Indian Institute of Technology, Delhi

FALL, 2011

ADVANCED COMPUTER ARCHITECTURE

Homework 1

(Homework Deadline : August 15th 11:59PM)

NOTE: All answers need to be brief and to the point.
Please make any assumptions that you deem to be reasonable.
Total Marks: 40

Files in this Homework:

1. hw1.pdf
2. add.c and add.s
3. factorial.c and factorial.s
4. funcptr.c and funcptr.s

Homework Submission

You need to create an Adobe pdf file that will contain the answers to all the questions in the prescribed format. All the homework submissions will be done through csl211.2011@gmail.com. For every extra day late, we will deduct 6 marks. If you are n days and m minutes late, then we will assume that you are $n+1$ days late. For any doubts about the ARM architecture, you can refer to the ARM Architecture Reference Manual:
http://www.cse.iitd.ac.in/~srsarangi/cs211/arm_book.pdf

CONTINUED

1. Installation of Tools: Learn to use the gnu ARM cross compiler. There are two ways in which you can obtain it. (10 marks)

(a) Use the installed tool chain on palasi.cse.iitd.ernet.in :

- export PATH=/misc/research/teaching/srsarangi/gnuarm-4.0.2/bin:$PATH
- You should now be able to run arm-elf-gcc

(b) Install on your own:

- Install Linux on your laptop
- You can either do a dual boot installation, or install on top of the vmplayer virtual machine. You can download vmplayer from the website of VMWare.
- Go to www.gnuarm.com
- Download gnuarm-3.4.3 for 32 bit linux, or the latest version for 64 bit linux
- Run the command : tar -zxf <name of downloaded file>
- arm-elf-gcc should be in gnuarm-XX/bin

Generate the assembly code for the C program.

```
#include <stdio.h>

int main() {
printf("Hello World \n");
}
```

Use the command :

```
arm-elf-gcc -S <name of .c file>
```

Paste the generated assembly code in the pdf file.

2. For each line of the program, add.s, explain each line of assembly code. (10 marks)

```
Example:
mov r3, #4
Set the value of register, r3, to the constant, 4.
```

3. Trace the execution of the program factorial.s (10 marks)

4. Trace the execution of the program funcptr.s for an input value of 1. (10 marks)

Program Tracing

Consider an assembly (.s) file. Start with the first line of the main function. For each assembly instruction, you need to write the values of the source registers, memory values, and destination registers in a tabular format. This table shows some sample entries for the add.s file. Please note that for stmfd and ldmfd instructions, you need to break them into individual loads and stores.

Instruction	dest.		source1		source2	
	location	value	location	value	location	value
str r3, [fp, #-16]	address	84	r3	4	fp	100
ldr r3, [fp, #-20]	r3	6	address	80	fp	100
add r3, r2, r3	r3	10	r2	4	r3	6
ldr r0, .L2	r0	.LC0	address	.L2		
bl printf	lr	line 33	function	printf		