EE6361:Advanced Topics in VLSI

Assignment 2

Define a simple IIT6361 Processor with the following features . Use the below diagrams for reference

1. 32 8-bit Memory Registers (R_0 - R_{31})

2. 5 Address Lines (A_4, A_3, A_2, A_1, A_0)

3. 8 bit Data Lines

4. 4 bit Flag Registers

5. 4 function ALU with

    a) R_0, R_1 Mapped input for ADD and SUBTRACT

    b) R_4, R_5 Mapped input for COMPARE: $R_4 > R_5$

    c) R_0 Mapped input for INC

    d) R_2 Mapped Output

    e) 2 ALU function select lines F_1, F_0

For the above processor design , write testbench code to simulate the following

1. Loading Value into the register
   a) Load 141 to R_4
   b) Load 208 to R_6
   c) Load 32 to R_8

2. Moving Value Across Register
   a) Move R_4 to R_5
   b) Move R_8 to R_9
   c) Move R_6 to R_7

3. $R_4 + R_6 => R_{10}$, check R_{10} and check if Carry

4. $R_6 – R_8 => R_{11}$, check R_{11} and check if Borrow

5. $R_8 - R_4 => R_{12}$, check R_{12} and check if Borrow.

6. INC R_{12}, check R_{12}.

7. $R_4 \geq R_6$? check the flag

8. $R_4 - R_4 => R_{13}$, check R_{13} and check zero flag

9. * Add the numbers with carry using a Loop and store in R_{13}.
   $R_4 + R_5 + R_6 + R_7 + R_8 + R_9 => R_{13}$, check R_{13} with carry.

10. * Find the largest number in $R_4, R_5, R_6, R_8, R_9, R_{10}$ and store in R_{13}, check R_{13}.

Function Select Line	Function
0	00 - ADD
1	01 - SUBTRACT
2	10 – COMPARE
3	11 - INC

Table 1: ALU Functions

Figure 1: ALU Functions

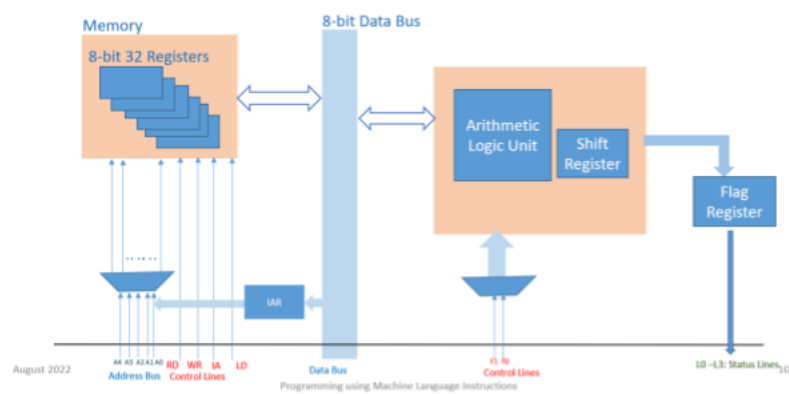| Bit number	Flag name	Description
0	L0	Carry/Borrow/Overflow/underflow
1	L1	Shifted out bit
2	L2	is set if any ALU operation results in Zero
3	L3	1 indicates result of compare is true, 0 otherwise

Figure 2: Flag Registers

Figure 3: Flag Registers

Note:

- Use the Register Memory designed in Assignment 1 .

- We will also run a plagiarism check to ensure that the code is not copied .

- Maintain Good Practices and add comments in your code explaining what you have done.

- Assignment should be submitted on or before **Sunday,10th March,11:59:59 pm** .

- Assignment should be sent in a zip file to **cindrellask@tenet.res.in** and cc to **ee23s059@smail.iitm.ac.in** with subject **"EE6361 Assignment 2".**

- The format of the zip file should be ***Rollno.zip*** .
  The zip file should contain:
  a) .v files of the module and testbench
  b) Screenshot of the Simulation
  c) Report Containing Simulation Result of all the 10 Operations