

CSE332 Lab 2

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Course: CSE332L

Section: 3

Experiment Name: Design of a 4-bit Arithmetic unit.

Table:

S1	S0	Cin	A3	A2	A1	A0	B3	B2	B1	B0	Cout	D3	D2	D1	D0	Microoperation
0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	Add
0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	0	Add with Carry
0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	Subtract with Borrow
0	1	1	0	1	1	1	0	1	0	0	1	0	0	1	1	Subtract
1	0	0	1	0	1	1	0	1	0	0	0	1	0	1	1	Transfer A
1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	Increment A
1	1	0	1	0	1	0	1	0	0	0	1	1	0	0	1	Decrement A
1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	Transfer A

Discussion: In the 2nd lab class our goal was to construct a 4-bit arithmetic unit which is a part of an ALU. In our lab class we have implemented a 2-bit arithmetic unit that can perform micro operations like Add, Add with carry, Subtract, Subtract with borrow, Increment, Decrement and Transfer. To design that circuit we used two 4x1 multiplexers and two full adders.

A combination of selection inputs S1, S0 of two multiplexers and the carry input Cin of first full adder have been used to select the operations. For example- if we set S1=0, S0=0 and Cin=0 then the Add micro operation will be selected. So, each bit of input A will added with the corresponding bit of input B and the sum will appear at the output of each full adder along with any carry out. We can change the inputs of S1, S0 and Cin to select other micro operations.

In each multiplexer B and B' is given as input. Here, B' is used to get 1's complement of B to perform subtraction and subtraction with borrow operations. To perform increment and decrement operation increment and decrement operation a default 1 is passed to the input each multiplexer. And a default 0 is passed to perform the transfer A operation. This is how the inputs are provided. The output of each full adder represents the output bit of those micro operations. A few operations have been tested in the implemented 2 bit arithmetic unit and we got correct outputs.

To implement a 4-bit arithmetic unit we will need four 4x1 multiplexers and four full adders.