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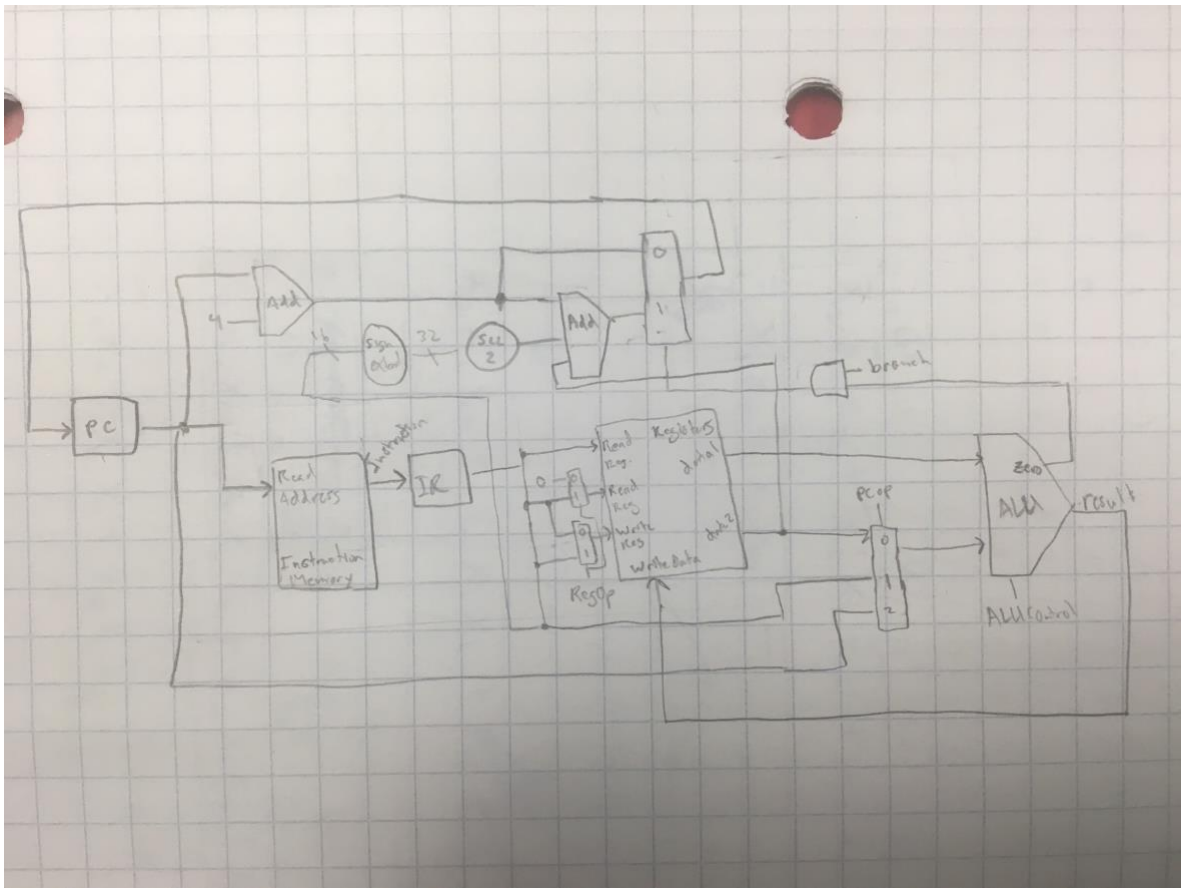
Assignment 6

1. A. The Mux leading into the Write Register line of the Register file is to allow for an I format instruction to place the correct register to be written. In other words, for an R instruction the Mux is set to 1 so rd is in the write register and for an I instruction the Mux is set to 0 rt is in the write register.

   B. The Instruction [5-0] connection into the ALU Control sends the funct field of the instruction into the ALU Control and combined with the ALUOp from the Control tells the ALU what exact operation to do.

   C. The zero output is for Branch instructions and is zero unless the compared values fit a given requirement (ie <, >, != etc.) then a 1 is sent into the and gate. So, if the Branch signal from the control is true and the zero output sends a 1, then the sign extended immediate is added to the program counter.

   D. The shift left 2 unit multiplies the sign extended branch immediate by 4. This allows for the branch instruction immediate to represent how many instructions to move up or down to since each instruction address is 4 bytes apart.

2. 

3. A.

```
add r0, r1, r2   F  D  E  M  W
xor r3, r2, r0      F  x  x  x  D  E  M  W
sub r3, r4, r0                  F  D  E  M  W
```

B.

```
add r0, r1, r2   F  D  E  M  W
xor r3, r2, r0      F  D  E  M  W          (E-E forwarding)
sub r3, r4, r0         F  D  E  M  W       (M-E forwarding)
```

4.
```
add  r1,  r2,  #0x34
sub  r2/r2,  r8,  r1
ld  r4,  c(r7)
add  r2/r2,  r4,  r7
```

RAW hazards
WAW hazards
WAR hazards