

HOMEWORK No. 1 - DUE beginning of class September 3, 2013

Download the Simulated Computer ZIP and PDF files from the Reference Material Folder on WebCT.

You can unzip and install the executable file on your own computer. This version of the Simulated Computer actually runs on an ATARI 800 computer. An emulator for the ATARI 800 is included in the ZIP file. The program to execute after un-zipping is (Atari800Win.exe). The first time you run the Atari emulator you should click on File>Autoboot Image>Simulated Computer II.atr. After this when you execute the emulator the Simulated Computer program should automatically start.

The Window should look like:



The PDF file is the User's Manual for the Simulated Computer.

The Manual has shown all of the major "building blocks" (commands and instructions) of the Simulated Computer. Appendix II and III list them all in one place with brief explanations. You may notice that there are several kinds of SKP instructions which have not been used thus far. The MUL and DIV instructions have also not been used. Appendix IV contains a list of the error messages which you may encounter. After you review these appendices, write assembly language programs for the following three exercises.

Hand in screen shots and if appropriate separate program listings for the exercises.

Your code must be commented in some way (I suggest annotating the screenshots).

### 1: EVALUATE ALGEBRAIC EXPRESSIONS

Those of you who have studied algebra may recall that you were occasionally required to calculate the value of an expression when particular values are substituted for variables. For example, the expression  $7X$  is equal to 14 if  $X$  is 2. The value is 42 if  $X$  is 6. The value of the expression  $3X - 5$  is 13 if you substitute 6 for  $X$ . (Note:  $3X$  means 3 times  $X$ .) Write a computer program which will evaluate each of the following expressions. Check your programs by running them and inputting the numbers given below.

Expression	Inputs	Computer should output
(a) $X - 5$	7	2
	5	0
	-77	-82
(b) $7X - 8$	3	13
	43	293
(c) $3A + 5B$	A=2, B=5	31
	A= -5, B=3	0
(d) $X^2 + 2X - 1$	3	14
	0	-1
	-3	2

### 2: NUMBER SEQUENCES

A number sequence is a series of numbers that follow a particular "rule", or pattern, as they go from one to the next. For example, the sequence:

(a) 3, 6, 12, 24, 48, 96, etc.

uses the rule "multiply by 2". Can you guess the rule for the following sequence?

(b) 2, 5, 11, 23, 47, 95, etc.

(It is "times 2 then add 1".)

Once you know the rule for a sequence, you can write a program which will output that sequence. Write programs which output the above sequences. Then try your hand at the following sequences:

(c) 2, 5, 14, 41, 122, etc.

(d) The following sequence is quite famous. It appears in many forms in nature. It is called the Fibonacci sequence. Its rule is somewhat different than the above examples.

1, 1, 2, 3, 5, 8, 13, 21, 34, etc.

### 3: A DECISION MAKER

(a) Write a program that uses an INP instruction. If the number that you INPut is positive or zero, have your program OUTput the number 1. If the number that you INPut is negative, have the program OUTput the number zero.

(b) This exercise is an extension of the above. If the user INPuts a positive number or zero, have your turtle turn right and draw a line 10 units long. If a negative number is INPut, the turtle must turn left and draw the line.

(c) Write a program which determines whether the value the user INPuts is less than or equal to 7. OUT-put a 1 if it is, and a 0 if it is not.

(d) In exercise 1 you were asked to write computer programs which evaluate expressions like  $X - 5$  or  $7X$ . Now write a program which can tell you if:  $x^2 - 3 = 2X$

If it is true for the user's INPut, then OUTput a 1. Output a 0 if it is not true. Run the program for the following INPuts:  $X = 2$       not true      and  $X = 3$       true