

CMSC 411 : Homework #2

Due on Monday, March 2, 2015

11:59pm

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Problem 1

Computing a Fibonacci Number (50 points)

The Fibonacci number is defined as

$$F(n) = F(n - 1) + F(n - 2) \quad (1)$$

where $F(1)=1$ and $F(2)=1$.

A) Write the MIPS assembly for the fib1(n) function, which computes the Fibonacci number $F(n)$:

Listing 1: C code fragment

```

int fib1(int n)
{
    int a = 0;
    int b = 1;
    int c = a + b;
    while (n > 1) {
        c = a + b;
        a = b;
        b = c;
        n--;
    }
    return c;
}

```

A) Write the MIPS assembly for the recursive function fib2(n). You must use recursion in your MIPS code.

Listing 2: C code fragment

```

int fib2(int n) {
    if (n == 0)
        return n;
    else if (n == 1)
        return n;
    else
        return fib2(n-1) + fib2(n-2);
}

```

Problem 2

MIPS ISA (30 points)

MIPS instruction j is a J-type instruction, which uses 6 bits for the opcode, and 26 bits for the immediate value (called the target). J-type instruction format is shown in Figure 1. The j-type instruction datapath and control signals are shown in Figure 2.



Figure 1: MIPS J-type Instruction Format

Answer the following questions:

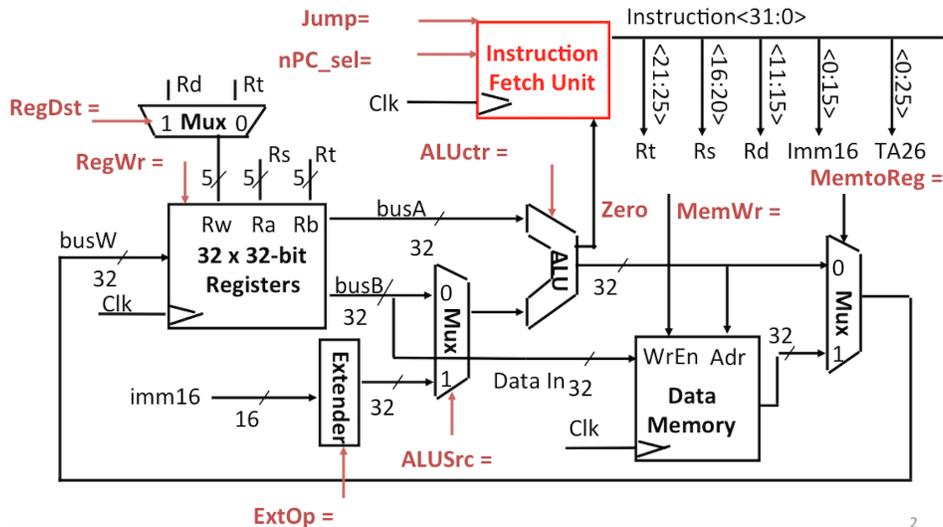


Figure 2: J-type Instruction Datapath

1. When a j-type instruction is executed, how is the 32-bit new PC address is computed?

Table 1: 32 bit target address

2. Set the values of the control signals for the j-type instruction

Control Signal	Value
RegDst	
RegWr	
jump	
nPC_sel	
ALUctr	
ExtOp	
ALUSrc	
Zero	
MemWr	
MemtoReg	

Problem 3

Amdahl's Law (20 points)

Suppose your company runs two applications SearchWeb and SellAds on a large cluster of PCs. SearchWeb takes up 70% of the total computing time. SearchWeb is 40% parallelizable, and SellAds is 95% parallelizable. Calculate the expected performance improvement when upgrading from 1-core to 8-core Xeon

systems (assuming the parallel portions of SearchWeb and SellAds scale linearly with the number of cores if parallelized):

1. For SearchWeb alone, if you make SearchWeb parallel
2. For SellAds alone, if you make SellAds parallel
3. For the entire system, if SearchWeb is parallelized
4. For the entire system, if SellAds is parallelized
5. Is it better to parallelize SearchWeb or SellAds?

What to submit

- Create a zip file that includes all the files (MIPS source code and solution to problems 2 and 3) for your project. Name your zip file as yourlastname_yourfirstname_hw2.zip, nothing else.
- Upload the zip file you created in the previous step using the submit server available at:
<https://submit.cs.umd.edu/spring2015>.
Make sure you select the submit server entry (Homework #2) that corresponds to this homework.