - Pho is $4.50
  - Spring rolls are $2.50
  - (# of people) bowls of pho
  - $\left\lceil \frac{\text{# of people}}{2} \right\rceil$ spring rolls
    - Use the CEILING function
- List the possible values
- Find the correct one
Another problem

- We may want to compare several items and choose which is best
  - This may depend on several factors
- For example, choose the best car from among several
  - Influenced by miles driven and gasoline prices

Modeling with spreadsheets

- We can think about using a spreadsheet as a model of the real world
  - Contains variables that reflect the world
  - Uses formulas to represent the relationship between things
Problem solving questions

1. What is the problem you are trying to solve?
2. What information will help you answer this question?
3. How can you demonstrate the answer to your question?

What is the problem you are trying to solve?

- The problem should be clear
  » “Which car is the best value over 5 years?”
- The answer you are looking for should be clear
  » “Car X is the cheapest because it costs Y, and the others cost more”
- You must know how to model the problem within the spreadsheet
  » Number of spring rolls =CEILING(people/2)

What information will you use to answer the question?

- What are the input variables?
  » Car cost, car mpg (for each car)
  » Gasoline cost, miles driven per week (globally)
- What is the desired output variable?
  » Cost of each car after 5 years
- What are the intermediate values we need?
  » Miles driven per year
  » Gas cost per year, cost after 1 year (for each car)

How can you demonstrate the answer to your question?

- What information will give us our answer?
  » The car with the lowest total cost
- How can we effectively present our answer?
  » Show cost relative to others
Spreadsheet design

Your spreadsheet should be clearly organized

Showing your results

- Charts can be effective tools for presenting a conclusion
- Some general guidelines
  - Keep it simple
  - Use the appropriate chart types
  - Show the right information
  - Avoid unclear or misleading charts

Inappropriate chart type

- Conclusion: “Toyoma is the best value”

Appropriate chart type

- Conclusion: “Toyoma is the best value”
Chart types

- Bar chart
  - Best for comparing multiple items along one dimension
- Line chart
  - Best for showing trends over time
- Pie chart
  - Best for showing relative proportions over time

Appropriate information

- Show all of the information that is needed to make your point, and no more
- Show your image at a reasonable scale

Misleading diagrams

- Diagrams come from data, but are affected by the choice of presentation
- It’s important to be able to read diagrams critically
  - Does this diagram prove what it claims to say?
  - Is the format of the diagram misleading?

Appropriate information

- Conclusion: “If gas is $2.50, the Toyoma is the best buy. But if gas rises to $5.00, the Porch is a better buy”
What is this really saying?

From http://mediamatters.org/items/200503220005

Read diagrams critically