



Midterm\_A

**York University**  
Lassonde School of Engineering  
Dept. of Electrical Engineering and Computer Science  
Fall 2016

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<b>EECS2021</b>	<b>Midterm</b>	<b>Computer Organization</b>
Wednesday, Oct. 26 <sup>th</sup> , 2016		5:30 – 6:30

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Last Name |\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_| First name|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|\_|

ID \_\_\_\_\_

**Instructions to students:**

- Answer all questions.
- Marks are shown in front of each question number.
- Show your work
- Be neat and clean while drawing your logic, block, or state diagrams.

This examination consists of **FIVE** questions

Problem	Points
1	/5
2	/5
3	/4
4	/2
5	/4
<b>Total</b>	<b>/20</b>

### Problem 1 (5 points)

Assume a CPU has the following instruction mix and CPI

Instruction type	% of instructions	CPI
Arithmetic	50	1
Load/store	25	2
Conditional	15	3
Mult/Div	10	12

The clock rate is 2GHz.

You have received 2 competing proposals to improve performance.

1. To have a special multiply/division unit that performs multiplication and addition in 2 cycles. You have to reduce the clock rate to 1.7GHz.
2. increase the clock to 3GHz, that will increase load/store by one cycle and the multiply division by 2 cycles

Which of these 2 proposals is better (or none at all, the current one is better)? Justify your answer.



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## Problem 2(5 points )

Consider the previous question.

If a new optimizing compiler reduces the number of load/store by 50%. What is the speedup of the machine with optimizing compiler compared with the one described in the table before any improvements?

### Problem 3 (4 points)

Consider the following MIPS code

```
        addi $r1, $r0, 12
        addi $r2, $r0, 15
Y1:    sub  $r2, $r2, $r1
        bltz $r2, X1
        j   Y1
X1:    add  $r3, $r2, $r1
        lui $4, 12
        ori $r4, $r4, 10
```

What are the values of registers \$r1, \$r2, \$r3, and \$r4 after the program ends its execution? If a register value did not change in the code above, write “NO CHANGE”. Be sure to indicate what base are you using to display the values.

\$r1=

\$r2=

\$r3=

\$r4=

### Problem 4 (2 points)

Given the following code

Assume \$t0 holds the value 0x00101000. What is the value of t2 after executing the following code

```
main:
    slt  $t2, $0, $t0
    bne  $t2, $0, ELSE
    j    DONE
Else:
    addi $t2, $t2, 2
DONE:
```

Problem 5 (4 points)

Write actual MIPS code to implement these pseudo instructions. Since these will be done by the compiler, you can only use \$at as a temporary register. Use only **real** instructions, no pseudo instructions.

ABSUB      \$t0, \$t1, \$t2;      t0 = |t1-t2|

What is the value in decimal of the 32-bit 2's complement number 0xFFFFFFF7

What is the maximum (+ve) and minimum (-ve) values that could be represented in 9-bit 2's complement

MAX      \$t0, \$t1, \$t2;      t0 = max(\$t1, \$t2)



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