ES204 Digital Systems
LAB Assignment - 9

Indian Institute of Technology, Gandhinagar
March 19, 2024

Marks : 50

Submission instructions:

Only one student from the team will submit with the word doc name Rollno1_Rollno2.pdf. The PDF will contain the code, testbench and simulation results.

1. **[50 Marks**]

In the last lab you have designed 32-bit Register File containing 8 registers. Extend this to 16 registers. Now, make this register file *dual-port read.* This means that we should be able to give in 2 sets of addresses and read two register contents simultaneously. The data read from the registers should be passed to the ALU which will perform arithmetic and logical operations on these registers' contents. The results (output of the ALU) will be stored back into the Register file.

For instance, we will implement ADD R1, R2, R2 instruction:
This instruction takes in the contents of R1 and R2, adds them and transfers the result (of addition) to R2. There is a separate 1-bit register called Cy which stores the Carry output.

For this lab:

You are to implement the following instructions:

Arithmetic instruction:
0001: ADD Rx, Ry, Rz

Logical instruction:
0010: AND Rx, Ry, Rz

(where x, y, and z would be any values between 0..15)

Here, 0001 and 0010 are the operation codes which are used to differentiate between different operations. In this case, they differentiate between ADD and AND.