MAT – Program Design
Outline

• problem solving
  – the big picture

• structured problem solving
  – focus on the plan
  – decomposition/refinement
  – pseudo code/flowchart

• flowchart tools

• reminders
Problem Solving

1. Define
2. Represent
3. Plan
4. Implement
5. Evaluate
Structured Problem Solving

3. Plan
Structured Problem Solving

- tasks
- decompose
  - big
  - medium
  - small
  - smallest
- order

3. Plan
Structured Problem Solving

• top down step-wise refinement
  – start big
  – determine subtasks and order
  – continue until you can't get any smaller

• pseudo code
  – informal
  – programming "light"
Scrambled Eggs – Top Down Style

• assumptions
  – you know how to cook scrambled eggs

• givens
  – food: eggs, butter
  – equipment: frying pan, stove, plate, bowl, fork, spatula
Scrambled Eggs – Top Down Style

• level 1

make scrambled eggs
Scrambled Eggs – Top Down Style

• level 2

make scrambled eggs
collect equipment
collect ingredients
prepare equipment
prepare ingredients
cook eggs
Scrambled Eggs – Top Down Style

- level 3

make scrambled eggs

collect equipment

  get frying pan
  get fork
  get bowl
  get plate

if all clean (enough?), continue
otherwise, wash as needed
Scrambled Eggs – Top Down Style

make scrambled eggs
collect ingredients
how hungry?
get egg
if more needed,
go to previous
otherwise,
go to next
get butter

level 3
Scrambled Eggs – Top Down Style

- level 3

**make scrambled eggs**

**prepare equipment**

- place pan on burner
- set burner temp
- butter in pan
- check pan temp
- if temp too low,
  - go to previous
- otherwise,
  - continue
Scrambled Eggs – Top Down Style

make scrambled eggs
prepare ingredients
  crack egg into bowl
  if uncracked eggs,
    go to previous
  otherwise,
    go to next
  scramble egg with fork

• level 3
Scrambled Eggs – Top Down Style

• level 3

make scrambled eggs
  cook eggs
    pour eggs into pan
    move eggs with spatula
    if eggs uncooked,
      go to previous
    otherwise
      turn off stove!
    scoop egg onto plate
Peanut Butter Sandwich

• problem: to create an open faced peanut butter sandwich, ready to eat

• write an algorithm to create the sandwich

• work in pairs
• list assumptions
• steps in order
Time to try it out

• One algorithm will be selected and demonstrated
How did it go?

• Computers are very literal
Structured Problem Solving

- **flowcharts**
  - develop not document
  - high level
  - executable only
  - coding guideline
  - specifics not included

- **symbols**
Structured Problem Solving

- algorithm
  - top down step-wise
  - pseudo code

- flowchart
  - higher level
  - verification
Structured Problem Solving

algorithm + flowchart = easy code
Flowchart Tools

• MS Word, Excel, PowerPoint
  – Insert/Shapes

• MS Excel flowchart symbols template
Flowchart Tools

- MS Visio or open source equivalent
  - Calligra Flow (Windows, OS X, Linux)
  - ArgoUML (Windows, OS X, Linux)
  - OpenOffice Draw 3.0 (Windows, OS X, Linux, Unix)

- Gliffy Online
  - http://www.gliffy.com/flowchart-software/
Reminders

• structured problem solving
  – top down step-wise
  – pseudo code
  – flowcharts