Assignment 2 | CSE 332

(To be submitted on 21/01/2021)

Question 1 **(10 marks)**

Consider the following MIPS loop:

```
LOOP: slt $t2, $0, $t1
      beq $t2, $0, DONE
      subi $t1, $t1, 1
      addi $s2, $s2, 2
      j LOOP
DONE:
```

a) Assume that the register $t1 is initialized to the value 10. What is the value in register $s2 assuming $s2 is initially zero?

b) For the loop written in MIPS assembly above, assume that the register $t1 is initialized to the value N. How many MIPS instructions are executed?

Question 2 **(10 marks)**

a) Translate the following C code to MIPS assembly code. Use the minimum number of instructions. Assume that the values of a, b, i, and j are in registers $s0, $s1, $t0, and $t1, respectively. Also, assume that register $s2 holds the base address of the array D.

```
for(i=0; i<a; i++)
   for(j=0; j<b; j++)
      D[4*j] = i + j;
```

b) Using registers mentioned in 2(a) translate the following C code to MIPS assembly code.

```
while (a<10){
   D[a] = b + a
   a+=1
   }
```

Question 3 **(20 marks)**

Implement the following C code in MIPS assembly using appropriate registers. Your solution does not need to be time efficient.

```
int fib(int n){
   if (n==0)
      return 0;
   else if (n == 1)
      return 1;
   else
      return fib(n−1) + fib(n−2);
```

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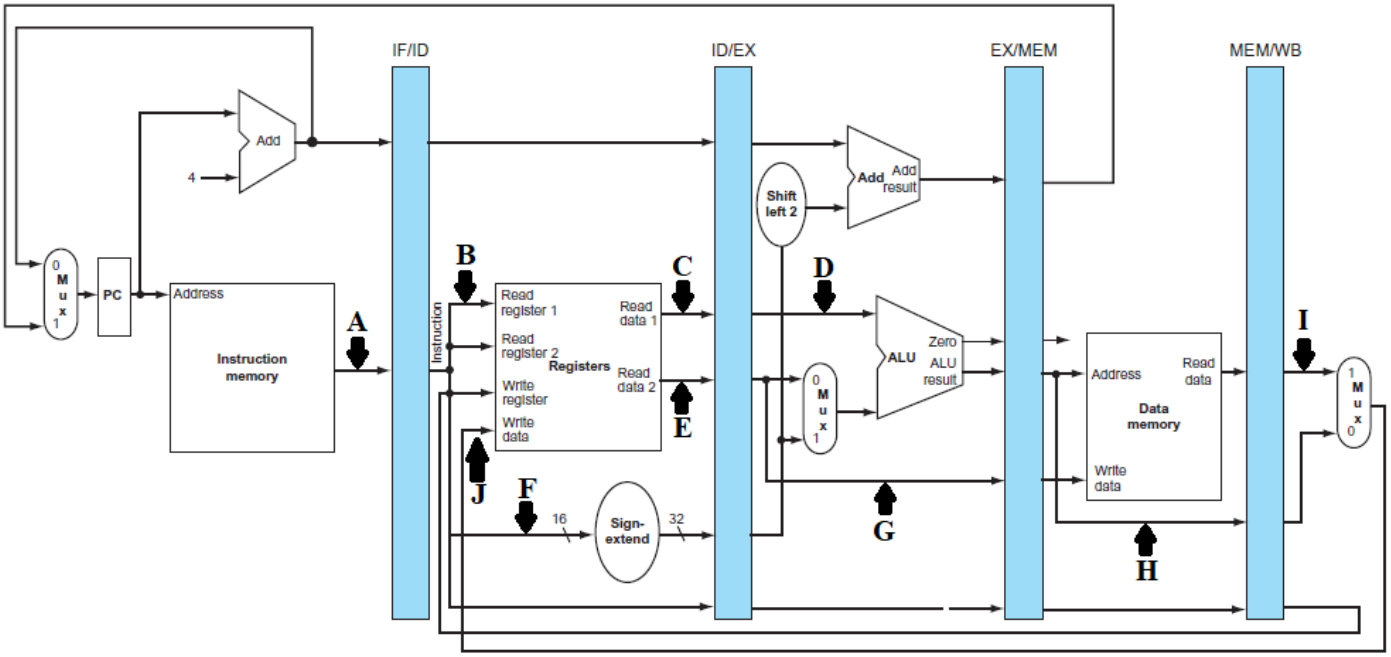
Question 4 **(10 marks)**

Datapath below shows a pipelined MIPS implementation. Given registers $1 = 4, $2 = 8, $3 = 12, $4 = 16, $5 = 20, $6 = 24, $10 = 28, $11 =32, $12 = 36, $13 = 40 and $14 = 44, and memory locations [24] = 50 and [28] = 100, what are sizes and values of the data in the indicated locations? If any value is unknown, put an "**X**".

	Size (or Number of bits)	Value
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		



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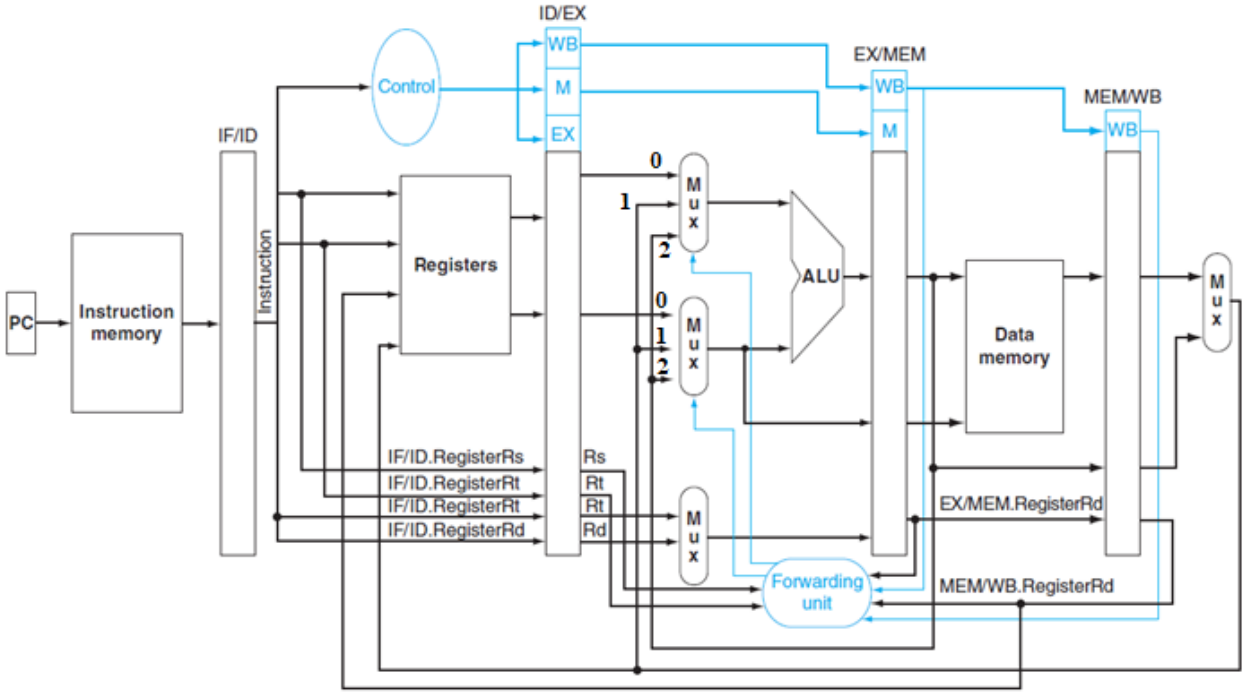
Question 5 **(10 marks)**

The pipelined MIPS implementation in *Question 4* can be modified to resolve data hazards through *Forwarding*. Draw a possible internal circuit diagram of the *Forwarding Unit* shown in the datapath below.



Question 6 **(10 marks)**

Consider the same datapath in *Question 5*, how can the register file be modified to resolve the data dependence between the first and fourth instructions in the following program? To demonstrate this modification, design a register file containing four two-bit registers.