

Homework #1 – ISA
Due September 8th, 2009

This assignment consists of five problems for a total of 100 points.

Problems 1, 2 and 5 should be handed in at the beginning of class, Tuesday the 8th of September. Each should be typewritten on a separate page with your name on each page.

Problems 3 and 4 should be turned in using the *turnin* program on the CS department linux servers per instructions below no later than 11:59pm on Tuesday the 8th of September.

1. (10) This problem consists of three parts.

- First, you are to give a sequence of C statements that produces the same results as the following MIPS code. Assume that \$s1 and \$s2 hold the respective addresses of variables i and j and that \$s3 holds the address of x[0].
- Second, you are to act as the assembler, translating the MIPS code into machine language. Your answer should be given in hexadecimal (so each instruction will consist of eight hex values).
- Third, specify (in English) what this program does.

```
lw    $t0, 0($s1)
lw    $t1, 0($s2)
slt   $t3, $t0, $t1
beq   $t3, $zero, L1
sll   $t3, $t0, 2
add   $t4, $t3, $s3
sw    $zero, 0($t4)
```

L1:

2. (10) Provide the MIPS assembly code that corresponds to the following machine language.

```
0x8fa40000
0x23bdfff8
0xaf40000
0x28880001
0x11000004
```

3. (20) Using SPIM, write and test a MIPS assembly language program that reads in a positive integer (using the SPIM system calls). If the integer is not positive, the program should terminate with the message “Invalid Entry”; otherwise the program should print out the names of the digits of the integer, delimited by exactly one space. For example, if the user entered “728”, the output should be “Seven Two Eight.”

You are to turn in the program using the following:
turnin --submit dongli hw1 digits.asm

Grading will be based on correctness, code organization and documentation.

4. (30) Using SPIM, write and test a MIPS assembly language program to compute and print the first 75 prime numbers. A number n is prime if no numbers except 1 and n divide it evenly. You should implement two routines:

- `test_prime(n)` which returns 1 if n is prime and 0 otherwise
- `main()` iterates over the integers, testing if each is prime, and printing those that are prime

You are to turn in the program using the following:

```
turnin --submit dongli hw1 prime.asm
```

Grading will be based on correctness, code organization and documentation.

5. (30) Our ISA of choice for this course is MIPS. But there are many others out there, some general-purpose and others special-purpose. For this part of the assignment you are to select one ISA (other than MIPS) and write a one-page, type-written survey on its characteristics. Make sure to identify its purpose and the features it incorporates to serve that purpose. Highlight differences with the MIPS ISA and reasons for those differences. Your survey should include all references used. Select the ISA from the list below (unless you wish to suggest one that is not on the list, in which case email me for approval to do it first).

List of ISAs:

- ARM “Thumb”
- TI “C6x” family of DSPs
- IBM Cell SPU
- Ageia PhysX
- Azul Vega
- Transmeta Crusoe
- Intel iAPX 432
- Any of the Symbolics 3600 series