EE502
SPRING 2007
Lab 1
Total 150 Points

SPIM and SimpleScalar Lab

Due: Feb 13, 2007

Note: Please add comments to each line of your assembly program for readability.

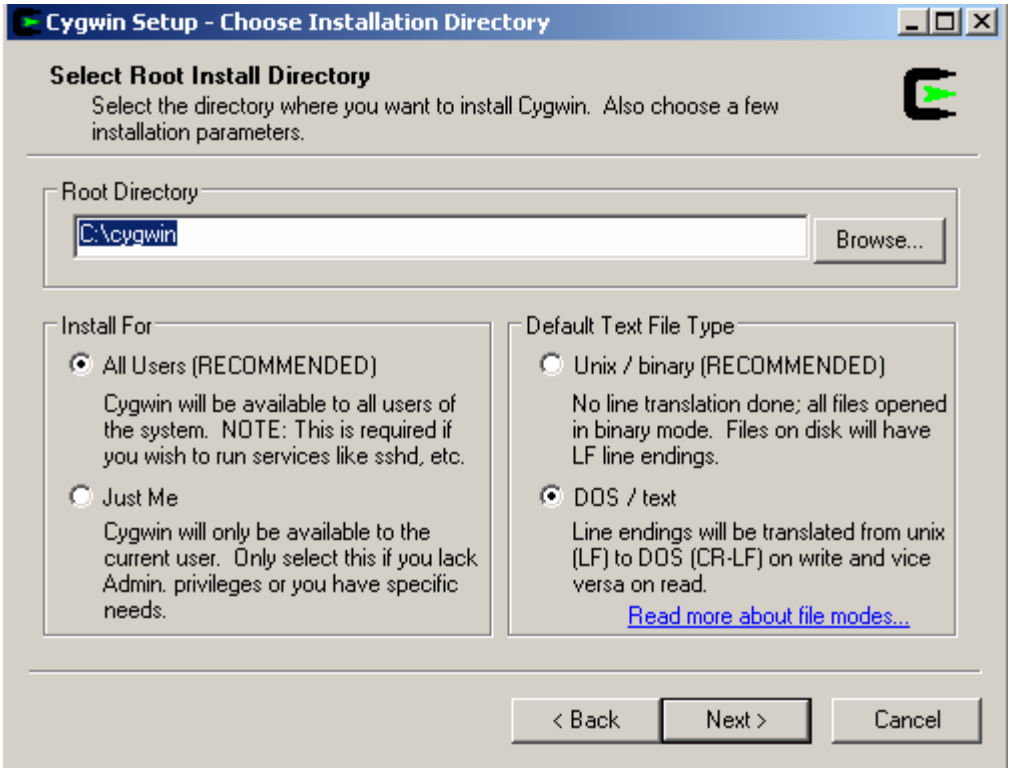
1. (20 points) In SPIM, write a MIPS program that calculates d=a*b-a*c without using mult instruction --- just for practicing your MIPS assembly.
    - Hint: use loop of additions to replace mult.
    - Practice SPIM system calls to input values for a, b and c, as well as printout the value of d.
    - Software optimization preferred. (refer to Textbook Exercise 1.54)
    - **Installation of SPIM or its PC version PCSpim.**
        i. Either go to http://www.cs.wisc.edu/~larus/spim.html to download executable or check your COD3e Software section.
        ii. Follow the installation instruction of the web page or COD3e Software.
        iii. Read SPIM documentations in http://www.cs.wisc.edu/~larus/spim.html and COD3e, especially http://www.cs.wisc.edu/~larus/SPIM/spim_documentation.pdf

2. (40 points) Using SPIM to implement MIPS assembly program for set_arrary() of Chap 2. Exercise 2.15.
    - You may setup the array and its content by yourself.
    - Set breakpoints before calling set_array(), during set_array(), during compare(), and during sub() to examine the status/content of stack and registers sp and fp.
    - **Make snapshots of the stack at the abovementioned locations** to be included in your report.

3. (90 points) Using sim-profile of SimpleScalar's SimpleSim-ARM and MiBench to generate instruction profiles of all 3 SMALL benchmarks of CRC32 and jpeg.
    a) **Install Cygwin** if you are working on a PC with Windows. If on Unix or Linux, skip this step.

i. Go to Cygwin web site http://www.cygwin.com/ click “install cygwin now” to download setup.exe

ii. During Cygwin installation, be sure to select “DOS/text” for “Default Text File Type” as shown below.



iii. Install the ‘base’ package as well as **‘gcc C compiler’, ‘gcc C++ compilers’ and ‘make’** which are under ‘devel’ (development) package

iv. More of Cygwin setup.exe can be found in http://www.cygwin.com/cygwin-ug-net/setup-net.html

b) Install SimpleScalar’s SimpleSim-ARM

i. Download http://www.eecs.umich.edu/~taustin/code/arm/simplesim-arm-0.2.tar.gz from SimpleScalar web page

Learn more at http://www.simplescalar.com/v4test.html --- you may also want to check the documents in SimpleScalar Home Page.

ii. Place the package in a specific directory, such as your Cygwin home directory, and Unzip the package.

- Use PC unzip tool
- Or give the following command in Cygwin/Unix/Linux
    - tar zvxf simplesim-arm-0.2.tar.gz

iii. Go to simplesim-arm directory to do the following

- make clean
- make config-arm
- make all
  - You will encounter a lot of warnings and just ignore them.
  - You may encounter one error in random() of misc.c if you are running in Windows 2000.
  - **Fix the error by commenting out the line containing "extern long randam(void)" in misc.c, then repeat 'make all'**
  - Once it is done, make sure all the sim-*.exe are in your $PATH or copy them to a location for executing your project
    - You may accomplish this by modifying .bashrc and .bash_profile files in your $HOME directory with $PATH command, such as
      - `PATH=${HOME}/simplesim-arm:${PATH}`
    - Links to example .bashrc and .bash_profile on EE502 BlackBoard

https://blackboard.temple.edu/bin/common/content.pl?action=LIST&render_type=EDITABLE&mode=&content_id=_786770_1

c) Install MiBench binaries

i. Go to MiBench web site and click ARM binaries to download. http://www.eecs.umich.edu/mibench/

ii. Unzip the package

iii. You may want to look at the source codes and the paper of MiBench for reference by click links in its web page.

d) **Run sim-profile** on three SAMLL CRC32 and jpeg benchmarks for their instruction profiles.

i. Command example:

```
sim-profile -iprof -dumpconfig configdump.doc -redir:sim simout.doc
c:/ee502/mibench/crc/crc.arm > progout.doc
```

- "-iprof" is to generate instruction profile
- It is a good practice to dump the configuration of SimpleScalar simulator to a file using "-dumpconfig" for future references.

- You run the compiled binaries, not the source codes, on SimpleSim-ARM sim-profile simulators.
- simout.doc contains the profile, i.e. the output of sim-profile
- progout.doc contains program output of the benchmark
- Link to the bash command file on EE502 BlackBoard

https://blackboard.temple.edu/bin/common/content.pl?action=LIST&render_type=EDITABLE&mode=&content_id=_786758_1

e) **Analyze the profiles** to generate a report for all 3 benchmarks. The report is about the percentages of various ARM instructions, such as arithmetic, data transfer, logical, conditional branch and jump for integer and floating point operations.

   i. Please refer to Figure 2.48 on page 146 of the Textbook.

   ii. ARM technical and quick reference manuals can be found in ARM documentation pages, such as http://www.arm.com/documentation/Instruction_Set/index.html