

CS M51A, Fall 2022, Midterm
(Total Mark: 15 points)

Student Name:

Student ID:

1. (2 Points) Using boolean algebra, Simplify the following expression as much as possible.

(a) $F = (B.C) + (B.1) + (C.0) + (B.B.C)'$

(b) $F = (C + A).(B + 1).(A + C)'.(B + C)$

2. (2 Points) Present the following numbers in decimal.

(a) 1100 is an unsigned number

(b) 1100 is a two's complement

3. (3 Points) Present the Sum of MINTERMS and Product of MAXTERMS for the following system, where A, B and C are inputs and F is the output. (Hint: you may first draw a truth table and then write the expressions)

$F = (A.B) + C$

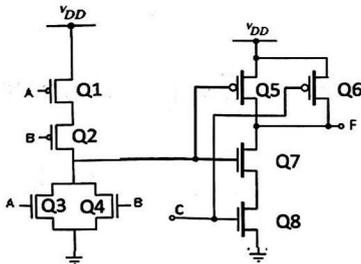
4. (3 Points) Implement $F = A \text{ XNOR } B$ using transmission gates. You are allowed to use 1, 0, A, A', B, and B' as your signals.

5. (2 Points) Using the following K-Map, write the simplified sum of product (SoP) and product of sum (PoS) terms. (For your convenience, two same K-maps are provided. Use one for SoP and the other for PoS)

	\bar{x}_0				
	1	1	0	1	
	0	0	0	0	x_2
x_3	1	1	1	1	
	1	0	0	1	
			x_1		

	x_0				
	1	1	0	1	
	0	0	0	0	x_2
x_3	1	1	1	1	
	1	0	0	1	
			x_1		

6. (3 Points) Given the circuit below, complete the table below, determining the resistances for Q_1 to Q_6 and the final output F . The transistors Q_1 to Q_8 should be High or Low (show by 'H' or 'L') resistance. The output F may be 0, 1, float (show by -) or short (show by *). Remember short means the output is connected to both VDD and ground at the same time.



A	B	C	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	F
0	0	1									
1	0	1									
1	1	1									