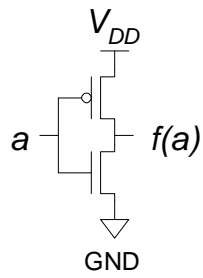
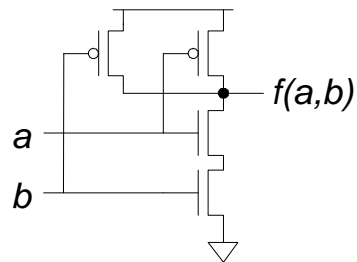


## CSE 140L Exercise Solution

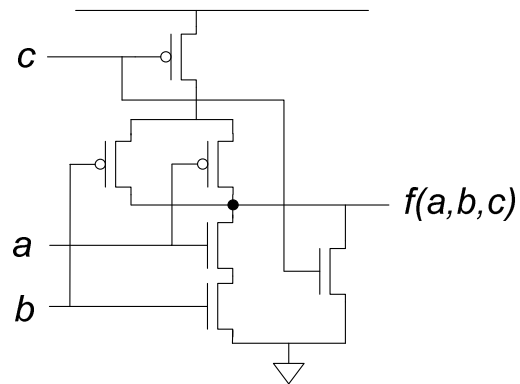
1. a)  $f(a) = a'$



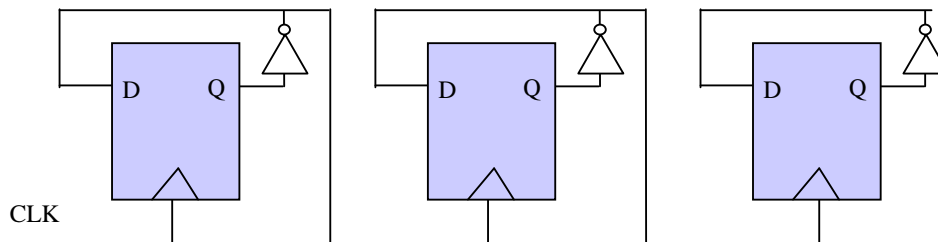
b)  $f(a, b) = (ab)'$



c)  $f(a, b, c) = (ab+c)'$



2. a) Logic diagram



b) The limiting factor of counter size is the clock frequency. In the case of “000...0” counting to “111...1”, the carry-in is propagated through every D flip-flop. When the total propagation delay exceeds the clock cycle, this asynchronous counter fails

3. State table of Moore machine

PS	x=0	x=1	z
A1	A1	B0	1
B0	C1	F1	0
C1	A1	E0	1
D1	B0	E0	1
E0	E1	D1	0
E1	E1	D1	1
F0	E0	F0	0
F1	E0	F0	1

4. a) Function table

R1_en	R2_en	R1_sel	clk	R1[5:0]	R2[5:0]
1	0	0	↑	M[5:0]	No Change
1	0	1	↑	D[5:0]	No Change
0	1	X	↑	No Change	R1

b) Instruction decoder

2-bit Instruction	R1_en	R2_en	R1_sel
00	1	0	0
01	0	1	X
10	1	0	1
11	1	0	1

c) Program of multiply-by-33

```

move1 a5a4a3a2a1a0
move2  xxxxxx
shift  000101
add    xxxxxx

```