

EE 2720, Spring 06

Homework #6

Due date of HW#6 will be  
posted on web + announced in class.

Friendly

Alex

Homework #6

Problem 1: Design a circuit to convert a number represented in Excess-3 code to BCD. You must use Karnaugh maps in this problem. Provide a circuit diagram as well.

Problem 2: Design a combinational logic circuit with three inputs  $A, B, C$  and three outputs  $X, Y, Z$ . When the binary inputs are 0, 1, 2 or 3, the binary output is two greater than the binary input. When the binary input is 4, 5, 6, or 7, the binary output is 2 less than the input. You must use Karnaugh maps in this problem.

Problem 3: A full adder (FA) is a circuit that adds three binary digits  $X, Y, C_{in}$ , producing a sum and a carry,  $S$  and  $C_{out}$ . The sum  $S$  is 1 if one or three of  $X, Y, C_{in}$  are 1. The carry  $C_{out}$  is 1, if two out of three, or all three of  $X, Y, C_{in}$  are 1. Design a full adder circuit using AND, OR and NOT gates; (I want an AND-OR realization). Show all your work, truth table, Karnaugh maps, logic equations and logic diagrams. (Here you learned something new that I was going to do in class!)

Problem 4: A half adder (HA) is a circuit that adds two binary digits  $X, Y$ , producing a sum and a carry  $S$  and  $C_{out}$ . The sum  $S$  is 1 if one of  $X$  or  $Y$  are 1. The carry  $C_{out}$  is 1 if both  $X$  and  $Y$  are 1. Design a half adder circuit using AND, OR and NOT gates; (I want an AND-OR realization). Show all your work, truth table, Karnaugh maps,

HW# 6 cont.

Problem 4 cont: logic equations and logic diagrams;  
 (again here you learned something new that I was going to do in class!!)

~~Problem 5: Do not return this problem. It is not going to be graded. Read section 5.10.2 on page 432 of the textbook entitled "Ripple Adders". This is very easy. I might do it in class if time allows.~~ <sup>don't do this.</sup>

Problem 6: Using a Karnaugh map, derive a simplified sum-of-products expression for the logic function  $F = \sum_{w,x,y,z}(1,2,4,7,8,11,13,14)$ .

Problem 7: Using Karnaugh maps, find a simplified sum-of-products expression for each of the following logic functions:

- (a)  $F = \sum_{x,y,z}(1,3,5,6,7)$
- (b)  $F = \sum_{w,x,y,z}(1,4,5,6,7,9,14,15)$
- (c)  $F = \prod_{w,x,y}(0,1,3,4,5)$
- (d)  $F = \sum_{w,x,y,z}(0,2,5,7,8,10,13,15)$
- (e)  $F = \prod_{A,B,C,D}(1,7,9,13,15)$ .

Problem 8: Using Karnaugh maps, find a simplified product-of-sums expression for each logic function of problem 7 above. Combine 0's here.

Problem 9: Using Karnaugh maps, find a simplified sum-of-products expression for each of the following logic functions:

HW # 6 cont.Problem 9 cont:

- (a)  $F = \sum_{w,x,y,z} (0,1,3,5,14) + d(8,15)$   
 (b)  $F = \sum_{w,x,y,z} (0,1,2,8,11) + d(3,9,15)$   
 (c)  $F = \sum_{A,B,C,D} (1,5,9,14,15) + d(11)$   
 (d)  $F = \sum_{A,B,C,D} (1,5,6,7,9,13) + d(4,15)$

Problem 10: Using Karnaugh maps, find a simplified product-of-sums expression for each logic function of problem 9 above.

Problem 11: Derive a simplified product-of-sums expression for the prime BCD-digit detector described in handout # 16. In this problem, you must, of course provide a Karnaugh map.

Note: Enjoy this homework. It is lots of fun!! It is about Karnaugh maps mainly, which is the most important subject in EE 2720. So enjoy it!!

Your friend  
Alex!!