10920EECS101001 Logic Design

Homework 2

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1. (20%) Simplify the following Boolean function, together with the don't-care conditions d. Express the simplified function in sum-of-products form. Also express the canonical form of each simplified function.

$$F(A, B, C, D) = \Sigma m(1,3,5,7,9,15) + \Sigma d(4,11,12)$$

2. (20%) Simplify the following Boolean function by first finding the essential prime implicants. Please also indicate the essential prime implicants and the other (nonessential) prime implicants.

(a) (10%) $F(w, x, y, z) = wz' + xy + y'z + wx'z$

(b) (10%) $F(w, x, y, z) = \Sigma(0,2,3,5,7,8,10,11,14,15)$

3. (20%) Simplify the following function and show its logic circuit. Is there a potential hazard in the circuit? How do you eliminate it if there is one?

$$F(x, y, z) = \Sigma(3,4,6,7)$$

4. (20%) For the Boolean functions f and g, as given in the truth table.

(a) (10%) Express f and g in sum-of-minterms algebraic form, and then simplify them to reduced sop form.

(b) (10%) Draw the logic diagrams for f and g from its reduced sop form, using only the NOT, AND, and OR gates.

a	b	c	f	g
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

5. (20%) Simplify the following Boolean function F using

$$F(A, B, C, D) = AB + BCD + AD + A'CD' + A'B'CD$$

(a) (15%) NAND-AND two-level form, and draw its logic diagram

(b) (5%) NOR-AND two-level form, and draw its logic diagram