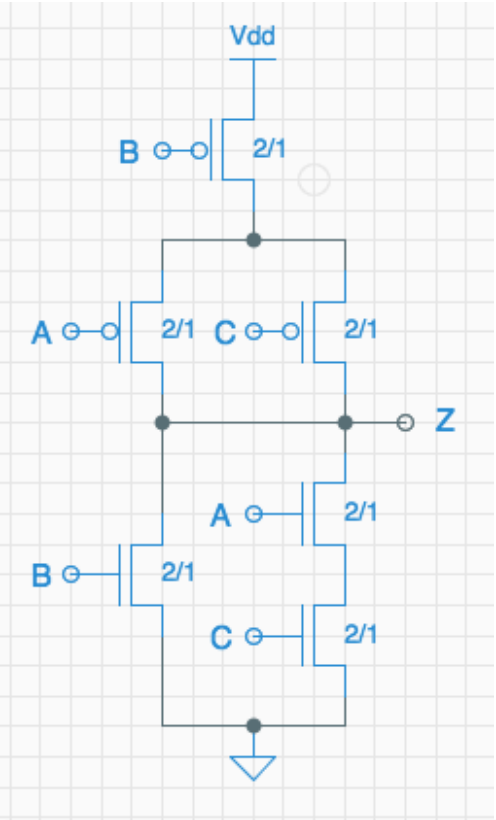
CMOS

1/1 point (ungraded)

Given the following cmos gate, determine the function computed by this gate.



A) $Z = B \cdot (A + C)$

B) $Z = B + A \cdot C$

C) $Z = \overline{B} \cdot (\overline{A} + \overline{C})$

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

E) None of the above

Explanation

Looking at the pulldown circuitry for this gate, we see that $Z = \overline{B + A \cdot C}$. To simplify this, we use DeMorgan's Law to find that $Z = \overline{B} \cdot \overline{A \cdot C} = \overline{B} \cdot (\overline{A} + \overline{C})$.

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Answers are displayed within the problem

CMOS

1/1 point (ungraded)

What is the minimum number of NFETs required to build a CMOS circuit (perhaps involving more than one CMOS gate) that has the following truth table?

A	B	C	G
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

- A) 3
- B) 4
- C) 5
- D) 6
- E) None of the above

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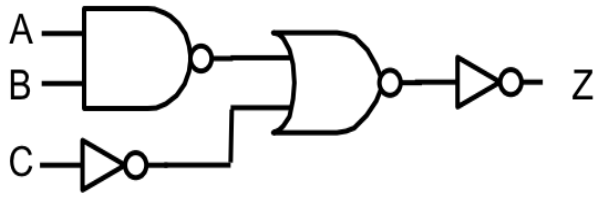
✔ Correct (1/1 point)

CMOS

2/2 points (ungraded)

Consider the following circuit that implements the 3-input function Z(A,B,C):



Which of the proposals below is the best way to shorten the rise time of the signal at Z?

P1: Add two additional series-connected inverters to the output.
P2: Double the width of the NFET in the output inverter.
P3: Double the width of the PFET in the output inverter.
P4: Halve the width of the NFET in the output inverter.
P5: Halve the width of the PFET in the output inverter.

Best proposal: P3 ✔ Answer: P3

Explanation
Making the PFETs wider will make it so that when the output is switching from 0 to 1, the PFETs will conduct more and the output will be pulled up to vdd more quickly.

Can the function Z(A, B, C) be implemented as a single 3-input CMOS gate having complementary pullup/pulldown circuits?

Implement as a single CMOS gate? YES ✔ Answer: YES

Explanation
The truth table for this circuit is the following:

A	B	C	$Z(A,B,C)$
0	0	0	1
0	0	1	1

0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

This is equivalent to $\overline{ABC}$, which is a 3-input NAND gate. We know that NAND gates can be implemented as a single CMOS gate, so the answer is YES.

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Answers are displayed within the problem

Discussion

Topic: 4. Combinational Logic / Tutorial : CMOS Continued

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? Why more current causes faster rise time?
I'm not surprised though, but why exactly is that? I don't remember learning it in the course. 2