ECE 71 – Engineering Computations in C
Class Assignment – February 10, 2009

Professor Kriehn
Due By: Midnight on Thursday, October 1, 2009

Print out your algorithms and commented code for each of your homework solutions.

HOMEWORK #10 – Compass Heading

While spending the summer as a surveyor's assistant, you decide to write a program that transforms compass headings in degrees (0 to 360) to compass bearings. A compass bearing consists of three items: the direction you face (north or south), an angle between 0 and 90 degrees, and the direction you turn before walking (east or west).

For example, to get the bearing for a compass heading of 110.0 degrees, you would first face due south (180 degrees) and then turn 70.0 degrees east (180.0 – 70.0 is 110.0). Therefore, the bearing is South 70.0 Degrees East. Be sure to check the input for invalid compass headings.

Specifications:
Your input prompt should say "Enter a Compass Heading: ". If you put in a Compass Heading greater than 360 degrees, the program should print the following error message: "Please Input a Compass Heading between 0 and 360 Degrees." After the error message is printed out, the program should automatically re-prompt the user to enter a compass heading again. If the user enters a heading of 360.0 degrees, the program should convert the heading to 0.0 deg automatically.

For the cardinal directions, the output should be the following:

Direction	Heading	Output
North	0.0	Compass Bearing: North 0.0 Deg East
East	90.0	Compass Bearing: North 90.0 Deg East
South	180.0	Compass Bearing: South 0.0 Deg West
West	270.0	Compass Bearing: South 90.0 Deg West

If you execute the program with the following inputs, the following information should be displayed:

```
~> hw10.o
Enter a Compass Heading: 500.7
Please Input a Compass Heading between 0 and 360 Degrees.
Enter a Compass Heading: 360.0
Compass Bearing: North 0.0 Deg East
~> hw10.o
Enter a Compass Heading: 270.0
Compass Bearing: South 90.0 Deg West
~> hw10.o
Enter a Compass Heading: 179
Compass Bearing: South 1.0 Deg East
~>
```

HOMEWORK #11 – Weather Balloons

Weather balloons are used to gather temperature and pressure data at various altitudes in the atmosphere. The balloon rises because the density of the helium inside the balloon is less than the density of the surrounding air outside the balloon. As the balloon rises, the surrounding air becomes less dense, and thus the balloon's ascent slows until it reaches a point of equilibrium. During the day, sunlight warms the helium trapped inside the balloon, which causes the helium to expand and become less dense; thus, the balloon will rise higher. During the night, however, the helium in the balloon cools and becomes more dense; thus, the balloon will descend to a lower altitude. The next day, the sun heats the helium again and the balloon rises. Over time, this process generates a set of altitude measurements that can be approximated with a polynomial equation. Assume that the following polynomial representation represents the altitude or height in meters during the first 48 hours following the launch of a weather balloon:

$$h(t) = -0.12t^4 + 12t^3 – 380t^2 + 4100t + 220,$$

where the units of t are in hours. The corresponding polynomial model for the velocity in meters/hr of the weather balloon is:

$$v(t) = -0.48t^3 + 36t^2 - 760t + 4100.$$

Write a program that will print a table of the time, altitude, and the velocity for this weather balloon using units of m and m/s. Let the user enter the start time, the increment in time between lines of the table, and the ending time, where all the time values must be less than 48 hours. After your table is printed out, also print the peak altitude and its corresponding time to a file called balloon.dat.

Specifications:
The format for your output table numbers should be `%6.2f` for the time, and `%9.2f` for both the altitude and velocity information. To format your table, use the "`\t`" (tab) character. For instance, you can use a statement similar to: `printf("%6.2f\t\t%9.2f\t%9.2f\n",time,alt,vel);`

```
~> hw11.o
Welcome to the Weather Balloon Altitude and Velocity Program.

Enter the Balloon's Starting Time: 1
Enter the Time Increment: 2.2
Enter the Balloon's Ending Time: 10
~> more balloon.dat
Weather Balloon Information
Time (hr)       Altitude (m)    Velocity (m/s)
  1.00            3951.88            0.94
  3.20            9829.43            0.56
  5.40           13066.73            0.27
  7.60           14298.57            0.05
  9.80           14092.26           -0.10

Peak Altitude: 14298.57 (m)
Corresponding Time: 7.6 hr
~>
```