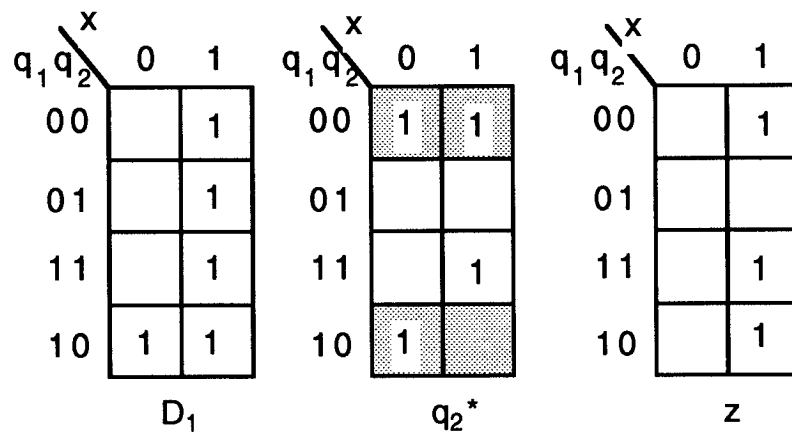


Blank Maps for first three problems provided on page 4, but write answers on the page with the problem statement.

1. For the following state table,

$q_1 q_2$	$q_1^* q_2^*$		z	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
0 0	0 1	1 1	0	1
0 1	0 0	1 0	0	0
1 0	1 1	1 0	0	1
1 1	0 0	1 1	0	1

Show the flip flop input equations and the output equation if the first flip flop is a D flip flop and the second is JK.



$$D_1 = x + q_1 q_2'$$

$$J_2 = x' + q_1'$$

$$K_2 = x' + q_1'$$

$$z = x (q_1 + q_2')$$

2. For the following state table and state assignment, show the equations and a block diagram for a system using an SR flip flop for q_1 and a T flip flop for q_2 and AND, OR and NOT gates. (Show only one of the solutions for R_1 .)

q	q *		z	
	x=0	x=1	x=0	x=1
A	B	C	1	1
B	A	B	1	0
C	B	A	1	0

q	q_1	q_2
A	1	0
B	0	1
C	1	1

x	q_1	q_2	q_1^*	q_2^*	z	S_1	R_1	T_2
-	0	0	X	X	X	X	X	X
B	0	1	1	0	1	1	0	1
A	1	0	0	1	1	0	1	1
C	1	1	0	1	1	0	1	0
-	1	0	X	X	X	X	X	X
B	1	1	0	1	0	0	X	0
A	1	0	1	1	1	X	0	1
C	1	1	1	0	0	X	0	1

$S_1 = x' q_1'$
 $R_1 = x' q_1$
 $T_2 = q_2' + x' q_1' + x q_1$
 $z = x' + q_2'$

3. Design a counter that goes through the sequence

1 0 7 3 4 2 and repeat

using a D flip flops. Just show the equations.

A	B	C	A*	B*	C*
0	0	0	1	1	1
0	0	1	0	0	0
0	1	0	0	0	1
0	1	1	1	0	0
1	0	0	0	1	0
1	0	1	X	X	X
1	1	0	X	X	X
1	1	1	0	1	1

$$D_A = A' B' C' + A' B C$$

$$D_B = A + B' C'$$

$$D_C = A' C' + \{A B \text{ or } A C\}$$

BONUS: Show a state diagram, including what happens if the system begins in state 5 or 6.

101 -> 010 or 011

110 -> 011 or 010

4. Show a state table or a state diagram for a system with one input, x , and one output, z , such that $z = 1$ if and only if the input has been at least three consecutive 1's followed by two 0's. (Full credit for a system with 5 states.)

Example

x 1 1 1 1 0 0 0 1 1 0 0 1 1 1 0 0
z 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0

q	q *		z	
	x = 0	x = 1	x = 0	x = 1
A	A	B	0	0
B	A	C	0	0
C	A	D	0	0
D	E	D	0	0
E	A	B	1	0