16.070 Introduction to Computers and Programming

Due: 21 February  Problem Set 2  Spring 2001

All of the homework guidelines should be followed. Be sure to comment your code and make it readable. Points will be deducted if the guidelines are not followed.

NB: Indicate the amount of time you spent working on each problem on your turn in.

Problem 1 (20%)
Feedback is very important for human operators of flight vehicles. For example, a pilot landing a craft on Mars would need to know altitude, velocity, state of his thrusters (on/off), and his fuel level. These parameters serve different purposes, some essential and some very helpful. The altitude obviously lets the pilot know the distance left to travel. The velocity is important because if the craft lands at a speed greater than the maximum allowable landing velocity the craft will not survive. The state of the thrusters is not absolutely necessary but is very helpful, and allows the pilot to instantly know whether the thrusters are on or off. The fuel level is important because the pilot must not use his fuel too quickly at the beginning of the descent or he will have none left and land at too high a velocity.

You must write pseudo-code for a function that displays the continuously changing altitude, velocity, thrust state, and fuel level to the pilot. The value of each of the variables should be obtained by calling other functions.

Turn In: Typed pseudo-code of the function and time spent working on this problem.

Problem 2 (20%)
A pilot operating a Mars lander has a lot of information to process at once, and may not notice that the fuel is getting low and the thrusters are on. Therefore you must give the pilot an extra warning when the fuel is getting low and the thrusters are on. Using the function you wrote in Problem 1. Add the ability to display a warning message instead of the thrust state and fuel level, if the thrust is on and the fuel level is below 20%. Draw a flow chart for the new function.

Turn In: Flow chart for the function and time spent working on this problem.

Problem 3 (20%)
Write a program that prompts the user to enter his/her month and year of birth, and the current month and year. The program should output the users age in years and months. In order to be Y2K compliant we will enter the year in 4 digit format.

Hint: This problem can be completed without the use of an “if”-statement (Uckan p108), but you may use the “if” statement if you want to.

Turn In: Printout of source code, screen dump of sample run and time spent working on this problem.

Problem 4 (40%)
The following problem should be considered a requirement specification for a software design problem. You should follow the spiral model of the software development process. Be sure to practice top-down design techniques and follow proper modular programming guidelines.
You have been selected to be part of the planning team for the next NASA mission to Mars. NASA is trying something new this time. This mission will have corporate sponsorship. In exchange for their sponsorship a company will be allotted time to have an experiment of their choice performed on Mars. The first step will be to send out an electronic survey and collect some basic information from the possible sponsors.

You have been given the task of writing the program for this electronic survey.

The possible sponsors should be presented with a menu that allows them to identify themselves by choosing a number that corresponds to their company’s name. Once they have selected their company name from the menu they must enter how much money they intend to donate in million dollar amounts, how many people are required to perform their experiment and the approximate amount of time in days that it will take to perform their experiment. This information must then be displayed on the screen.

You must come up with two of the company names that are to be used.

A sample run is given below.

Companies that are currently being considered:
1.) Spacely Sprockets   2.) Nesta Navigation
3.) Company of your choice 1  4.) Company of you choice 2

Enter the number of your company: 2
Enter the amount of money you intend to donate: 10
How many crewmembers are required to perform you experiment: 2
How many days will it take them to perform the experiment: 90

You have provided the following information:
Company: 2
Donation: 10
Crew Required: 2
Days Required: 90

Press any key

**Turn In:** Printouts of the 5 steps of software design as detailed in Recitation 2. You may choose any one of the following three methods of implementing part 2 of step 3: Pseudo-code, Flow chart or State diagrams. Also add the time you spent working on this problem.