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CSCI 3301 Homework # 1

Due: **Tuesday March 09, 2020 (11:59 pm), via Moodle.**

**The rules:**

* All work must be your own. You are not to work in teams on this assignment. You are not to use materials from previous offerings of this course.
* Format: Submit as a single file (via moodle) containing a PDF file. Email me ([ayn@cs.uno.edu](mailto:ayn@cs.uno.edu)) assignment only if moodle is not working.
* You may use the textbook and lecture notes, but do NOT search the Internet for solutions.
* The submission deadline is strict. Therefore, please submit on time.

# Total Marks = 100

1. [2 x 4=8 *points*]
2. For the following C statement, what is the corresponding MIPS assembly code? Assume that the variables *f*, *g*, *h*, and *i* are given and could be considered 32-bit integers as declared in a C program. Use a minimal number of MIPS assembly instructions.

*f* = *g* + (*h* – 5);

**# $s1 = h**

**# $s0 = g**

1. For the following MIPS assembly instructions below, what will be the corresponding possible minimal Java/C statement?

add *f*, *g*, *h*

add *f*, *i*, *f*

**int f,g,h,i;**

**int f = g+h;**

**int f = i+f;**

1. [3 × 5=15 *points*] Assume the following register contents:

$t0 = 0xAAAAAAAA, $t1 = 0x12345678

* 1. For the register values shown above, what is the value of $t2 for the following sequence of instructions?

sll $t2, $t0, 4 or $t2, $t2, $t1

**0xbabefef8**

* 1. For the register values shown above, what is the value of $t2 for the following sequence of instructions?

sll $t2, $t0, 4 andi $t2, $t2, –1

**0xaaaaaaa0**

* 1. For the register values shown above, what is the value of $t2 for the following sequence of instructions?

srl $t2, $t0, 3

andi $t2, $t2, 0xFFFFFFFF

**0xF555555**

1. [15 *points*]

Assume $t0 holds the value 0x00101000. What is the value of $t2 after the following instructions? Explain.

slt $t2, $zero, $t0 bne $t2, $zero, ELSE j DONE

ELSE: addi $t2, $t2, 2 DONE:

**$t2 = 0x101002**

1. **[**3 x 3 = 9 *points***] DO NOT** use calculator or converters from the Internet. Show your calculation results step by step. Note that 0x means HEX.
2. Translate 0xabcdef12 into binary.

**1010 1011 1100 1101 1111 0001 0010**

1. Translate 0xabcdef12 into decimal.

**2882400018**

1. Translate 8985 into Hex.

**2319**

1. [2 x 7 = 14 *points*]
   1. Provide the ***type***, ***assembly language instruction***, and ***binary representation*** of instruction described by the following MIPS fields:

# op=0, rs=3, rt=2, rd=3, shamt=0, funct=34

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Type** | **instr** | **op** | **rs** | **rt** | **rd** | **shamt** | **funct** |
| **R-format** | **add** | **000000** | **00011** | **00010** | **00011** | **00000** | **010000** |

* 1. Provide the ***type***, ***assembly language instruction***, and ***binary representation of instruction***

described by the following MIPS fields:

# op=0x23, rs=1, rt=2, const=0x4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **instr** | **op** | **rs** | **rt** | **const** |
| **I-format** | **addi** | **100011** | **00001** | **00010** | **00100** |

1. **[**3 × 7 =21 *points***]** Consider the following MIPS loop:

LOOP: slt $t2, $zero, $t1

beq $t2, $zero, DONE addi $t1, $t1, -1

addi $s2, $s2, 2 j LOOP

DONE:

* 1. Assume that the register $t1 is initialized to the value 10. What is the value in register $s2 assuming the $s2 is initially zero?

**20**

* 1. For each of the loops above, write the equivalent *Java* / C code routine. Assume that the registers $s1, $s2, $t1, and $t2 are integers A, B, *i*, and temp, respectively.

**Int b = 0;**

**for(int i = 10; 0 < i; i-- ) {**

**b += 2;  
}**

* 1. For the loops written in MIPS assembly above, assume that the register $t1 is initialized to the value N. How many MIPS instructions are executed? **5N**

1. **[**3 × 6 =18 *points***]** Assume that for a given program 70% of the executed instructions are arithmetic, 10% are load/store, and 20% are branch.
   1. Given the instruction mix and the assumption that an arithmetic instruction requires 2 cycles, a load/store instruction takes 6 cycles, and a branch instruction takes 3 cycles, find the average CPI.
   2. For a 25% improvement in performance, how many cycles, on average, may an arithmetic instruction take if load/store and branch instructions are not improved at all?
   3. For a 50% improvement in performance, how many cycles, on average, may an arithmetic instruction take if load/store and branch instructions are not improved at all?



