Chemical Engineering 263 – Numerical Tools

Class Business

* Opening prayer
* Personal Introduction (Name, career history, research interests, family)
* Review Syllabus

- Questions
- Course Website
- HW policy
- Office Hours
- Academic dishonesty
- Grades
- competencies
- Intro TAs.

* Review schedule.

I. Study Tips

* I have been a student for a long time
* "Make it stick" by Brown, Roediger & McDaniel (2014)
  ↳ summary of education literature.

- Learning is durable when effortful (like exercise)
- Re-reading & grouped/mass practice are common but among least productive activities
- Retrieval practice (quiz yourself / do w/out looking) is much better. Learning happens during retrieval.
- Familiarity ≠ knowledge.

example. Sacrament prayers. How many of you know the prayer for the bread?

↳ pick a student.

↳ Can you say it right now?

Tips

* Try your HW by yourself first.
* After class you will be familiar, but not know it yet. Need to put in effort to retrieve to learn. Try to do your HW w/o looking at notes.
* HW is meant to help you learn. Avoid the mentality of just "trying to get it done." Learn something while you do it!
* Prepare for exams by (i) looking at the big picture (how things are connected) & (ii) testing yourself (e.g. w/ a friend) by answering conceptual questions or describing procedures of how to solve a problem.

II. Unit of the day

1 meter = 3.28084 feet

1 m = 3.28 ft.

$$\frac{\text{1 m}}{\text{1 ft}}$$

III. Numerical tools

A. What are numerical tools? Why do we use them?

* Numerical tools are computer programs that help us do math
* We use them for 2 reasons:
  1. They make our life easier.
     - Computers can do simple arithmetic quickly and easily (calculator)
     - Computers store data so we don't have to remember or write by hand
     - computers can be used to plot & visualize data
  2. They allow us to solve problems we otherwise couldn't do by hand.
     - Systems of equations, Non-linear equations, ODEs, PDEs, etc.
     - Numerical Methods is the discipline that tells us how we can turn a math problem into a computer problem.

B. Types of numerical tools

- Spreadsheets – excel
- Mathematics packages – Math CAD, Mathematica, Maple
- Programming languages – C/c++, Fortran, python, etc.

↕ Matlab is kind of a hybrid

↳ At the base, all of computers are run by programming languages (C/C++ often)

II. Introduction to Excel – Hands-on. Everyone Download sheet & do examples.

* Talk through "A":

A. Basics.

- workbook is made of worksheets is made of cells
  - Each worksheet has a name
  - Each cell is a "calculator". An execution unit.
  - Cells can reference other cells. Can have chains / networks.
  - Cells can contain formulas (built-in or defined)
  - cells can contain numbers or text.
  - Cells can be formatted to make a table.
- Other elements
  - plots / graphs
  - Text Boxes
- File operations
  - save / save as
  - open

} look through menus...

* students start here

B. Moving around.

- Active cell
  - control by mouse, arrow keys or box in upper left
- Cell selection
  - mouse: click & drag, click + shift or click + ctrl
  - Keyboard: shift + arrows
- other commands for moving / selecting.
  - ctrl + arrow
  - ctrl + shift + arrow
  - tab / shift + tab
  - dble click boundary → move to bottom / left / etc
  - drag boundary → move cell

- copy / paste
  - edit → copy / paste — ctrl + C / ctrl + V / ctrl + X (cut)
  - right click → copy / paste — paste special

- "Smart Fill"
  - drag box on lower right
  - double click box on lower right

- Deletion / Insertion
  - clear all (Del)
  - get out w/o changes (esc)
  - right-click → delete / insert cells
    " " rows

C. Formatting

- Adjust cell size - column / row width
- Format cells - text, borders, fill color, text color, alignment, indent
- Merge cells
- Copy / Paste preserves formatting
- Number formatting
- Auto Sum button
- Enter text using quote.

D. Calculations

- Readibility, white space, comments
- Calculations - operations, order of operations, parentheses
- Variables - named cells, name manager
- Do unit conversions in separate cells.

E. Formulas

- Locking a cell: A4 or $A4 or A$4. ("locks" that piece of the address.)