HANOI UNI. OF SCI. AND TECH. **FACULTY OF MATH. AND INFORMATICS**

MIDTERM TEST, FALL 2024 **Course: CS365 - Intro. to COA** **Duration:** 60 **minutes**	**Student name:** ..... **Student Id:** .....**Order.** **Class Id:** .....

Assessors' name and signature	**Examiners' name and signature**	**Total score**

Test Id: 1 **(This test consists of 10 questions)**

Note: ***This is an open-book exam and students are allowed to use books, smartphones, etc.***

Questions with one correct answer

Question 1. What is the decimal value of this 8-bit two's complement number 1100 0101 after shifting the number right two bits?

☐ 15 ☐ −49 ☐ 49 ■ −15

Question 2. Suppose that register `$t2` contains 0000 0000 0000 0000 0000 1101 0000 0000 and register `$t1` contains 0000 0000 0000 0000 0011 1100 0000 0000. Which of the following MIPS instructions places the value 0000 0000 0000 0000 0000 1100 0000 0000 in register `$t0`?

☐ `and $t1, $t2, $t0`
■ `and $t0, $t1, $t2`
☐ `add $t1, $t2, $t0`
☐ `add $t0, $t1, $t2`

Question 3. Which of the following MIPS codes loads the 32-bit constant `0x00300100` into register `$s0`?

☐
```
lui $s0, 256
addi $s0, $s0, 48
```
■
```
lui $s0, 48
addi $s0, $s0, 256
```
☐
```
lui $s0, 46
addi $s0, $s0, 256
```
☐
```
lw $s0, 256
add $s0, $s0, 48
```

Question 4. Suppose that the computer A, which has a 400MHz clock, runs a program P in 10 seconds. The computer B, which has twice the clock rate of A, runs P in 6 seconds. What is the number of clock cycles required for P on B?

☐ 3600×10^6 cycles ☐ 4500×10^6 cycles ☐ 4600×10^6 cycles ■ 4800×10^6 cycles

Question 5. What is the machine instruction corresponding to the MIPS instruction: `add $s0,$a1,$t7`?

☐ `0x00BF8020` ☐ `0x00AE8020` ■ `0x00AF8020` ☐ `0x00AD8020`

Question 6. Suppose that we have two computers A and B implementing the same instruction set architecture. Computer A has a clock cycle time of 1 ns and a CPI of 2.0 for a program P, and computer B has a clock cycle time of 1.5 ns and a CPI of 1.2 for P. How much faster is computer A than computer B for this program?

☐ 1.5 times ☐ 1.3 times ☐ 1.2 times ■ 0.9 times

Constructed-response questions

Question 7. Assume that $a0 initially contains 5 and $v0 is used for the output. Add comments to the following MIPS code and describe in one sentence what it computes.

```
begin: addi $t0, $zero,0      .....
       addi $t1, $zero,1      .....
loop:  slt  $t2, $a0,  $t1    .....
       bne  $t2, $zero,fin    .....
       add  $t0, $t0,  $t1    .....
       addi $t1  $t1,  2      .....
       j    loop              .....
fin:   add  $v0, $t0,  $zero  .....
```

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Question 8. What is the MIPS assembly code corresponding to the following machine code?

10001101001010000000010010110000 .....

00000010010010000100000000100000 .....

10101101001010000000010010110000 .....

Question 9. Compile the following C program into MIPS assembly code.

```
int func (int n)
  {
    int i=0;
    while (i<n)
      i=i+1;
    return i;
  }
```

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Question 10. Construct the full truth table described by the following Verilog module.

```
module func {A, B, C, S, D};
   input A, B, C;
   output S, D;
   assign S=A&B&C;
   assign D=(A^B)|(B^C)|(C^A);
endmodule
```

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HANOI UNI. OF SCI. AND TECH. **FACULTY OF MATHEMATICS AND INFORMATICS**

MIDTERM TEST, FALL 2024 **Course: Intro. to Comp. Org. and Arch.** **Course Id: CS365, Duration:** 60 **minutes**	**Student name:** ..... **Student Id:** ..... **No.** ..... **Class Id:** .....

Assessors' name and signature	Examiners' name and signature	Total score

Test Id: 2 **(This test consists of 10 questions)**

Note: ***This is an open-book exam and students are allowed to use books, smartphones, etc.***

Questions with one correct answer

Question 1. What is the decimal value of this 8-bit two's complement number 1110 0101 after shifting the number left two bits?

☐ −148 ☐ 108 ☐ 148 ■ −108

Question 2. Suppose that register `$t2` contains 0000 0000 0000 0000 0000 1011 0000 0000 and register `$t1` contains 0000 0000 0000 0000 0011 1100 0000 0000. Which of the following MIPS instructions places the value 0000 0000 0000 0000 0011 1111 0000 0000 in register `$t0`?

☐ `and $t1, $t2, $t0`
☐ `add $t1, $t2, $t0`
■ `or $t0, $t1, $t2`
☐ `add $t0, $t1, $t2`

Question 3. Which of the following MIPS codes loads the 32-bit constant 0000 0000 0010 0000 0000 0001 0000 0000 into register $s0?

☐
```
lui $s0, 256
addi $s0, $s0, 32
```
☐
```
lui $s0, 46
addi $s0, $s0, 256
```
■
```
lui $s0, 32
addi $s0, $s0, 256
```
☐
```
lw $s0, 256
add $s0, $s0, 32
```

Question 4. Suppose that the computer A, which has a 500MHz clock, runs a program P in 10 seconds. The computer B, which has twice the clock rate of A, runs P in 6 seconds. What is the number of clock cycles required for P on B?

☐ 3600×10^6 cycles ☐ 4600×10^6 cycles
☐ ····· cycles ■ 6000×10^6 cycles

Question 5. What is the machine instruction corresponding to the MIPS instruction: `add $s0,$a0,$t7`?

☐ `0x00BF8020` ■ `0x008F8020`
☐ `0x00AE8020` ☐ `0x00AD8020`

Question 6. Given a program P. Suppose that we have two computers A and B implementing the same instruction set architecture. Computer A has a clock cycle time of 1 ns and a CPI of 2.0 for P, and computer B has a clock cycle time of 2.5 ns and a CPI of 1.2 for P. How much faster is computer A than computer B for this program?

■ 1.5 times ☐ ····· times
☐ 1.3 times ☐ 0.9 times

Constructed-response questions

Question 7. Add comments to the following MIPS code and describe in one sentence what it computes. Assume that $a0 is initially contains 8 and $v0 is used for the output.

```
begin:  addi $t0,  $zero, 0       .....................................................
        addi $t1,  $zero, 1       .....................................................
loop:   slt  $t2,  $a0,   $t1     .....................................................
        bne  $t2,  $zero, fin     .....................................................
        add  $t0,  $t0,   $t1     .....................................................
        addi $t1   $t1,   2       .....................................................
        j    loop                 .....................................................
fin:    add  $v0,  $t0,   $zero   .....................................................
```

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Question 8. What are the MIPS instructions corresponding to the following machine instructions?

1000 1101 0010 1000 0000 0100 1011 0000 .....

0000 0010 0100 1000 0100 0000 0010 0000 .....

1010 1101 0010 1000 0000 0100 1011 0000 .....

Question 9. Compile the following C program into MIPS assembly code.

```
int func (int n)
  {
     int i;
     for (i=0;i<n;i=i+1)
        if (i=n) return i;
  }
```

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Question 10. Construct the full truth table described by the following Verilog module.

```
module func {A, B, C, S, D};
   input A, B, C;
   output S, D;
   assign S=A^B^C;
   assign D=(A&B)|(B&C)|(C&A);
endmodule
```

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