Designing a Spreadsheet

• When a spreadsheet is used repeatedly, it becomes a tool of planning, analysis, and decision-making
• Must be well designed and flexible to be effective

The Trip

• Driving trip to the Arctic Circle from Chicago
• Make a spreadsheet to figure out how long it will take and how much it will cost
Design Guidelines

• **Focus on Form**
  – Make the form logical, the layout clean, and the entries clear and understandable
    • Descriptive info should be on the top and left
    • Summary info should be on the bottom and right
      – Use different fonts, colors, separate sheet for each table

• **Explain Everything**
  – It should be possible to know immediately what every cell means

Initial Spreadsheet: Applying the Rules

• **Focus on Form:**
  – title, authors, completion date, column headings, color, clean font, data aligned

• **Explain Everything:**
  – comments added to cells (*Insert > Comment*)
Conditional Formatting

• **Cell Value Is Specifications**
  – Format > Conditional Formatting…
  – Change formatting in response to certain conditions
  – Can specify one or more conditions
  – Can use formulas in the comparison
    • Example: **bold** data greater than average of range
Trip to the Arctic Circle
by Pat and Alex; completed 23 June 07

<table>
<thead>
<tr>
<th>Segment</th>
<th>Time Ext.</th>
<th>Miles</th>
<th>Fuel Price Report</th>
<th>Fuel Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago to Carrington ND</td>
<td>12:02</td>
<td>778 US Chicago</td>
<td></td>
<td>$3.59</td>
</tr>
<tr>
<td>Carrington to Belford SK</td>
<td>11:06</td>
<td>620 US Monroe WA</td>
<td></td>
<td>$2.96</td>
</tr>
<tr>
<td>Battleford to Fort St. John</td>
<td>11:26</td>
<td>646 CA Moose Jaw SK</td>
<td></td>
<td>$1.09</td>
</tr>
<tr>
<td>Fort St. John to Watson Lake YK</td>
<td>10:17</td>
<td>555 CA Medicine Hat AB</td>
<td></td>
<td>$1.61</td>
</tr>
<tr>
<td>Watson Lake to Dawson YK</td>
<td>14:00</td>
<td>494 CA HI Ak Heavy BC</td>
<td></td>
<td>$1.21</td>
</tr>
</tbody>
</table>

Figure 15.3 The Arctic Circle road trip spreadsheet with conditional formatting for "long days."
Conditional Formatting (cont)

- **Formula Is Specifications**
  - Allows comparison with cells other than the one being formatted
  
  \[ \text{A2 cell: } \text{IF}(B2>\text{AVERAGE}(B$2:B$7), \text{TRUE}, \text{FALSE}) \]

Conditional Formatting (cont)

- **Distinguish Between the U.S. and Canada**
  - Italicize fuel cost if fuel price estimate is in Canadian dollars
  
  \[ \text{E2 cell: } \text{IF}(\text{Left}(D2,2)="\text{CA}", \text{TRUE}, \text{FALSE}) \]

Figure 15.4 Conditional formatting to highlight trip segments, whose Price for Diesel is greater than average.

Figure 15.5 Conditional formatting to highlight trip segments, whose Time for Diesel is greater than average.
Conditional Formulas

- Computing with conditional factors
- Figuring the Amount Paid
  - Miles per gallon (22) vs. miles per liter (5.8)
    \[ =\text{IF(LEFT(D2,2)="US", E2*C2/22, E2*C2/5.8)} \]

Conditional Formulas (cont)

- Cost in One Currency
  - Canadian to US currency exchange rate (0.93)
    \[ =\text{IF(LEFT(D2,2)="CA", F2*0.93, F2)} \]
Naming: Symbolic Reference

• Defining Names
  – Refer to cells symbolically by name rather than literally by explicit column/row position
  – A name is a word or phrase assigned to a cell or range of cells (no spaces)
  – Name used wherever cell references are used
  – Minimizes errors when columns/rows added later
  – Insert > Name > Define
  – Insert > Name > Apply

Naming: Symbolic Reference (cont)

• Applying Names
  =IF(LEFT(D2,2)="US", fuelPrice*distance/22, fuelPrice*distance/5.8)
  – Safer, easier to read and understand

• Make Assumptions Explicit
  – Assign instance-specific quantities that may change to cells, give them names, and use these names in the formulas
  – mpg, mpl, exchange rate, # of travelers
  =IF(LEFT(priceSrc,2)="US", fuelPrice*distance/mpg, fuelPrice*distance/mpl)
"What If" Analysis

• Spreadsheets recalculate everything whenever a number is changed
• Ideal for speculating on the consequences of change
  – Make a change and notice what happens to the "bottom line"

"What If" Analysis (cont)

• Direct Experimentation
  – Potential risk of making permanent changes to data and formulas
• Scenarios
  – A named alternative to a spreadsheet based on different inputs
  – Aid to understanding changes in plans, like changes in gas mileage
Scenarios

- Tune-up Scenario
  - Select mpg cell, Tools > Scenarios…

Figure 16.8 Dialog box sequence for adding a scenario to the Arctic Circle spreadsheet.

Figure 16.8 Dialog box sequence for adding a scenario to the Arctic Circle spreadsheet.

Scenario Summary

<table>
<thead>
<tr>
<th>Changing Cells</th>
<th>Current Values</th>
<th>Tuneup</th>
</tr>
</thead>
<tbody>
<tr>
<td>mpg</td>
<td>22</td>
<td>$5</td>
</tr>
</tbody>
</table>

Result Cells:
- FuelCell: $1197.71, $1227.95

Notes: Current values column represents values at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

Figure 15.9 The Scenario Summary sheet showing the result of the TuneUp scenario.
Scenarios (cont)

• Traveling Companions Scenario
  – Adding buddies in the car will drop the mpg but also the cost per person

Analyzing a Model

• Formulating a Model
  – Account for all foreseeable costs

• The Model
  – Table summarizing the per person expenses

• Reusing Scenarios
  – Rerun scenarios to see how the total cost changes as the number of travelers increases
Analyzing a Model

- A Change in Plans
  - Stay in Hostels vs. camping

Analyzing Data Using Filtering

- Travel Log spreadsheet
  - Can use a filter to access subsets of information (selecting only certain rows from a list) to create a customized version of a spreadsheet
- Auto Filtering Technique
  - Data > Filter > AutoFilter
  - Options for filtering the list based on data in each column
  - Turn off AutoFilter by selecting it again (toggle)
Advanced Filtering Technique

• More refined analysis with precise filtering criteria
• Advanced Filtering Setup
  – Add a new column with the same heading as the column containing the date to be filtered
  – Enter a criterion to indicate that values in the other column by the same name should be filtered with that criterion

Advanced Filtering Technique (cont)

• Executing an Advanced Filter
  – Select a cell in the column to be filtered
  – Data > Filtering > Advanced Search…
    • List range: dimension of the list to be filtered
    • Criteria range: range covering the heading and the criterion of setup column
    • Copy to: specifies a new place on the spreadsheet to place the filtered result (optional)
  – Restore original table: Data > Filtering > Show All
Advanced Filtering Technique (cont)

- Filtering on Multiple Criteria
  - Define multiple setup columns with criteria
  - *Criteria range* in Advanced Filter window is enlarged to cover all criteria in the setup columns

<table>
<thead>
<tr>
<th>Route</th>
<th>Distance</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago toกรณีนี้, ND</td>
<td>770 miles</td>
<td>12 hrs, 2 minutes</td>
</tr>
<tr>
<td>กรณีนี้ to Battleford, SK</td>
<td>620 miles</td>
<td>11 hrs, 6 minutes</td>
</tr>
<tr>
<td>Battleford to Fort St. John, BC</td>
<td>648 miles</td>
<td>11 hrs, 26 minutes</td>
</tr>
<tr>
<td>Fort St. John to Watson Lake, BC</td>
<td>556 miles</td>
<td>10 hrs, 17 minutes</td>
</tr>
<tr>
<td>Watson Lake to Dawson, YK</td>
<td>601 miles</td>
<td>11 hrs, 55 minutes</td>
</tr>
<tr>
<td>Round-trip Dawson to Arctic Circle</td>
<td>484 miles</td>
<td>14 hours</td>
</tr>
<tr>
<td>When</td>
<td>Seq Nr</td>
<td>Where</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
<td>--------------</td>
</tr>
<tr>
<td>8/4/07 12:05</td>
<td>1</td>
<td>Dr. Paul NY</td>
</tr>
<tr>
<td>8/4/07 16:55</td>
<td>1</td>
<td>Forgot Paper</td>
</tr>
</tbody>
</table>