United International University
Department of Computer Science and Engineering

CSE 313: Computer Architecture

Mid Term Examination Time: 1 Hour 45 minutes

N.B.Answer all the questions

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1. (a) Compilers can have a profound impact on the performance of an application. Assume that, for a program, Compiler A results in a dynamic Instruction Count of 1.0 X 10^9 and has an Execution Time of 1.1 s, while Compiler B results in a dynamic Instruction Count of 1.2 X 10^9 and an Execution Time of 1.5 s. Find the average CPI value for both Compiler A and Compiler B given that the processor has a Clock Cycle Time of 1 ns. [4]

   (b) A certain program runs in 250 milliseconds on a computer, of which 120 milliseconds is spent on Arithmetic operations, 80 on Conditional operations and 50 on I/O operations. Suppose we are trying to improve the run time by using a better ALU that only improves the time for Arithmetic operations. Determine if we can get 2 (two) times overall better performance only by changing the ALU or not. What is the maximum speedup possible to attain by using better ALU? [4]

2. (a) Convert the following C code for finding the two largest elements in an array of size 10 to its equivalent MIPS assembly code. Assume necessary registers. [6]

```
largest1 = array[0];
largest2 = array[1];
if (largest1 < largest2)
{
    temp = largest1;
    largest1 = largest2;
    largest2 = temp;
}

for (i = 2; i < 10; i++)
{
    if (array[i] >= largest1)
    {
        largest2 = largest1;
        largest1 = array[i];
    }
    else if (array[i] > largest2)
    {
        largest2 = array[i];
    }
}
```

   (b) Convert the following C code to corresponding machine code in binary. Assume necessary registers. Hint: convert to MIPS first and then calculate the corresponding machine code from the resulting MIPS code instruction by instruction. [5]

```
c=b+a--;
A[a]=++c;
```

(c) Convert the following C code to its equivalent MIPS assembly code. Assume necessary registers. [4]

```
int sum(int num)
 {
    if (num>0)
       return num + sum(num-1);
    else
       return num;
 }
```

(d) What's the purpose of the register $zero in MIPS architecture? Why isn't there registers like $one, $two etc.? [2]

3. (a) Assuming 4 bit architecture and using the division algorithm show each step of the division of 10 by 4. [3]

(b) What are the advantages of using optimized multiplication algorithm over the traditional multiplication algorithm? [2]