Name *Answers*

CE-1901 – Dr. Durant – Quiz 4
Fall 2015, Week 4

1. (0.5 point) **Which** of the standard forms is F = ac' + ab' in? POS **or** SOP

2. (1 point) **Apply** Boolean algebra, specifically the distributive property, to write the equation in the **other** standard form

Answer: $\boxed{F = a(\bar{c}+\bar{b})}$

Example: Dual

note this → $\bar{F} = \bar{a} + (cb)$

literals inverted since 1s/0s interchange roles

Example $\bar{c}+\bar{b}$, a ← 0s for POS

F: a \ bc	00	01	11	10
0				
1	1	1		1

$a\bar{c}$ ← 1s for SOP

$a\bar{b}$

3. (0.5 point) **Is** the equation in problem 1 in **canonical** form? Yes **or** No

not all 3 literals appear in each product term

4. (1 point) **Prove** that x'+y' = (xy)' using perfect induction. Hint: evaluate both expressions in a truth table and confirm that they agree in all rows.

x	y	$\bar{x}$	$\bar{y}$	$\bar{x}+\bar{y}$	xy	$\overline{xy}$
0	0	1	1	1	0	1
0	1	1	0	1	0	1
1	0	0	1	1	0	1
1	1	0	0	0	1	0

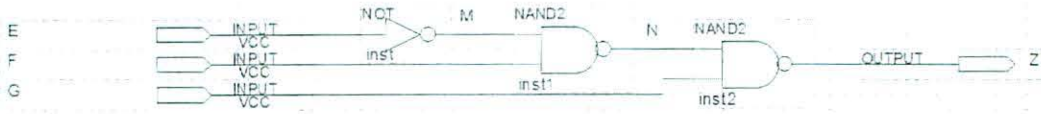
← equal

Space for work on problem 10

Z: E \ FG	00	01	11	10
0	1	0	1	1
1	1	0	0	1

$Z = (F+\bar{G})(\bar{E}+\bar{G})$

5. (2 points) **Draw** the truth table for the following schematic. **Include** columns for each intermediate term (all gate outputs); there are more columns than you need in the given table.



E	F	G		M	N		Z	
0	0	0		1	1		1	
0	0	1		1	1		0	
0	1	0		1	0		1	
0	1	1		1	0		1	
1	0	0		0	1		1	
1	0	1		0	1		0	
1	1	0		0	1		1	
1	1	1		0	1		0	

6. (1 point) **Write** the equation **directly** from the schematic above

$Z = \overline{G\bar{E}F}$

7. (1 point) **Write** the canonical sum-of-products (SOP) equation based on your truth table above. Don't use a shorthand form.

$Z = \bar{E}\bar{F}\bar{G} + \bar{E}F\bar{G} + \bar{E}FG + E\bar{F}\bar{G} + EF\bar{G}$

(-1/2) MIN, NOT CAN., SOP

8. (1 point) **Write** the canonical product-of-sums (POS) equation based on your truth table above. Don't use a shorthand form.

$Z = (E+F+\bar{G})(\bar{E}+F+\bar{G})(\bar{E}+\bar{F}+\bar{G})$

(-1/2) NOT I/O INPUT REVERSAL

9. (1 point) **Restate** the equation above in **both** Σ and Π notations. Hint: These are based on minterm and maxterm numbers.

$Z(EFG) = \Sigma_m(0,2,3,4,6)$
$= \Pi_M(1,5,7)$

OR

$Z(EFG) = \Sigma(m_0, m_2, m_3, m_4, m_6)$
$= \Pi(M_1, M_5, M_7)$

(-1/4) no EFG

10. (1 point) ***On the other side of this sheet,*** **draw** a K-map for Z and **use** the map to determine the **simplest** (most reduced) equation in **product-of-sums** form. **Reminders**: adjacent terms in a K-map may differ in the value of only 1 bit. Start with M_0 in the upper left corner, putting M_1 to the right and M_4 below it. Form largest groups possible. It is okay to cover zeros (terms that are off) more than once in order to form larger groups.