Outline

- Announcements
  - HWII due Monday
  - HWIII out soon
  - Sign-up for CTC account
- OpenGL graphics
- Portability with GLUT

Why Add Graphics?

- Writing graphics routines can be difficult (not as hard as you think, though)
- There are many packages for scientific visualization (MATLAB, AVS, OpenDX)
- So, why bother coding yourself?
  - Get a quick view of results
  - Make program accessible to non-specialists
  - It’s cool!

- OpenGL is *the* graphics library
  - Started as proprietary library on Silicon Graphics workstations
  - Now available everywhere (standard with most systems)
  - Tightly coupled with graphics cards
  - Underlying system for most games and scientific visualization systems

- Built-in primitives to draw points, lines, polygons
- Can easily transform objects in 3D
  - scale, rotate, translate, change viewpoint
- Can control opacity of objects, not just color
- Can add textures to objects
- For more info:
  - www.opengl.org or
  - CS417

OpenGL and GLUT

- OpenGL is a rich description of graphics operations
- But, OpenGL needs to interact with system
  - needs windows to draw in
  - needs windows to recognize graphics commands
- GLUT--Graphics Library Utility Toolkit
  - System independent library for creating windows and managing simple user interaction (mouse, keyboard, menus)
  - Can call from C (C++), FORTRAN, and now Java

GLUT

- Can build simple GUI’s with GLUT
  - for more sophisticated GUI’s consider Java or system-dependent tools
- However, GLUT GUI’s demonstrate basic GUI ideas:
  - Developer writes Callbacks--routines that are executed upon user events:
    - Mouse click in window, keyboard input
  - The program tells GUI system which routines go with which events
  - Control is turned over to GUI system
    - GUI system calls Callbacks as needed

GLUT and RAD1D

- I added GLUT routines to RAD1D to plot C at several times
- main:
  - Creates a window
  - Registers “DrawC” as “DisplayFunc”
    - DrawC is called when screen must be re-drawn
    - No inputs to display functions!
  - Registers “ResizeIt” as “ReshapeFunc”
    - ResizeIt(width,height) is called when window is resized
  - Calls RunRad
    - Original RAD1D main
  - Gives control to GLUT

RunRad

- Accepts 1 more input: Nsamp--number of time samples
- C is stored every T/(Nsamp-1) time units
  - AddC stores C in array GLC in Glout.c

DrawC

- plots a line for every time observation of C
- first line is red, last line is blue, color varies in between