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

Note: *No electronic devices (laptops, smart devices, etc except calculators) are allowed.*

Questions with one correct answer

Question 1. What is the decimal value of this 8-bit two's complement number 11000101 after shifting the number right two bits?

☐ 15 ☐ −49 ☐ 49 ☐ −15

Question 2. Suppose that register `$t2` contains $0x00000D00$ and register `$t1` contains $0x00003C00$. Which of the following MIPS instructions places the value $0x00000C00$ 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. What decimal number is represented by the following IEEE 754 single precision float?

1100 0001 0101 0110 0000 0000 0000 0000

☐ 12.375 ☐ −12.375 ☐ 13.375 ☐ −13.375

Question 5. What is the Verilog code that creates a 32-bit value with the pattern 0101 . . . 01?

☐ `{2{16'b01}}` ☐ `{8'b1,4'b0}` ☐ `{16{2'b01}}` ☐ `32'b01`

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 .....
```

....

....

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;                         .....
   for (i=0;i<n;i=i+1)            .....
    if (i==n) return i;           .....
  }                               .....
                                  .....
.....                             .....
.....                             .....
.....                             .....
```

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                         .....
                                  .....
.....                             .....
.....                             .....
.....                             .....
```

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

Note: *No electronic devices (laptops, smart devices, etc except calculators) are allowed.*

Questions with one correct answer

Question 1. What is the decimal value of this 8-bit two's complement number 11100101 after shifting the number left two bits?

☐ −148 ☐ 108 ☐ 148 ☑ −108

Question 2. Suppose that register `$t2` contains $0x00000D00$ and register `$t1` contains $0x00003C00$. Which of the following MIPS instructions places the value $0x00004900$ in register `$t0`?

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

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

Question 3. Which of the following MIPS codes loads the 32-bit constant `0x01000030` 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. What decimal number is represented by the following IEEE 754 single precision float?

1011 1111 0100 0000 0000 0000 0000 0000

☐ −0.375 ☐ −1.75 ☐ 0.375 ☐ −0.75

Question 5. What is the Verilog code that creates a 32-bit value with the pattern 0101 . . . 01?

☐ `{2{16'b01}}` ☐ `{16'b01,16'b01}` ☐ `{2{16'h5555}}` ☐ `32'b01`

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 2 ns and a CPI of 1.5 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?

☐ 0.9 times ☐ 1.3 times ☐ 1.2 times ☐ 0.6 times

Constructed-response questions

Question 7. Assume that $a0 initially contains 7 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,2
loop:  slt  $t2, $a0,  $t1
       bne  $t2, $zero,fin
       add  $t0, $t0,  $t1
       addi $t1  $t1,  1
       j    loop
fin:   add  $v0, $t0,  $zero
```

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

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
```

A	B	C	S = A∧B∧C	D = (A⊕B)∨