

Computer Organization Homework #8

Due: November 7, 2008 (F)

The high-level language program to calculate x^y could be written as

```
main:
    result := 1
    for counter := 1 to y do
        result := result * x
    end for
```

In MIPS assembly language this translates to the following program:

```
#####
# HW 8 by Mark Fienup <<<<<< Replace my name with your name here as a comment
    .data
x:    .word 2      # x stored in $8
y:    .word 3      # y stored in $9
result: .word 0    # result stored in $10
        # counter stored in $11

    .text
    .globl main
main:
    lw    $8, x          # store x in reg. $8
    lw    $9, y          # store y in reg. $9
    li    $10, 1         # store result in $10 and initialize it to 1

for:
    li    $11, 1        # store counter in $11 and initialize it to 1
for_compare:
    bgt   $11, $9, end_for
for_body:
    mul   $10, $10, $8   # mult. result by x
    addi  $11, $11, 1
    j     for_compare
end_for:
    sw    $10, result
    li    $v0, 10        # system call to exit
    syscall
```

Your assignment is to type in the above program using some editor like WordPad, and run the assembly language programming using PCSpim. Detailed directions on the back page.

Turn in: Printout of the file containing the program and the resulting PCSpim window **after** running the program.

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

- 1) Log on the Wright lab using your AD-ITS (same account you use for the Library, Union, Dorm, and various hallway computers on campus. If you need your password reset, you must go to ITT 36 for ITS User Support. CNS Support CANNOT reset passwords for student accounts.)
- 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 as a **Text Document** on a USB flash memory stick.
- 4) Run and debug your MIPS assembly language program using PCSpim.
- 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. (Details below)
- 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 | All Programs | Accessories | WordPad
- 2) Type in the program in a new file
- 3) File | Save As
Change the "Save as type" to "Text Document" and name the file: hw8.s
- 4) After debugging, print a copy of the program to hand in

Running the Program using PCSpim:

- 1) Start | All Programs | Programming | PCSpim
- 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 of x (2_{10}) and y (3_{10}) in memory (as hexadecimals) before the program runs:
DATA
[0x10000000]...[0x10010000] 0x00000000
[0x10010000] **0x00000002** 0x00000003 0x00000000 0x00000000
[0x10010010]...[0x10040000] 0x00000000
- 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 "result" (8_{10}) in memory (as hex) after the program runs:
DATA
[0x10000000]...[0x10010000] 0x00000000
[0x10010000] 0x00000002 0x00000003 **0x00000008** 0x00000000
[0x10010010]...[0x10040000] 0x00000000
- 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 | All Programs | Microsoft Office | Microsoft Office Word 2007
- 2) Type your name at the top of the blank page and hit <enter>
- 3) Paste in the PCSpim window from the Clipboard by <Ctrl><v>
- 4) Change to landscape by Page Layout tab | Orientation menu item
- 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 MIPS simulator (Spim) for your home computer:

The Spim web-site is <http://pages.cs.wisc.edu/~larus/spim.html>

Download PCspim if you are using Microsoft Windows (Windows NT, 2000, XP, Vista).

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.