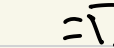
CS315-02 Digital Logic Components

Lab 08 Testing

gates 

wires, inputs, outputs, splitter/merger

combinational logic

1) Outputs depend only on the inputs
2) A circuit without cycles
   a DAG -> Directed Acyclic Graph

sum-of-products
boolean algebra equation -> circuit

adder - ripple-carry adder

circuit as components

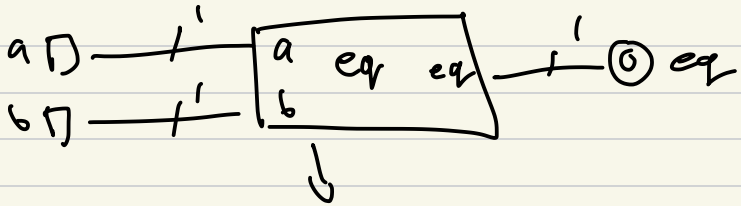
Project 05 -> static analyzer

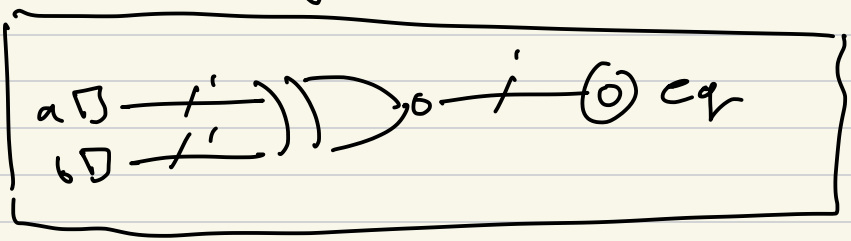
Comparator is a == b ?

$eq = (\bar{a} \cdot \bar{b}) + (a \cdot b)$

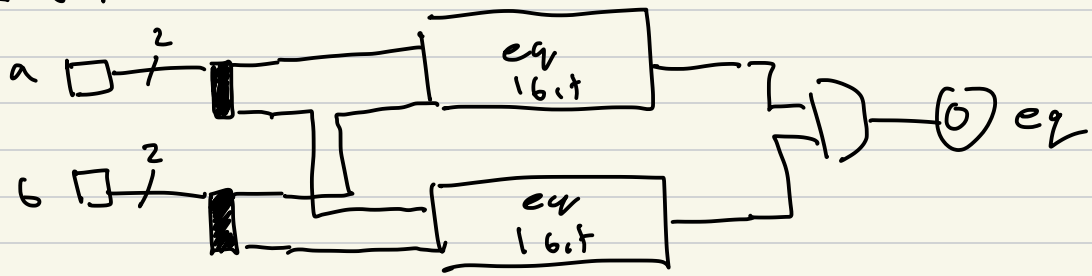
a	b	eq	XOR	XNOR
0	0	1	0	1
0	1	0	1	0
1	0	0	1	0
1	1	1	0	1

1 bit comparator



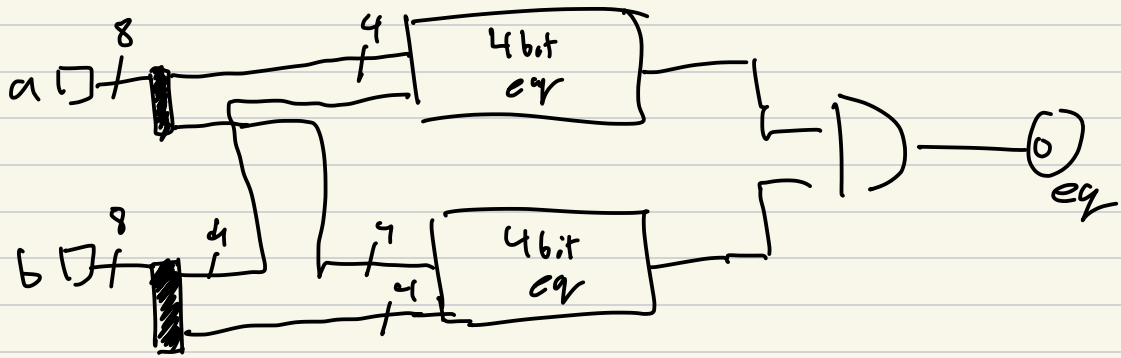


2-bit Comparator

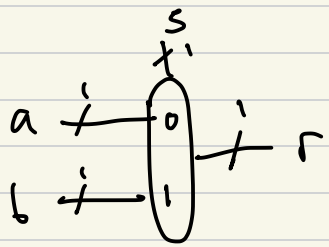


N-bit Comparators

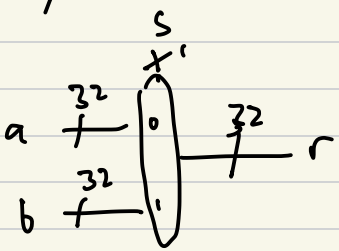
8 bit comparator



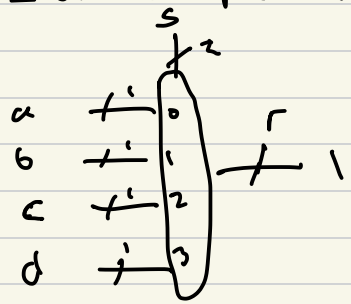
Multiplexor (MUX)



1 bit 2 input MUX



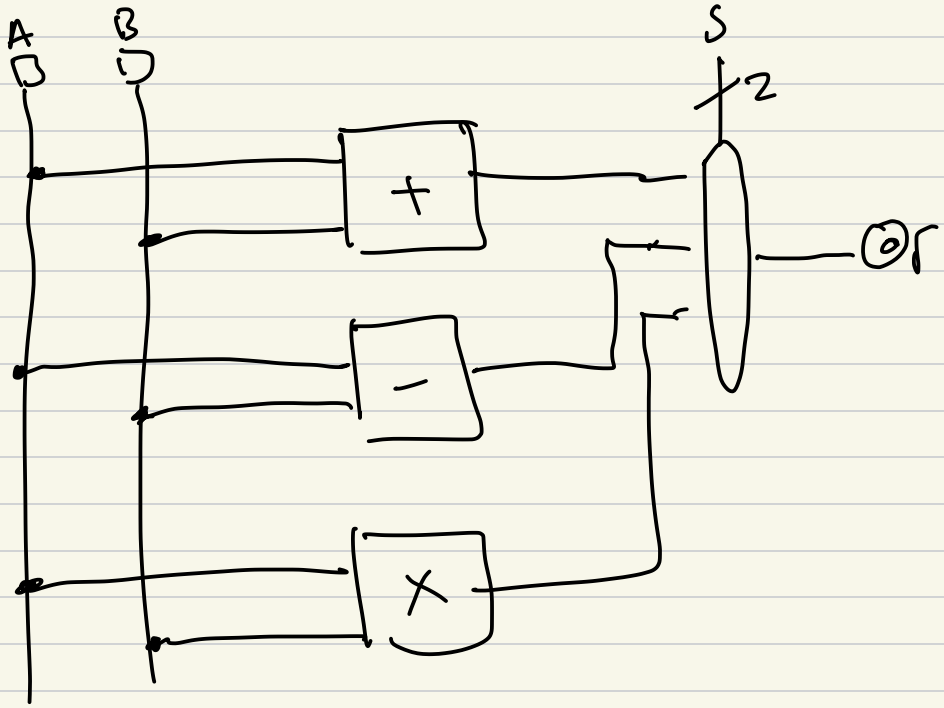
32 bit 2 input MUX



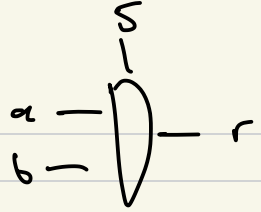
1 bit 4 input MUX

Uses of MUXes

ALU Arithmetic Logic Unit



Implementing MUXes



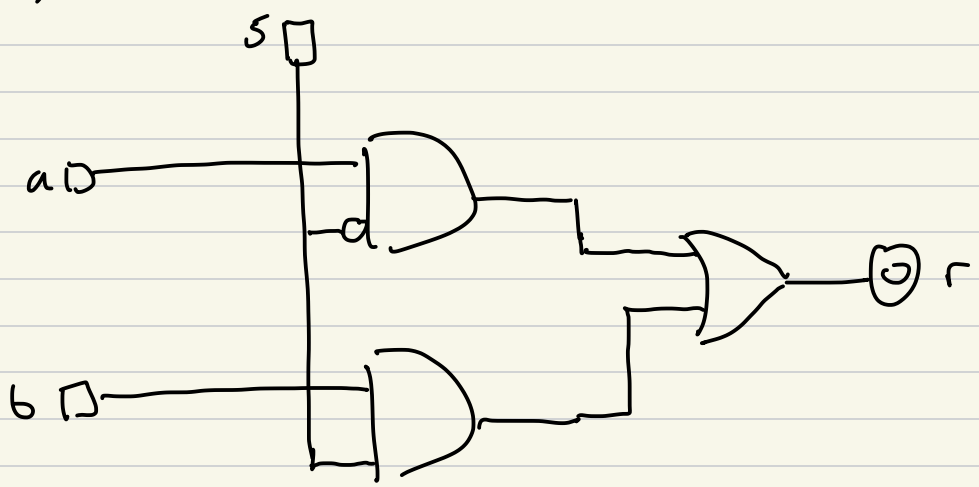
1 bit 2 input MUX

a	b	s	r
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

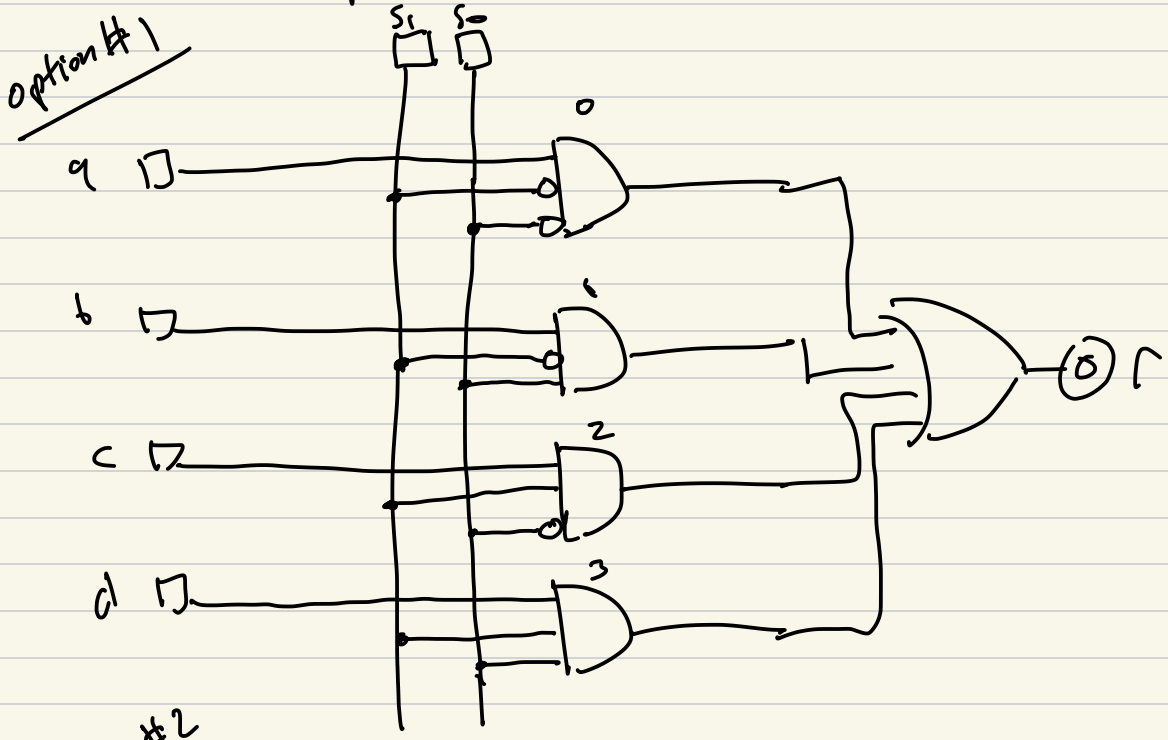
$r = (\bar{a} \cdot b \cdot s) + (a \cdot \bar{b} \cdot \bar{s}) + (a \cdot b \cdot \bar{s}) + (a \cdot b \cdot s)$

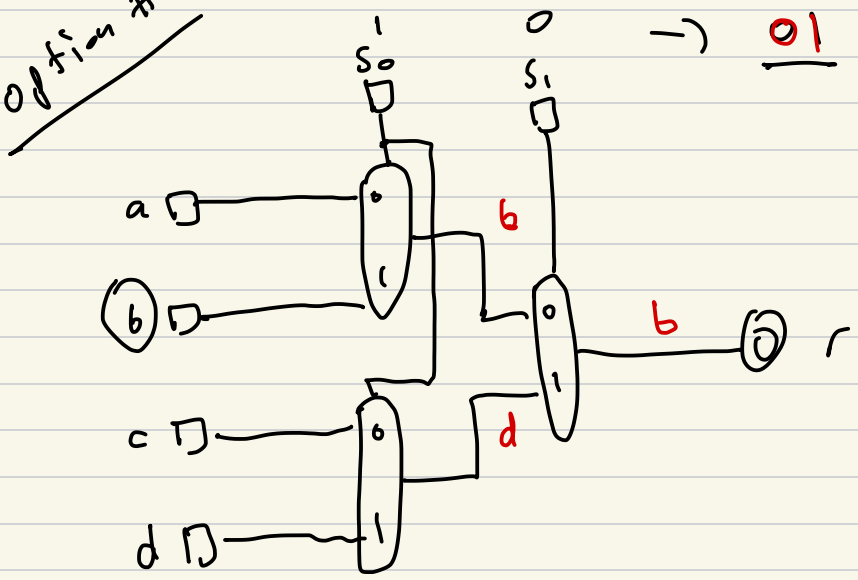
↳ circuit

Direct implementation

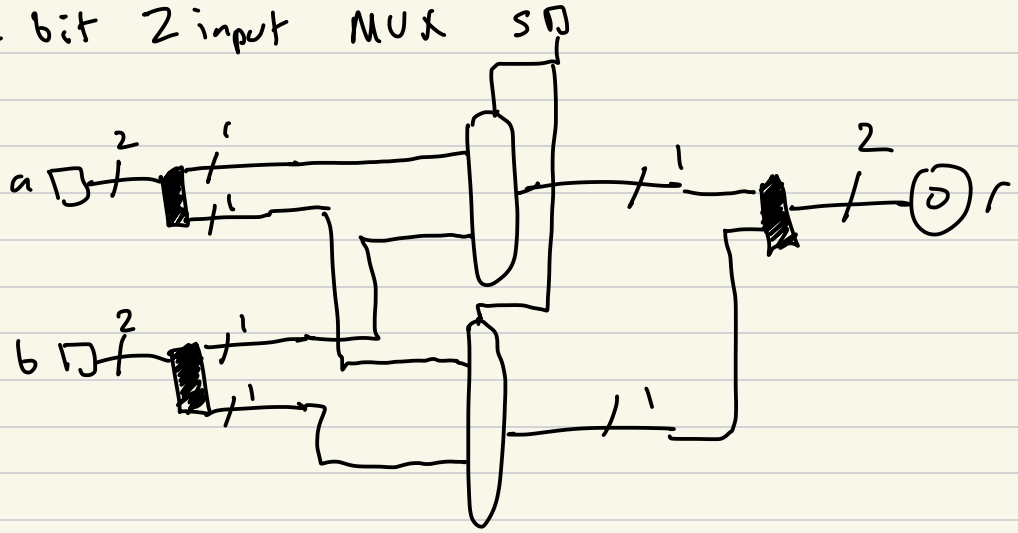


1 b.1 4 input MUX

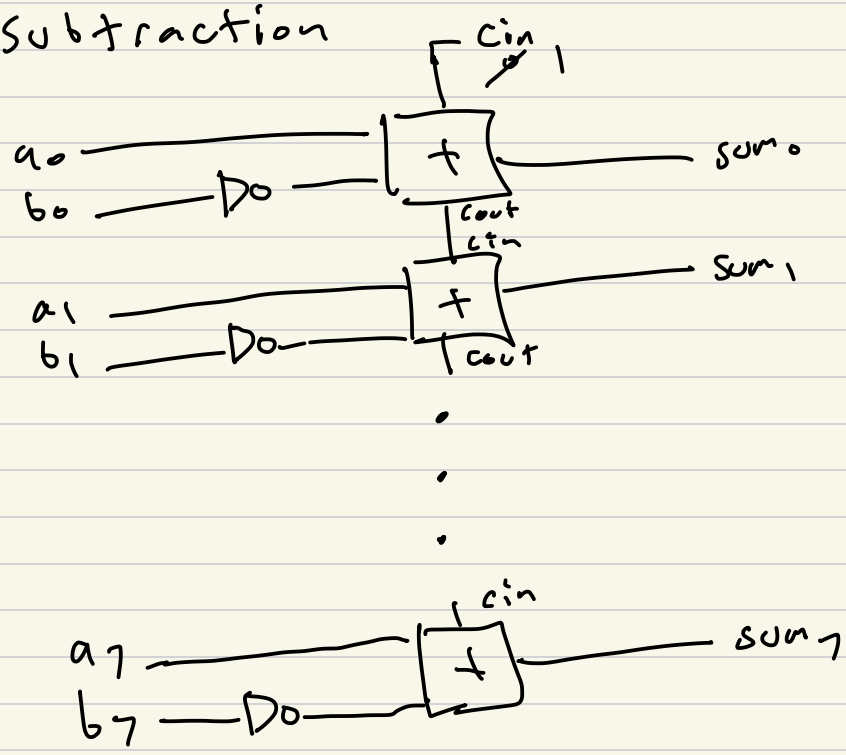




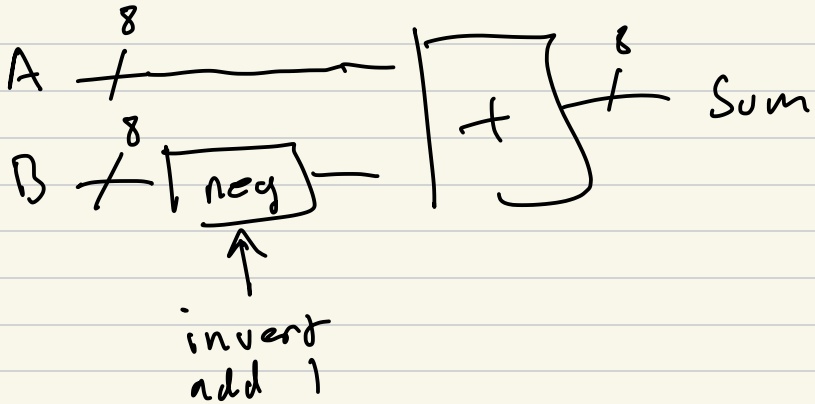
2 bit 2 input MUX

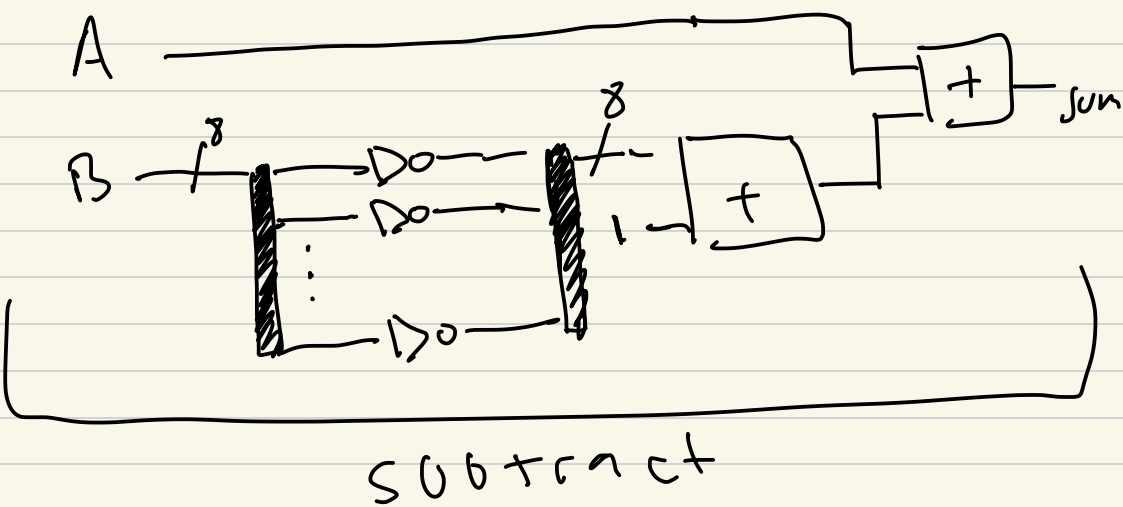


Subtraction

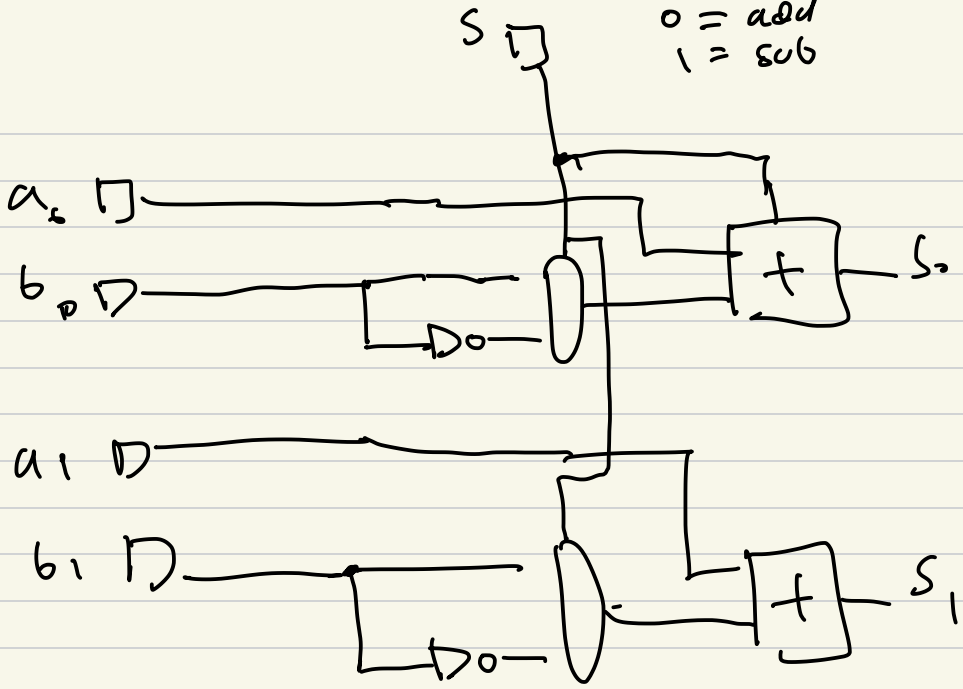


$$A - B = A + (-B)$$





subtract



Sequential Logic