EE 2720, Fall 03

Homework #6

Due Wednesday November 19 at 9:30 am in my office; (Room EE 245).

Note: Please STAPLE your homework. It is for your safety.

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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,

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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". It is very easy. I might do it in class if time allows.

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:

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Problem 9 cont:

(a) $F = \Sigma_{w,x,y,z}(0,1,3,5,14) + d(8,15)$

(b) $F = \Sigma_{w,x,y,z}(0,1,2,8,11) + d(3,9,15)$

(c) $F = \Sigma_{A,B,C,D}(1,5,9,14,15) + d(11)$

(d) $F = \Sigma_{A,B,C,D}(1,5,6,7,9,13) + d(4,15)$

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!!