EE332

Quiz 5

Computer Organization and Sequential Counters

CLOSED BOOK, CLOSED NOTES, ONE $8\frac{1}{2}$" × 11" SHEET PERMITTED

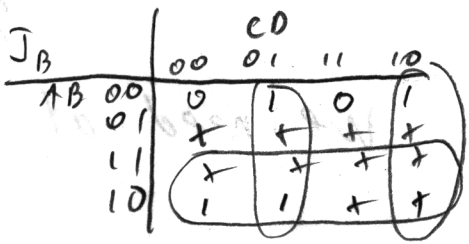
Name: Solution
Section: 3311
Date: 19 November 2002

Do not overlook the questions on the back of this sheet.

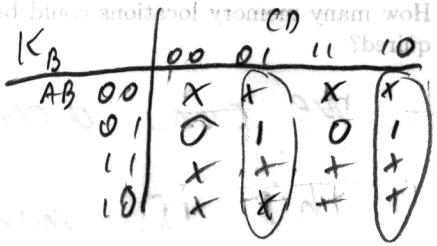
1. Consider a synchronous counter for four variables A, B, C, and D. In a truth-table laid out in a standard counting sequence where the most significant bit is A and the least significant bit is D, we find the desired next state of variable B is $\{0,1,1,0,1,0,0,1,1,1,\times,\times,\times,\times,\times,\times\}$.

   (a) Using a Karnaugh map, find minimal logic functions to operate the J- and K-inputs of a JK-flip-flop for variable B.

A	B	C	D	Next B	J_B	K_B	T_B
0	0	0	0	0	0	X	0
0	0	0	1	1	1	X	1
0	0	1	0	1	1	X	1
0	0	1	1	0	0	X	0
0	1	0	0	1	X	0	0
0	1	0	1	0	X	1	1
0	1	1	0	0	X	1	1
0	1	1	1	1	X	0	0
1	0	0	0	1	1	X	1
1	0	0	1	1	1	X	1
1	0	1	0	X	X	X	X
1	0	1	1	X	X	X	X
1	1	0	0	X	X	X	X
1	1	0	1	X	X	X	X
1	1	1	0	X	X	X	X
1	1	1	1	X	X	X	X



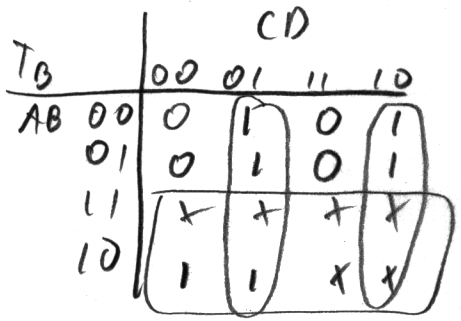
$J_B = A + \bar{C}D + C\bar{D}$



$K_B = \bar{C}D + C\bar{D}$

   (b) Do the same for the T-input of a toggle flip-flop for variable B.

See T_B column above



$T_B = A + \bar{C}D + C\bar{D}$

2. Suppose we desire a computer to be able to address 27 000 different memory locations.

(a) What is the minimum number n of address lines the computer must use?

we want $2^n \geq 27000$

$n \log 2 \geq \log 27000$

$n \geq \frac{\log 27000}{\log 2}$

≥ 14.7

≈ 15

We need at least 15 address lines.

(b) How many memory locations could be addressed in this system, beyond the 27 000 required?

We can access $2^{15} = 32,768$ locations.

This is more than we need by,

$32,768 - 27,000 = 5,768$