# COMPSCI 111 / 111G

*Mastering Cyberspace:*
*An introduction to practical computing*

Spreadsheets

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## 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**

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## Development

- **Background**
  - Dan Bricklin and Bob Frankston
  - VisiCalc released in 1979.

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## 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.

# Microsoft Excel - Overview

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

Columns

Current cell

A1

Entry box

A B C D

Rows
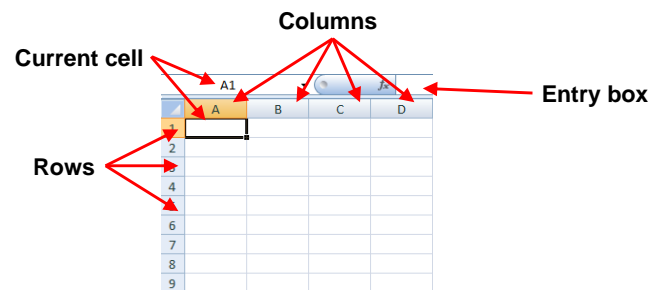
**http://en.wikipedia.org/wiki/Microsoft_Excel**

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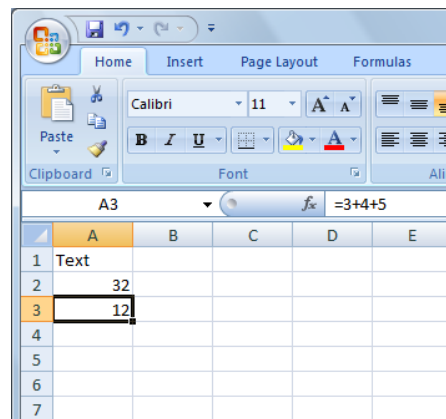
# Changing appearance of cells

- **Alter Size**
  - Click on cell separator and drag

- **Add Borders**
  - Format Cell

- **Add Shading**
  - Format Cell

- **Font**
  - Style
  - Size
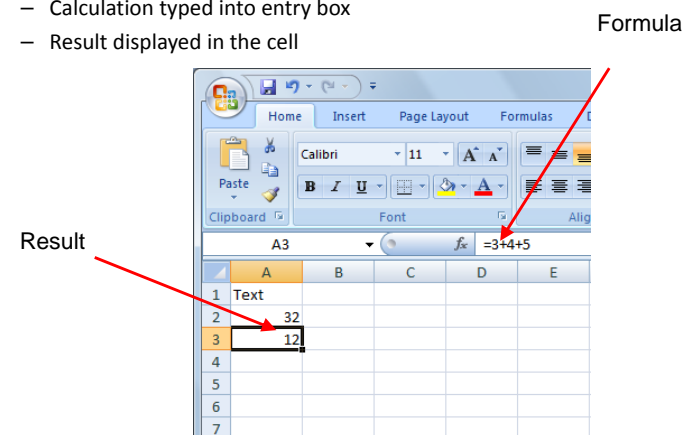  - Alignment

- **Numbers**
  - Decimal points

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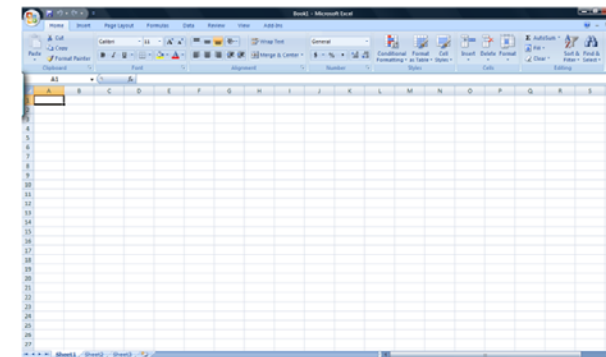
# Entering Data

- **Cells contain**
  - Text
  - Numbers
  - Formulae
    (start with "=")

A3    =3+4+5

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Text | | | | |
| 2 | 32 | | | | |
| 3 | 12 | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |

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

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# Formulae

- **Entering formulae**
  - Always begin with an equals sign
  - Calculation typed into entry box
  - Result displayed in the cell

Formula

Result

A3    =3+4+5

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Text | | | | |
| 2 | 32 | | | | |
| 3 | 12 | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |

# Using Cell References

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

# 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



=B5 + C5

=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

| | E7 | ▾ | | $f_x$ | =$B$4 | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| 1 | | | | | | |
| 2 | | Hours Worked | | | | |
| 3 | | | | | | |
| 4 | Pay rate: | 12 | | | | |
| 5 | | | | | | |
| 6 | Name | Monday | Tuesday | Total | Pay rate | |
| 7 | Paul | 24 | 12 | 36 | 12 | |
| 8 | Sebastian | 4 | 20 | 24 | 12 | |
| 9 | Stefan | 1 | 5 | 6 | 12 | |
| 10 | Ali | 2 | 11 | 13 | 12 | |
| 11 | | | | | | |
| 12 | | | | | | |

formula stays the same

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## Relative and Absolute references

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

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | Hours Worked | | | | | |
| 3 | | | | | | | |
| 4 | Pay rate: | 12 | | | | | |
| 5 | | | | | | | |
| 6 | Name | Monday | Tuesday | Total | | Pay rate | Total Pay |
| 7 | Paul | 24 | 12 | 36 | | 12 | 432 |
| 8 | Sebastian | 4 | 20 | 24 | | 12 | 288 |
| 9 | Stefan | 1 | 5 | 6 | | 12 | 72 |
| 10 | Ali | 2 | 11 | 13 | | 12 | 156 |
| 11 | | | | | | | |

= D7 * $B$4

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## Exercises

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

| | A | B | C | D |
|---|---|---|---|---|
| 1 | | Ticket Sales | | |
| 2 | | | | |
| 3 | Price | $10.00 | | |
| 4 | | | | |
| 5 | Event | Tickets Available | Tickets Sold | Remaining |
| 6 | Cycling | 4000 | 2000 | 2000 |
| 7 | Weightlifting | 2000 | 750 | 1250 |
| 8 | Triathlon | 1000 | 100 | 900 |
| 9 | Football | 3000 | 3000 | 0 |
| 10 | Badminton | 5000 | 4500 | 500 |
| 11 | | 15000 | 10350 | 4650 |

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## Exercises

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

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | Ticket Sales | | | |
| 2 | | | | | |
| 3 | Price | $10.00 | | | |
| 4 | | | | | |
| 5 | Event | Tickets Available | Tickets Sold | Remaining | Sales |
| 6 | Cycling | 4000 | 2000 | 2000 | $20,000.00 |
| 7 | Weightlifting | 2000 | 750 | 1250 | $7,500.00 |
| 8 | Triathlon | 1000 | 100 | 900 | $1,000.00 |
| 9 | Football | 3000 | 3000 | 0 | $30,000.00 |
| 10 | Badminton | 5000 | 4500 | 500 | $45,000.00 |

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

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | Ticket Sales | | | |
| 2 | | | | | |
| 3 | Price | $10.00 | | | |
| 4 | | | | | |
| 5 | Event | Tickets Available | Tickets Sold | Remaining | Sales |
| 6 | Cycling | 4000 | 2000 | 2000 | $20,000.00 |
| 7 | Weightlifting | 2000 | 750 | 1250 | $7,500.00 |
| 8 | Triathlon | 1000 | 100 | 900 | $1,000.00 |
| 9 | Football | 3000 | 3000 | 0 | $30,000.00 |
| 10 | Badminton | 5000 | 4500 | 500 | $45,000.00 |
| 11 | | 15000 | 10350 | 4650 | $103,500.00 |

## Using built-in functions

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





(Insert Function dialog box)

Insert Function

Search for a function:

Type a brief description of what you want to do and then click Go     Go

Or select a category: Most Recently Used

Select a function:

SUM
AVERAGE
IF
HYPERLINK
COUNT
MAX
SIN

**SUM(number1,num...**
Adds all the numbers i...

Help on this function        OK      Cancel

Category list: Most Recently Used / All / Financial / Date & Time / Math & Trig / Statistical / Lookup & Reference / Database / Text / Logical / Information / Engineering
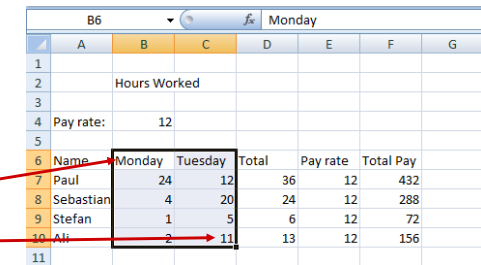
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## Functions

- **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



(Spreadsheet showing Hours Worked)

|   | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | Hours Worked | | | | | |
| 3 | | | | | | | |
| 4 | Pay rate: | 12 | | | | | |
| 5 | | | | | | | |
| 6 | Name | Monday | Tuesday | Total | Pay rate | Total Pay | |
| 7 | Paul | 24 | 12 | 36 | 12 | 432 | |
| 8 | Sebastian | 4 | 20 | 24 | 12 | 288 | |
| 9 | Stefan | 1 | 5 | 6 | 12 | 72 | |
| 10 | Ali | 2 | 11 | 13 | 12 | 156 | |
| 11 | | | | | | | |

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## Functions

- **Format of Excel functions:**

`=nameOfFunction(comma separated list of parameters)`

- **Examples:**

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

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## 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 ) )