

Homework #6 - Due 11/7/06 (Tuesday)

Write an MIPS assembly language program to perform bubble sort of “length” elements.

```
lastUnsorted = length - 1
sortedFlag = 0
while (lastUnsorted >= 1 and sortedFlag == 0) do
    sortedFlag = 1
    for test = 0 to lastUnsorted-1 do
        if (numbers[test] > numbers[test+1]) then
            temp = numbers[test]
            numbers[test] = numbers[test+1]
            numbers[test+1] = temp
            sortedFlag = 0
        end if
    end for

    lastUnsorted = lastUnsorted - 1
end while
```

Use the data below when you run your program.

```
.data
numbers: .word 2, 3, 1, 8, 5, 6, 3, 7, 1, 5
length: .word 10

.text
.globl main
main:
##### Your code goes here #####

li    $v0, 10          # system code for exit
syscall
```

Directions: (This assume you are using PCSpim, but xspim is the labs under Linux too)

- 1) Log on the Wright lab using the generic user account “wrtlab” with password “wr+l@b”
- 2) Write your assembly language program on paper first! I will not help anyone debug their program without your handwritten program.
- 3) Type in your program using WordPad and save it on a USB flash memory stick. Remember to use quotes around the file name "hw6.s"
- 4) Debug your MIPS assembly language program.
- 5) When it is correct, **run it to completion** and copy to the Window's clipboard a snapshot of the PCSpim window by using the <Alt> and <Print Screen> keys together.
- 6) Open up new Word document and set its page layout to Landscape by File | Page Setup | Paper Size and then select Landscape.
- 7) Paste the snapshot of the PCSpim Debugger window into the Word document. Resize the snapshot to the margins and print a copy to turn in.
- 8) Print a copy of the assembly language program to turn in too.
- 9) Hand in a copy of your assembly language program **and** the snapshot of the PCSpim window showing the resulting sorted memory.

Entering the Program using WordPad:

- 1) Start | Programs | Accessories | WordPad
- 2) Type in the program in a new file
- 3) File | Save As
 - Save in file name: "hw6.s" (USE DOUBLE-QUOTES AROUND FILE NAME)
- 4) After debugging, print a copy of the program to hand in

Running the Program using PCSpim:

- 1) Start | Programs | Programming | PCSpim7
- 2) Maximize the window by clicking on the 2nd icon in the upper right of the window
- 3) Load the program by File | Open
- 4) Observe the *initial* DATA values for “numbers” and “length” in memory (hex) before the program runs:
0x00000002 0x00000003 0x00000001 ... 0x00000005 0x0000000A
- 5) Observe the *initial* register are all 0's before the program runs
- 6) Run the program by Simulator | Go, then Click "OK" in the Run Parameters window
- 7) Observe the *resulting* DATA values for “numbers” and “length” in memory (hex) after the program runs:
0x00000001 0x00000001 0x00000002 ... 0x00000008 0x0000000A
- 8) Observe the *resulting* register values after the program runs
- 9) Copy the PCSpim window to the Window's Clipboard using <Alt><Print Screen> keys

Printing the PCSpim window using Word:

- 1) Start | Programs | Microsoft Office | Microsoft Office Word 2003
- 2) Type your name at the top of the blank page and hit <enter>
- 3) Paste in the PCSpim window from the Clipboard by Edit | Paste
- 4) Change to landscape by File | Page Setup and then click "Landscape" button
- 5) Resize the frame containing the PCSpim picture by
 - clicking on the frame
 - drag the lower-right corner to make the picture bigger
- 6) Print this picture of the PCSpim window to hand in

Downloading PCSpim at Home:

To run PCspim on a PC under Microsoft Windows, download the file
<http://www.cs.wisc.edu/~larus/SPIM/pcspim.zip>, unzip it, and run setup.exe.

To run spim or xspim on a Unix or Linux system, copy either the compressed tar file
(<http://www.cs.wisc.edu/~larus/SPIM/spim.tar.Z>) or the gzip'ed tar file (
<http://www.cs.wisc.edu/~larus/SPIM/spim.tar.gz>). Both files contains source code and must be compiled on a particular system.