COMPS CI 111 / 111G

Mastering Cyberspace:
An introduction to practical computing

Spreadsheets
The 1st Killer App. VisiCalc

• The idea for the electronic spreadsheet came to me while I was a student at the Harvard Business School, working on my MBA degree, in the spring of 1978. Sitting in Aldrich Hall, room 108, I would daydream. "Imagine if my calculator had a ball in its back, like a mouse..." (I had seen a mouse previously, I think in a demonstration at a conference by Doug Engelbart, and maybe the Alto).

• And "..imagine if I had a heads-up display, like in a fighter plane, where I could see the virtual image hanging in the air in front of me. I could just move my mouse/keyboard calculator around, punch in a few numbers, circle them to get a sum, do some calculations, and answer '10% will be fine!'" (10% was always the answer in those days when we couldn't do very complicated calculations...)

• Source: www.bricklin.com/history/intro.htm
Development

• **Background**
  – Dan Bricklin and Bob Frankston
Design

• **Visible Calculator**
  – Organize calculations as we would on paper - in columns and rows.
  – Supports automatic updating of calculations.
  – Copy formulas so we may apply these to large amounts of data.

![Spreadsheet Image]
Microsoft Excel - Overview

- Used to represent a table of data
  - Rows (labelled with numbers)
  - Columns (labelled with letters)
  - Cells

http://en.wikipedia.org/wiki/Microsoft_Excel
### Changing appearance of cells

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alter Size</strong></td>
<td>Click on cell separator and drag</td>
</tr>
<tr>
<td><strong>Add Borders</strong></td>
<td>Format Cell</td>
</tr>
<tr>
<td><strong>Add Shading</strong></td>
<td>Format Cell</td>
</tr>
<tr>
<td><strong>Font</strong></td>
<td>Style, Size, Alignment</td>
</tr>
<tr>
<td><strong>Numbers</strong></td>
<td>Decimal points</td>
</tr>
</tbody>
</table>
Entering Data

• Cells contain
  – Text
  – Numbers
  – Formulae (start with "=")

• Entry box
  – Type data in entry box
  – Hit Enter key to accept value
  – All formulae are recalculated
  – Results shown in each cell
Formulae

• Entering formulae
  – Always begin with an equals sign
  – Calculation typed into entry box
  – Result displayed in the cell
Using Cell References

- **Cell Reference**
  - Formulae refer to other cells
  - Specify cell location using Row and Column IDs

![Spreadsheet Example](image)

- **Example**: D5 formula: \( =B5+C5 \)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Paul</td>
<td>24</td>
<td>12</td>
<td></td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>6</td>
<td>Sebastian</td>
<td>4</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Stefan</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ali</td>
<td>2</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Filling Down and Filling Right

• **Save time**
  – Fill many cells with same contents
  – Select a group of cells
  – Fill Right
  – Fill Down
Filling Cells with Formulae

• Use Fill Down/ Fill Right on formulae
  – Saves us entering new formula for each row

- D5 should contain =B5 + C5
- D6 should contain =B6 + C6
- D7 should contain =B7 + C7
- D8 should contain =B8 + C8
Relative References

- **Cell reference in formula**
  - Use same formula, different cell references
  - Cell reference is relative to position of formula
  - Spreadsheets adjust formula automatically during fill operation

![Spreadsheet Example](image.png)

- \( \text{=B5 + C5} \)
- \( \text{=B8 + C8} \)
Cell references that don’t change

• Absolute references
  – Sometimes the cell reference should not change
    • Eg. for constants
  – Use a dollar sign $ before the row or column

![Spreadsheet](image.png)
Relative and Absolute references

- Sometimes formulae require a mixture of references that change and references which are fixed

$$\text{Total Pay} = \text{D7} \times \$\text{B$4}$
Exercises

Exercise 1: Is the reference to cell D6 in the formula =$D$6*2 a relative or an absolute reference?

- An absolute reference

Imagine that you are keeping track of the sales for tickets at the Olympic games. A number of different sports are located in different venues. Each venue has a number of seats available. Your spreadsheet will keep track of the number of tickets available and the number actually sold.

Exercise 2: Given the following spreadsheet, what formula would you use in cell D6 to calculate the number of tickets remaining?

=\text{B6} - \text{C6}
Exercises

Exercise 3: What formula would you use in cell E8 to calculate the money made from ticket sales?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Ticket Sales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Price</td>
<td>$10.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4000 2000 2000 $20,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2000 750 1250 $7,500.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1000 100 900 $1,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>3000 3000 0 $30,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>5000 4500 500 $45,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

=\text{C8} \times \$\text{B3}

Exercise 4: What formula would you use in cell B11 to calculate the total number of tickets available?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Ticket Sales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Price</td>
<td>$10.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4000 2000 2000 $20,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2000 750 1250 $7,500.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1000 100 900 $1,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>3000 3000 0 $30,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>5000 4500 500 $45,000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

=B6 + B7 + B8 + B9 + B10
Using built-in functions

- **Insert a Function**
  - Many categories
  - Help is useful
Functions

• Many functions exist
  – Allow us to make more complicated formulae
  – Examples
    • SUM
    • MAX
    • MIN
    • AVERAGE

• Specifying a range of cells
  – Top Left cell
  – Bottom Right cell
  – B6:C10
Functions

• Format of Excel functions:

=setNameOfFunction(comma separated list of parameters)

• Examples:

=SUM(5,6,7)
=AVERAGE(A2:D2)
Boolean Logic

• Boolean value
  – True or False
  – 2-valued logic

• Compare two different values
  – =
  – >
  – <
  – >=
  – <=

• Example. Are the following true or false?
  – =(3 = 4)
  – =(4 < 6)
  – =(MAX(5, 6) = 5)
  – =(SUM(1,2,3) = 6)
IF functions

• Makes a decision
  – Different values used in the cell depending on the logical test

• IF( logical_test , value_if_true, value_if_false )

Must be either true or false
• value
• condition (test)
• boolean function

This value appears in the cell if the boolean is true

This value appears in the cell if the boolean is false
Boolean Functions

- **AND( a, b )**
  - True only when a and b are both true

- **OR( a, b )**
  - True if either a is true or b is true

- **NOT( a )**
  - True only when a is false

- **Are the following formulae TRUE or FALSE?**
  - =AND( 3 = 4, 2 = 2 )
  - =OR( 7 < 5, 3 > 3 )
  - =NOT( 3 = 2 )
  - =OR( AND( 2 = 3, 4 > 3 ), NOT( 2 = 3 ) )