

EE434

ASIC and Digital Systems

Midterm Exam 1

Mar. 4, 2020. (2:10pm – 3pm)

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Name:

WSU ID:

Problem	Points	
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
Total	80	

Problem #1 (Static CMOS gates, 10 points)

Design the following logic using the static CMOS design methodology. Try to minimize the # transistors. Available input: A, B, C, D .

$$Y = \overline{A + \overline{B} \cdot \overline{C} \cdot \overline{D}}$$

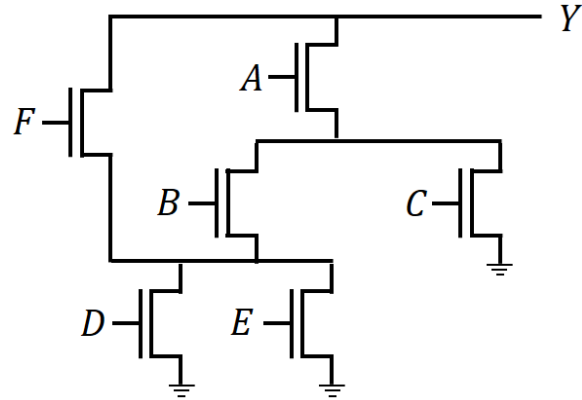
Problem #2 (Static CMOS gates, 10 points)

Design the following logic using the static CMOS design methodology. Try to minimize the # transistors. Available input: A, B, C, D .

$$Y = A \cdot B \cdot (\bar{C} + \bar{D})$$

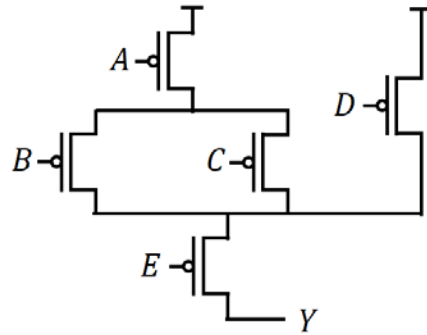
Problem #3 (Static CMOS gates, 10 points)

The following shows the NFET network of a static CMOS gate. Express the output Y as a Boolean function of the inputs ($A \sim F$). (You don't need to simplify the expression.)



Problem #4 (Static CMOS gates, 10 points)

The following shows the PFET network of a static CMOS gate. Express the output Y as a Boolean function of the inputs ($A \sim E$). (You don't need to simplify the expression.)

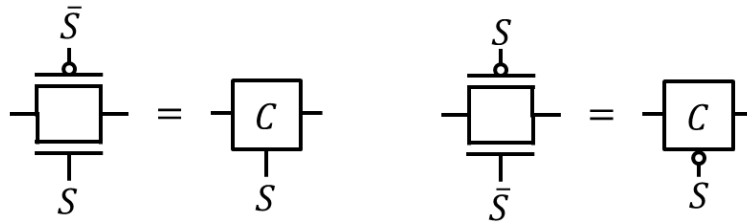


Problem #5 (Transmission Gates, 10 points)

Design (draw a schematic) the following Boolean function using transmission gates only.

$$Y = A \oplus (B \cdot (C \oplus D))$$

Available inputs: $A, B, C, D, 0, 1$. Use the following symbols for the transmission gates.



(# TGs ≤ 12 : 10 points. $13 \leq$ # TGs ≤ 15 : 7 points. $16 \leq$ # TGs ≤ 18 : 5 points. # TGs > 18 : 3 points)

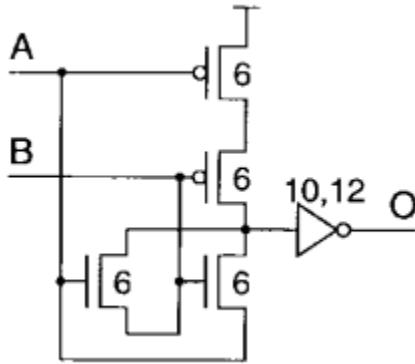
Problem #6 (Sequential Logic, 10 points)

The following truth table shows the function of a sequential logic. CK is the clock signal. A, B, D, E, and F are data or control (e.g., reset) signals. What does the gate do??
Explain the function in detail.

A	B	D	E	F	CK		Q ⁺
0	X	0	E	X	↓		E
0	X	1	X	F	↓		F
1	B	X	X	X	↓		B
X	X	X	X	X	↑		Q
X	X	X	X	X	0 or 1		Q

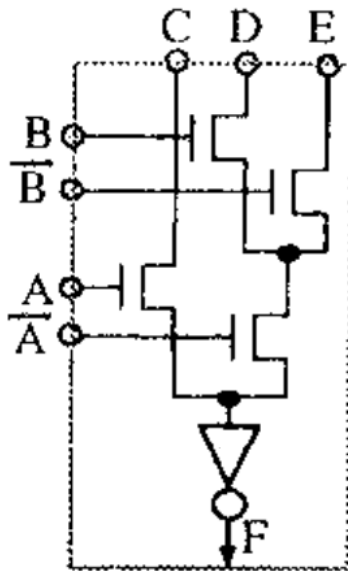
Problem #7 (Analysis, 10 points)

What do the following circuits do? (You can ignore the numbers in the schematics.) For each schematic, you can draw a truth table or express the output as a function of the inputs.



(a)

(JSSC'97)



(b)

(JSSC'96)

