

NMJ31804 – PRINCIPLES OF COMPUTER ARCHITECTURE

LAB 2: Arithmetic Logic Unit (ALU)

Introduction

An arithmetic logic unit (ALU) is a combinational digital electronic circuit and part of a central processing unit (CPU) that carries out the operations of arithmetic and logic on the operands in computer instruction words. It represents the fundamental building block of the CPU in a computer system. Examples of arithmetic operations include addition, subtraction, multiplication, and division while logic operations are comparisons of values such as NOT, AND, and OR.

Objectives

- To design an ALU circuit using Verilog HDL.
- To apply behavioural modelling in Verilog design.

Task 1

Design a 4-bit ALU circuit using Verilog HDL. The design must consider all functions in Table 1. Verify your design by using Quartus II software.

Table 1: Functions of ALU

ALU Selections	ALU Operations
0000	$ALU_Out = A + B$
0001	$ALU_Out = A - B$
0010	$ALU_Out = A * B$
0011	$ALU_Out = A / B$
0100	$ALU_Out = A \gg 1$
0101	$ALU_Out = A \ll 1$
0110	$ALU_Out = A$ rotated right by 1
0111	$ALU_Out = A$ rotated left by 1
1000	$ALU_Out = A \text{ or } B$
1001	$ALU_Out = A \text{ and } B$
1010	$ALU_Out = A \text{ nor } B$
1011	$ALU_Out = A \text{ xnor } B$
1100	$ALU_Out = A \text{ xor } B$
1101	$ALU_Out = A \text{ nand } B$
1110	$ALU_Out = 1 \text{ if } A = B \text{ else } 0$
1111	$ALU_Out = 1 \text{ if } A > B \text{ else } 0$

Submission: Verilog coding and simulation waveform.

Due date for submission: 24th April 2022