

# CMSC 313 Spring 2024

## Quiz 2

Full Name \_\_\_\_\_ Student ID \_\_\_\_\_

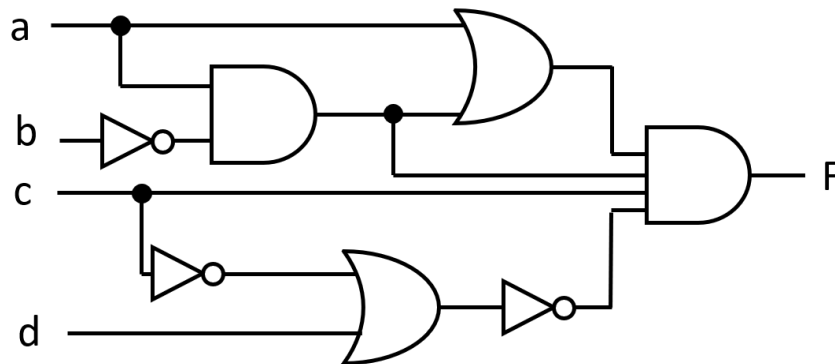
For every exercise, show your work. Not showing complete work may result in penalties. Box your final answer.

**Exercise 1.** (10 pts) Convert the equation  $F(a, b, c) = (a + b)(\bar{c})$  to **Canonical Sum of Products** using a truth table. Your final answer should be in  $\Sigma$  notation.

a	b	c	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

$$F = \sum (2,4,6)$$

**Exercise 2.** (10 pts) Convert the circuit below to a boolean equation for F. Do not simplify the equation.



$$F = (a + ab) ab c (\bar{c} + d)$$

**Exercise 3.** (10 pts) There is an error in the following simplification. Identify the step number in the simplification where the error was made. Correct that line, but **do not complete the rest of the proof.**

$$G = \overline{(\bar{a} + c)}c + cb$$

1.  $= \overline{\bar{a} + c} \cdot \bar{c} + cb$  (DeMorgan's)
2.  $= \bar{\bar{a}} \bar{c} \cdot \bar{c} + cb$  (DeMorgan's)
3.  $= a \bar{c} \cdot \bar{c} + cb$  (Involution)
4.  $= a\bar{c} + cb$  (Idempotent)

Rules

DeMorgan's:  $\overline{x + y} = \bar{x} \cdot \bar{y}$  and  $\overline{x \cdot y} = \bar{x} + \bar{y}$

Involution:  $\overline{\bar{x}} = x$

Idempotent:  $x + x = x$  and  $x \cdot x = x$

The error is in step 1.

It should read:

$$\bar{\bar{a}} + \bar{c} + \bar{c} + cb \text{ (DeMorgan's)}$$

**Exercise 4.** (10 pts) Find the 4 variable Karnaugh map of the following and then find the minimized expression in **Sum of Product (SOP)** form (circle the 1s).

$$F(a, b, c, d) = \Sigma(0, 11, 13, 14, 15) + d(2, 10, 12)$$

		cd			
	ab	00	01	11	10
00		1	0	0	x
01		0	0	0	0
11		x	1	1	1
10		0	0	1	x

$$F = ab + ac + \bar{a}\bar{b}\bar{d}$$