CSE332 Lab 7

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Section: 3
Experiment Name: Design of an ALU.

Lab Discussion : In this lab class our goal was to design an ALU (arithmetic logic unit). ALU is a combinational digital circuit that performs arithmetic and bitwise operations on integer binary numbers. So, an ALU can perform both logical and arithmetic operations. In the class, we are given a brief discussion about how an ALU works, and how they are used in MIPS architecture.

In the class we have designed a 1 bit ALU that can perform logical operations like AND, OR, XOR, NOR and arithmetic operations like addition, subtraction, and multiplication. To perform logical operations we have used AND, OR, XOR, and NOR logic gates. A combinational multiplier is used to perform multiplication, and a comparator is used to perform comparison between two inputs. Two inputs A and B are connected to all these, since we will be performing logical and arithmetic operations based on input A and B.

For addition and subtraction we have used the same Adder circuit. A Cin input line is connected to the carry input of the Adder circuit. When Cin=0, the adder will perform addition operation; when Cin=1, the adder will perform subtraction operation. We have used an extra XOR logic. Cin and B value first perform XOR operation and then the output is passed to the adder input. So, when Cin=0, B value is passed to the adder input and it performs addition with A. But when Cin=1 and B=1, then B complement is passed to the adder input and it will perform subtraction with A.

Our designed ALU is performing eight different operations. To select any of these eight operations we have used 8x1 multiplexers. The output line of each operation is given to the MUX. With the help of three selection pins, we can select our desired output line. The MUX output will be the output of a specific operation that we have selected.

This is how we can design a 1 bit ALU which can perform eight operations. To design a 16 bit ALU, we can use 16 copies of our designed 1bit ALU by connecting them properly. A 16 bit ALU will take two 16 bit inputs and it will provide a 16 bit output.

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