Spreadsheets

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Key Points

1) Spreadsheets are programs for storing and manipulating data that is represented as a table of cells.

2) Each cell has a row number and column label which combine to represent its address.

3) Spreadsheets allow you to organize data and write formulas to do computations. They are a powerful tool for data storage and analysis.

Spreadsheet Overview

A ***spreadsheet*** organizes information into a two-dimensional array of cells (a *table*).

A ***cell*** has two components:

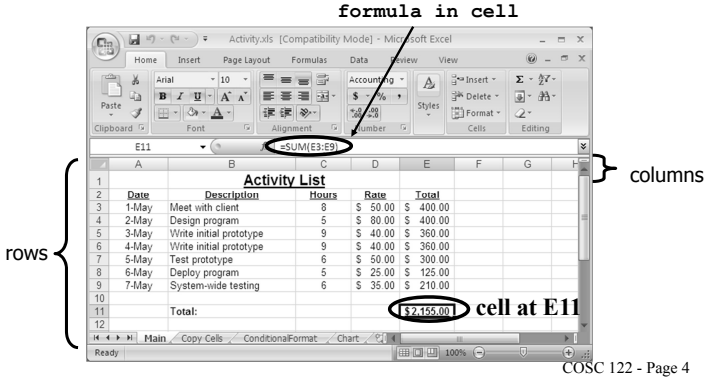
- an address - specified given a row and column number
- a location - that can store a number, text, or formula

The power of a spreadsheet is that we can write simple formulas (commands) to perform calculations and ***immediately see*** the results of those calculations.

Spreadsheets are very common in accounting and reporting applications.

Spreadsheet Addressing

A ***cell*** is identified by a row number and column letter.



Spreadsheet Addressing

The rows in a spreadsheet are numbered starting from 1.

The columns are represented by letters.

- A is column 1, B is column 2, …, Z is column 26, AA is column 27, …

A cell is identified by putting the column letter first then the row number.

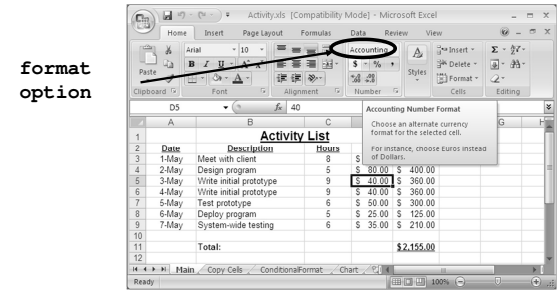
- e.g. B3 is the 2nd column and the 3rd row.

Question: What column number is AD? How about BAD?

Spreadsheet Data Entry

An entry can be added to a cell by clicking on it and typing in the data. The data may be a number, text, or a date.

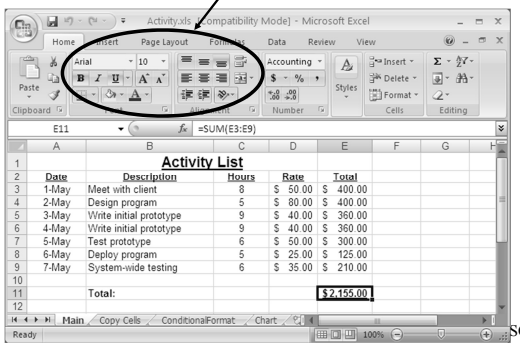
- The spreadsheet attempts to detect the data type and format it accordingly. It is also possible to manually format the data.



Spreadsheet Formatting

We can format cells in italics, underline, and bold similar to a text editor. It is also possible to justify data and change fonts.

`format and justify shortcuts`

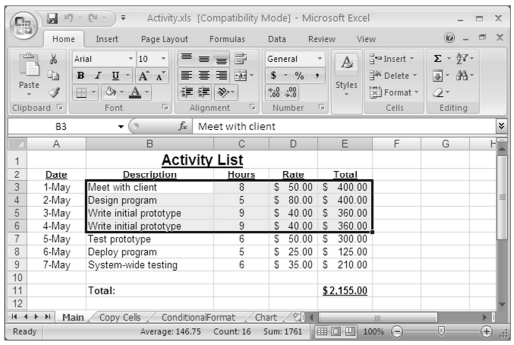


Spreadsheet Selecting Cells

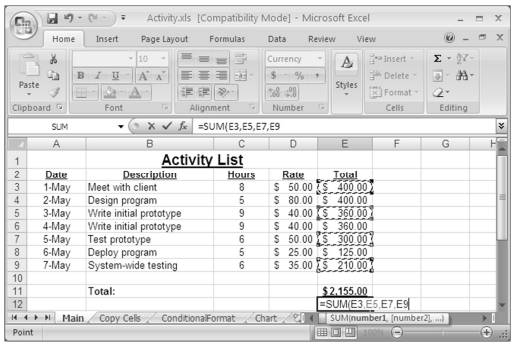
Multiple ways of selecting cells:

- 1) With the mouse, (left) click and drag mouse to select a rectangle region of cells.
- 2) With keyboard, hold `SHIFT` key and use arrow keys to select a rectangle region of cells.
- 3) With mouse and keyboard, while holding `CTRL` key, (left) click on individual cells to select non-contiguous cells.
- 4) Click on a row number to select a whole row.
- 5) Click on a column header to select a whole column.

Range Selecting Cells Example



Selecting Individual Cells Example



Manipulating Cells

Once you have selected one or more cells, there are several common actions you can perform:

- 1) DELETE
  - ⇨delete the contents of all cells by pressing delete key
  - ⇨delete the contents and the cell locations (then shift remaining) by choosing `Delete…` from pop-up menu (brought up by right click).
- 2) Cut, Copy, Paste
  - ⇨cut - copies selected cells to clipboard and removes from document
  - ⇨copy - copies selected cells to clipboard
  - ⇨paste - copies cells in clipboard to sheet starting at currently selected cell
- 3) Add selected cells to a formula (requires that you were previously constructing a formula before selecting the cells).

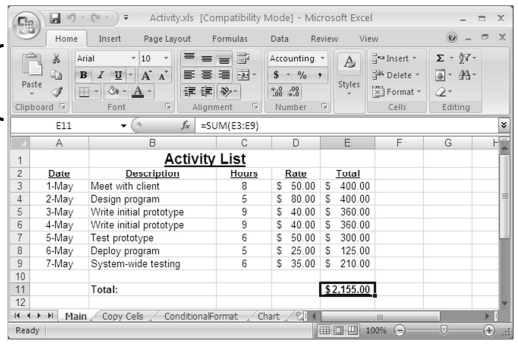
Manipulating Cells - Filling

Filling combines copy and paste.

There is a small box or tab beyond the cell's lower right corner (fill handle). Grab it with the cursor and pull to other cells.

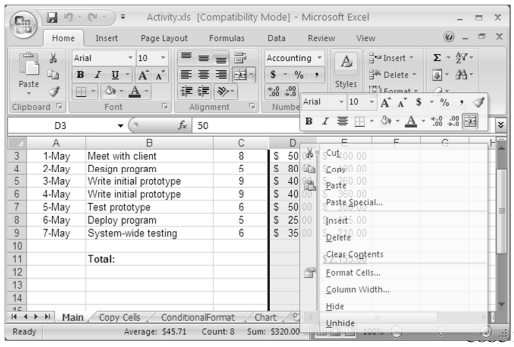
Cut, Copy, Paste

cut,
copy,
paste



Hiding Columns and Rows

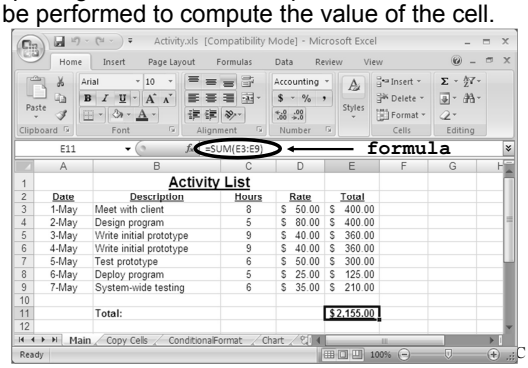
You can ***hide*** a column or row by right-clicking on the column or row header and selecting **`Hide`**. The column/row still exists but will not be displayed or printed unless unhidden.



Entering Formulas

A ***formula*** is any expression that begins with an equal sign ("**=**").

The equal sign indicates to the spreadsheet that a calculation must be performed to compute the value of the cell.



Formula Expressions

A ***formula*** expression can consist of literals (numbers, text strings), operators, functions, and cell references.

Simple mathematical expressions:

- `= 1 + 5`
- `= 1.5 * 3.14 + 42`

Common functions:

- `= ROUND(PI,2)` // Result is 3.14
- `= CONCATENATE("Hello", " World")` // Hello World
- Other common functions for trigonometry, dates, and financial.

Formula Expressions

The power of formulas comes from using cell references (similar to variable names in programming).

Cell reference examples:

- `= A1 + A2`
- `= B1 + A3 - A4`

Spreadsheets
Selecting Cells

Question: Which method allows you to select non-contiguous cells in a spreadsheet?

A) hold `SHIFT` key and use arrow keys

B) With the mouse left click on a cell and drag mouse

C) hold `CTRL` key and use arrow keys

D) hold `CTRL` key and left click on cells

Spreadsheets Formulas

Question: A cell contains the following:

= 3 + 5 * 2

What is the value of the cell?

A) 13

B) 16

C) =3+5*2

Spreadsheets Formulas

Question: A cell contains the following:

'ABC'+'DEF'

What is the value of the cell?

A) error

B) ABCDEF

C) 'ABC'+'DEF'

Advanced Spreadsheet Addressing

The dollar sign "**$**" is a special symbol that indicates an **absolute address**.

- **By default**, addresses are "**relative**" in the sense that if they are in a formula that is **copied to another cell, they will be changed** relative to where they were copied from their origin.

Example:

- Cell `A1` has the formula `=A2+B1`
- Copy contents of cell `A1` to cell `C4`.
- Formula changes to `=C5+D4` because moved down three rows and over two columns.
- If cell `A1` had the formula `=$A$2+$B$1`, then the same formula would be in cell `C4`.
- Question: What if formula was `=$A2+B$1`?

Spreadsheets Formulas and References

Question: Cell **A1** contains the following: **=$B2+D$4** What is the formula if the cell is copied to cell **D3**?

A) error

B) =$B2+D$4

C) =$B4+F$4

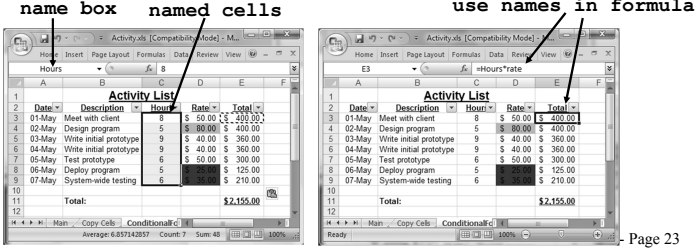
D) =$B4+G$4

Naming Cells

Instead of referring to cells by their address, you can give a cell a name and use that name in cell formulas.

- This makes it easier to read and understand formulas.
  - ⇨Like programming variables where we use names instead of addresses to refer to data locations.

Example: Refer to columns by name `Hours` and `Rate`.



Aggregate Formulas

An ***aggregate formula*** computes a summary function over a range of cells. The values can either be literals or cell locations.

Common functions are:

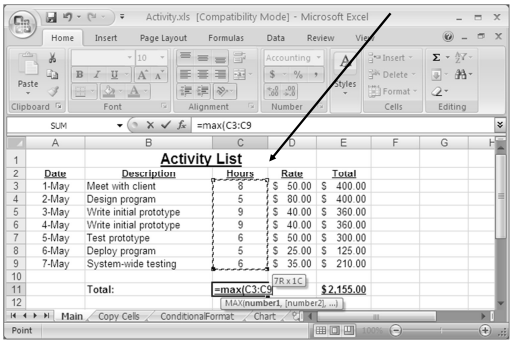
- `MIN(<value list>)` - returns minimum value in list
- `MAX(<value list>)` - returns maximum value in list
- `SUM(<value list>)` - returns sum of all values in list
- `AVERAGE(<value list>)` - returns average of values in list
- `COUNT(<value list>)` - returns count of 'numbers' in list
- `MEDIAN(<value list>)` - returns median value of list

If specifying a cell rectangle, give the upper left and lower right corners, separated by a colon.

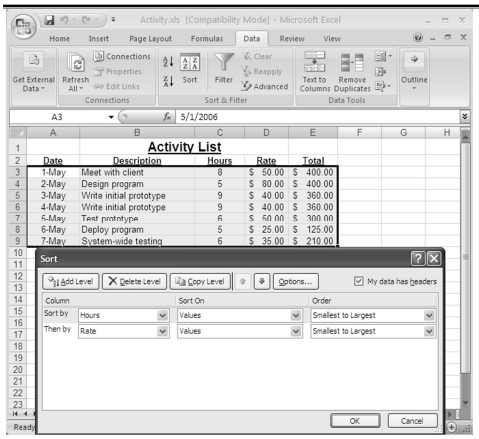
- e.g. `=average(A3:E6)` - rectangle of 4 rows and 5 columns

Aggregate Formula Example

`building formula by selection`



Sorting Data



Data can be sorted by selecting the **`Sort`** option under the **`Data`** menu.

Select the column(s) to sort on.

Spreadsheets Aggregate Formulas

Question: Assume the three cells in the range A1:C1 contain numbers. Which of these formulas is **ALWAYS** the largest?

A) MAX(A1:C1)

B) MIN(A1:C1)

C) COUNT(A1:C1)

D) SUM(A1:C1)

E) none of the above are always guaranteed to be the largest

Charts

A ***chart*** is a graphical representation of spreadsheet data.

A chart is of a particular type (line, bar, etc.) and requires the user to supply the data that will be displayed in the chart.

Chart: Step #1 - Select Data and Type

Select **Insert**, then click **`Chart`** Icon, and pick the chart type.

`chart shortcut`

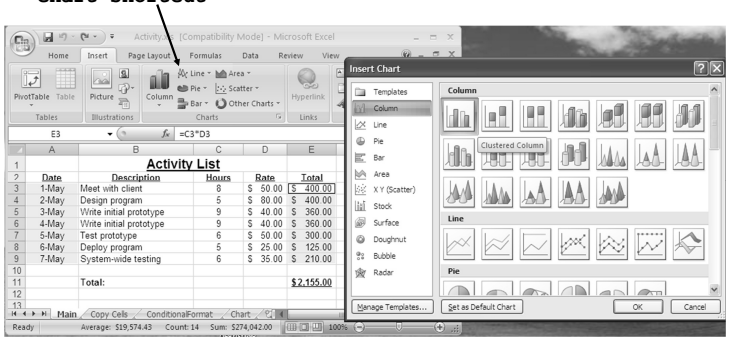


Chart Options

Chart design tools allows you to modify the data in the chart, change the chart type, and move the chart in the Worksheet.

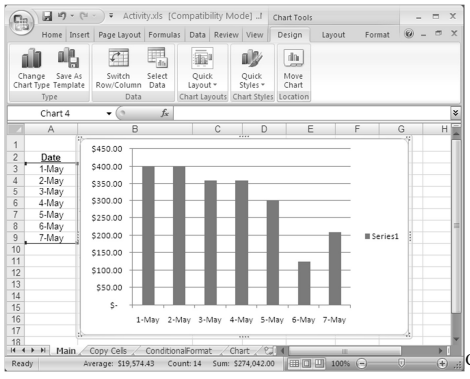


Chart: Step #2 - Verify Data

You may modify the data displayed in the chart using the `Select Data` option. This includes adding legends.

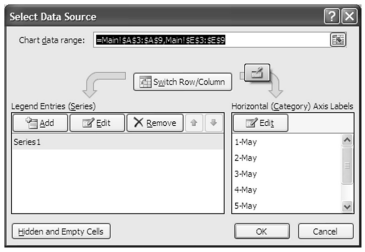


Chart: Step #3 - Chart Options

Under **`Layout`** (**`Chart Tools`**) you can set the title, legend, and colors. There are more format options under **`Format`**.

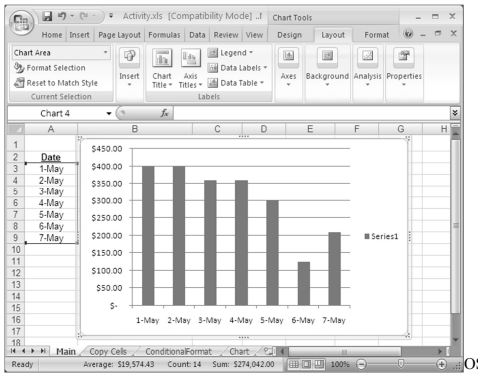
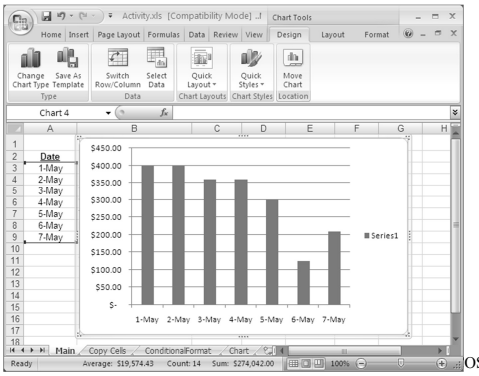
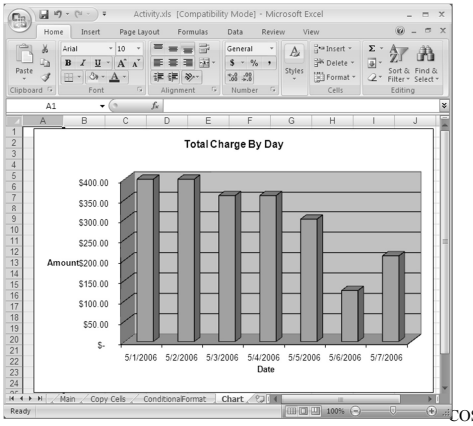


Chart: Step #4 - Chart Location

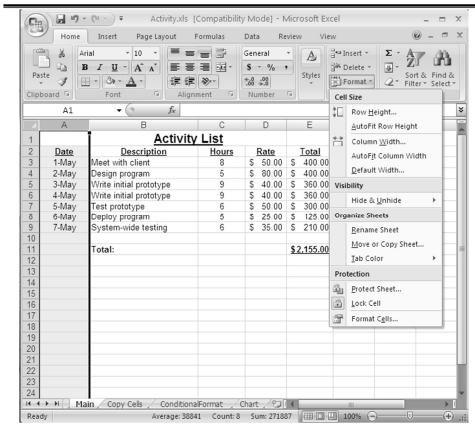
Put chart on an existing sheet or on its own sheet by selecting **`Move Chart`** in the **`Design`** area.



Final Chart



Other Formatting: Column Width



Resizing columns:

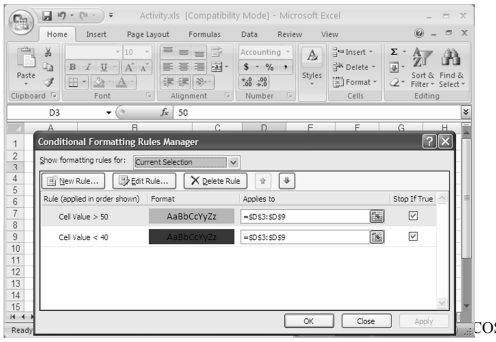
Auto-resize by double clicking on border between columns or using the `Format` option.

May also right-click on column to get `Format` option in the pop-up menu.

Conditional Formatting

Conditional formatting allows you to change the cell format based on data values. This is accessible under **`Styles`**.

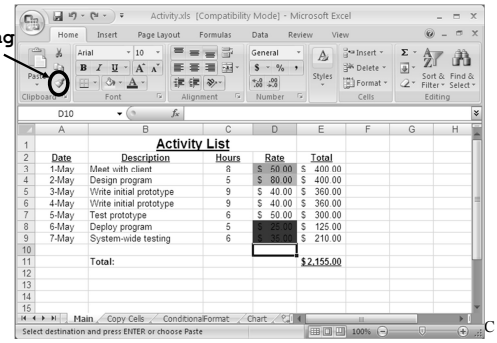
- Other options: data bars, color scales



Conditional Formatting Result

The paint format button allows you to copy formatting to many cells. Select the cell, click paint button, then highlight cells to have identical formatting.

paint formatting button



Spreadsheets for Data Management

A spreadsheet is often used as a simple form of a "database". A database is an organized representation of information.

- Examples: schedules and calendars, timesheets, expenses and finances, records, notes, and recipes, data research/analysis

We can use a spreadsheet as a database by:

- Using a row to store all the information about something we want to represent.
- Giving each column a meaningful name. A column represents a property or feature of the object stored in the row.
- Using the formulas to calculate new facts from the data.
- Using sorting to organize the data by key features.
- Using simple filtering (querying) to only show the most important data or data of interest.

Filtering

A ***filter*** shows a subset of the rows in the spreadsheet by only showing rows that pass a given condition (test).

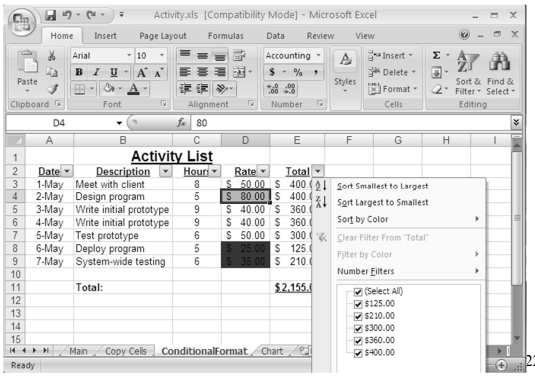
For our purposes, the **`Auto Filter`** under the **`Data`** then **`Filter`** menu is sufficient.

Once you select `Auto Filter`, each column heading has a drop-down list. By selecting a filtering criteria from the list, you can limit the rows that are displayed.

It is possible to filter on more than one column at the same time.

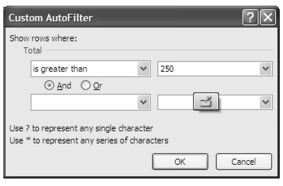
Filter Example

Filter on `Total` column: Can select a value, Top 10 items, or write a custom filter.



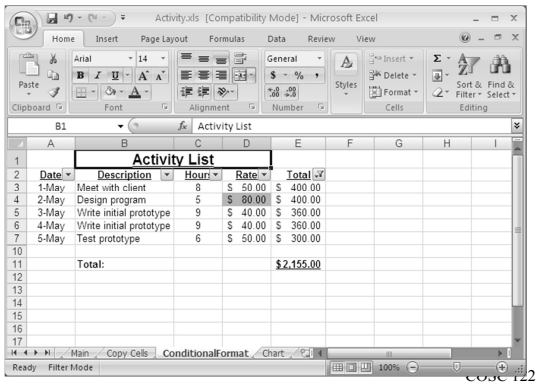
Custom Filter Example

Filter on `Total` column: Custom filter with **`Total > 250`**



Custom Filter Result

Filter on `Total` column: Custom filter result with **`Total > 250`**



Conclusion

Spreadsheets are programs for storing and manipulating data that is represented as a table of cells.

Each ***cell*** has a row number and column label which combine to represent its address. A cell can contain a number, text, date, or a formula that calculates its value.

Spreadsheets allow you to organize data and write formulas to do computations. They are a powerful tool for data storage and analysis.

Objectives

- Define: spreadsheet
- Explain how cells are addressed in a spreadsheet.
- List some of the ways to select cells in a spreadsheet.
- Explain: filling
- Define and explain: formula
- Explain how an aggregate function works. List some examples.
- Explain the usefulness of charts.
- Define: conditional formatting
- Explain how spreadsheets can be used as a database.