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Sample problems

Q1. Determine if each of the following statements is true or false. *(20 points)*

(True / False)

a) $(1024)_{10} = (1000)_8$ _____

b) $(11111111)_2 = (001001010101)_{BCD}$ _____

c) $x + xy + xyz = x$ _____

d) $(x \oplus y)' = (x' \oplus y') \oplus 1$ _____

e) $((x\ y\ z)'.(w\ s)')' = xyz + (w' + s')'$ _____

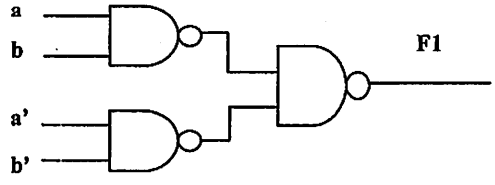
f) **The minimal size of a ROM that implements 4 functions in the same 6 variables is 24 bits.** _____

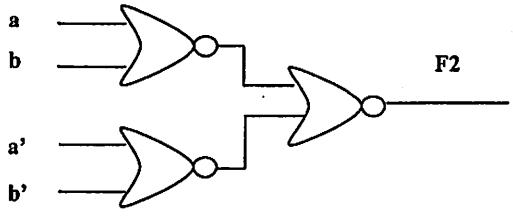
g) **The sum of minterms for the function $(x \oplus y \oplus z)'$ is $xyz' + xy'z + x'yz$.** _____

h) **If $x \oplus y = z$, then $x = y \oplus z$.** _____

i) **If $x+y = z$, then $x = z+y'$.** _____

j) **In the following circuits, F1 = F2.** _____





Q2. Express the following function *(12 points)*

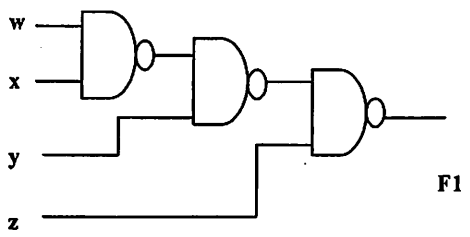
$$F(w,x,y,z) = \Sigma(0,1,2,5,10,11,13,14,15)$$

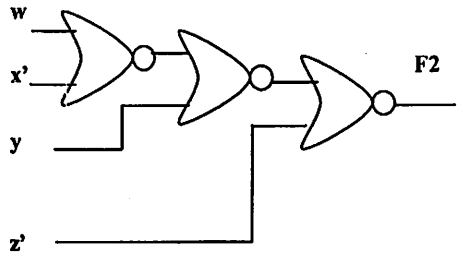
in the following forms

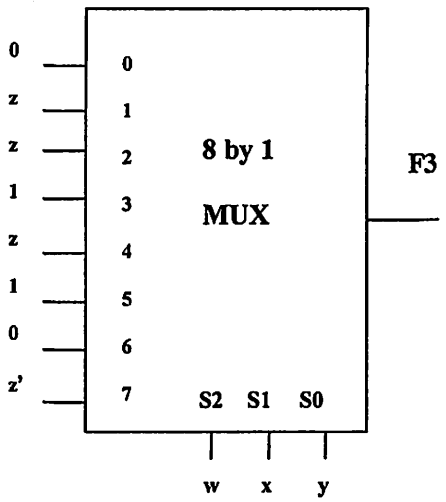
a. **Minimal sum of products**
b. **Minimal product of sums**

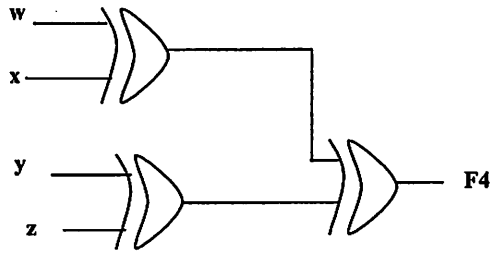
Q3. Complete the truth table for the outputs of the following circuits.

(20 points)









w	x	y	z	F1	F2	F3	F4
0	0	0	0				
0	0	0	1				
0	0	1	0				
0	0	1	1				
0	1	0	0				
0	1	0	1				
0	1	1	0				
0	1	1	1				
1	0	0	0				
1	0	0	1				
1	0	1	0				
1	0	1	1				
1	1	0	0				
1	1	0	1				
1	1	1	0				
1	1	1	1				

Q4. Design a circuit with three inputs x, y, z, that represent a binary integer M and six outputs A, B, C, D, E, F that represent a binary integer $N = M^2$. For example,

x,y,z = 0,0,1 implies A, B, C, D, E, F = 0,0,0,0,0,1;
x,y,z = 0,1,1 implies A, B, C, D, E, F = 0,0,1,0,0,1;
x,y,z = 1,1,0 implies A, B, C, D, E, F = 1,0,0,1,0,0;

i) Assume one 3×8 binary decoder and exactly six OR gates are available.

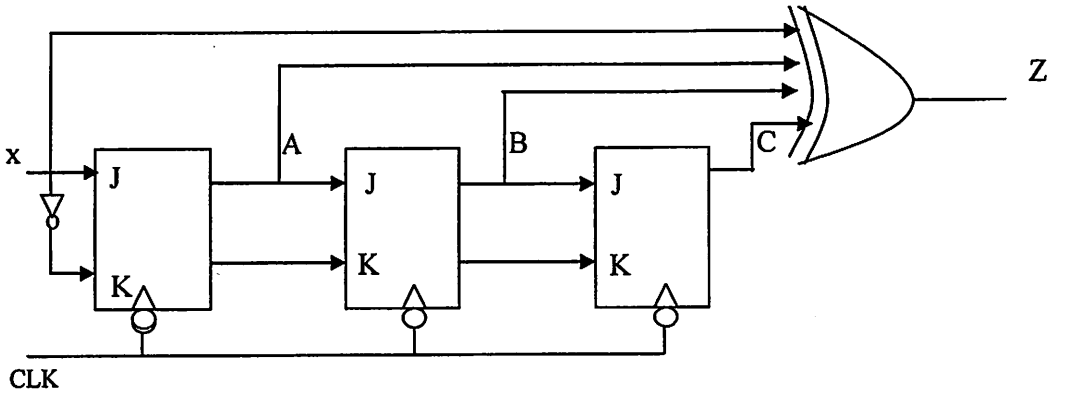
(8 points)

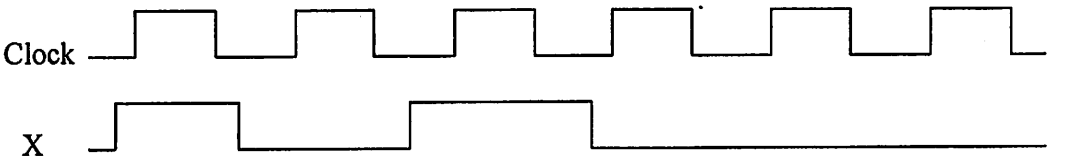
ii). If the above circuit is to be implemented as a ROM, determine the size of the ROM.

(4 points)

Q5. Draw the timing diagram for the signals A, B, C and Z in the following curcuit. Assume intitally A=B=C=0.

(12 points)





A?

B?

C?

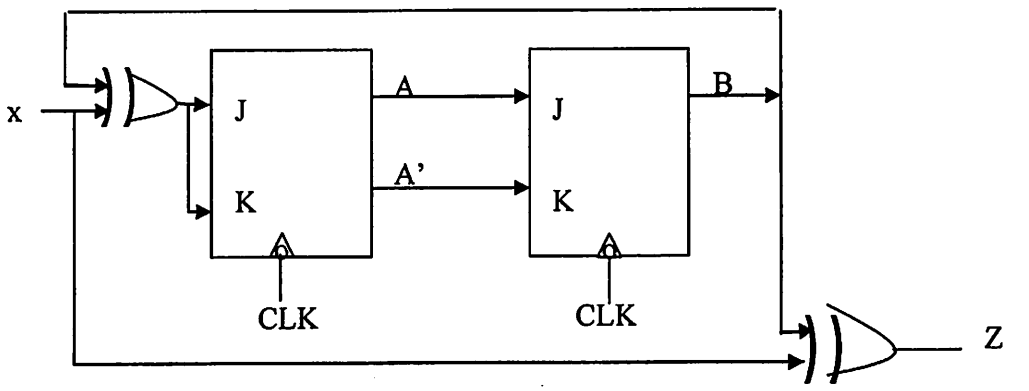
Z?

Q6. **For the following circuit, setup**

i. **The state table and the state diagram**

ii. **If the starting state is (0,0) and the input sequence is 1000000 determine the output sequence and the corresponding final state.**

(12 points)



Q7. **Design a sequential circuit to implement the following state diagram using D flip-flops.**

(12 points)