

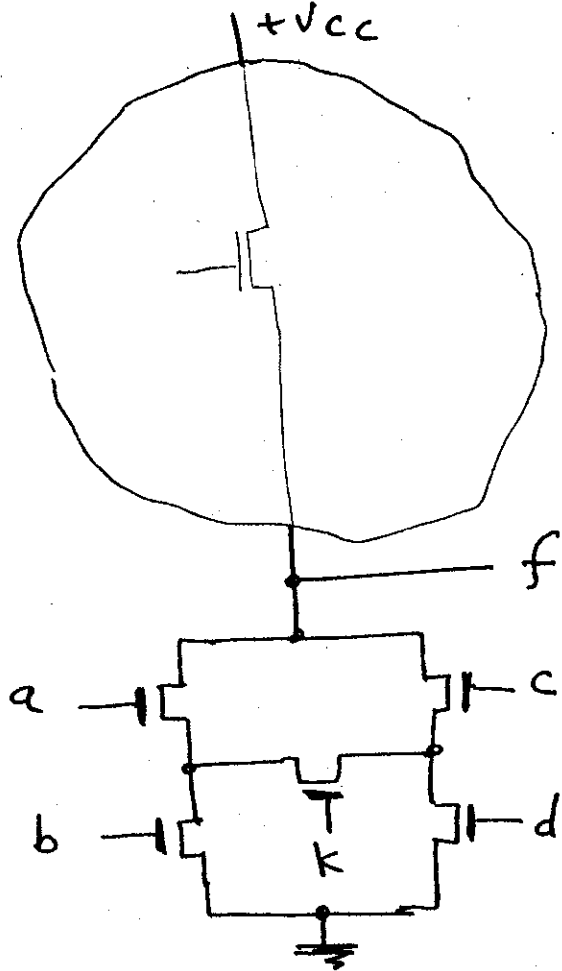
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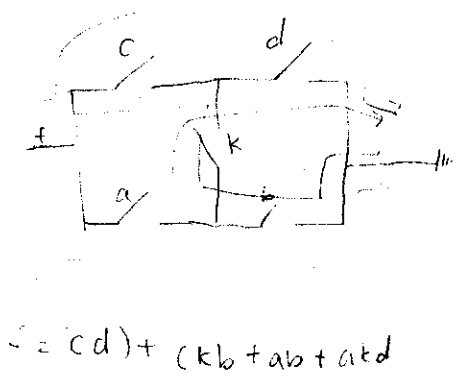
Problem #1:

Complete the circuit diagram for the given CMOS logic block. You can treat transistors as switches as explained in the class. Use the methods that you learned in lectures. Your final circuits should be in the minimal logic form.

(a)



0



$$f = cd + (kb + ab + akd)$$

(b) Write the logical expression for f.

$$f = cd + ckb + ab + akd = \bar{f}$$

0

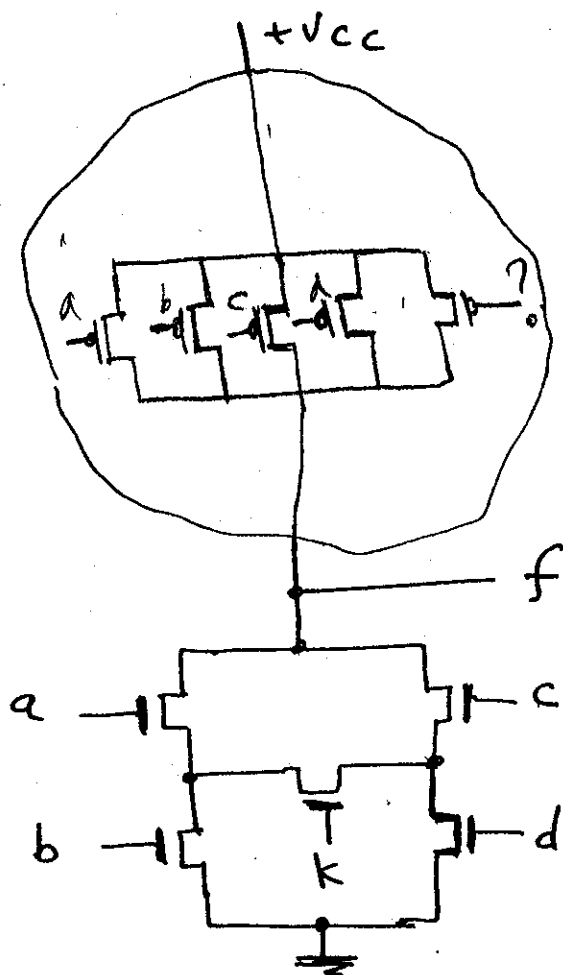
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(a)

(b) Write the logical expression for f .

$$f = akcbd$$

0

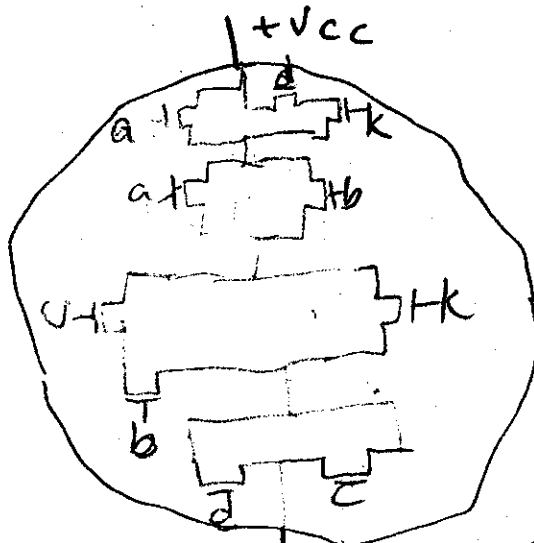
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Problem #1:

Complete the circuit diagram for the given CMOS logic block.

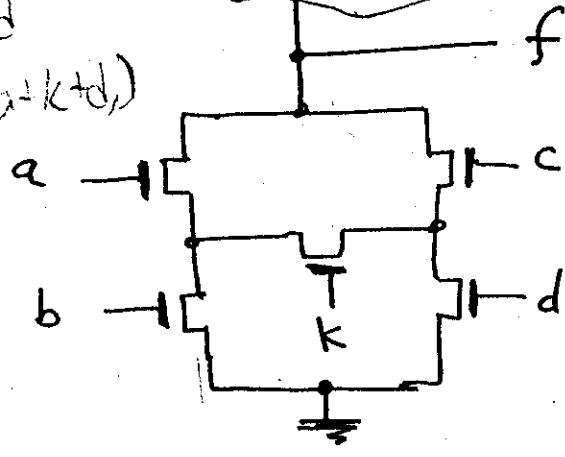
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(a)



PMOS

$d + ck + b + ab + akd$
 (3) $(c+k+b)(a+b)(a+k+d)$



(b) Write the logical expression for f.

$$f = (\bar{c} + \bar{d})(\bar{c} + k + b)(a + b)(a + k + d)$$

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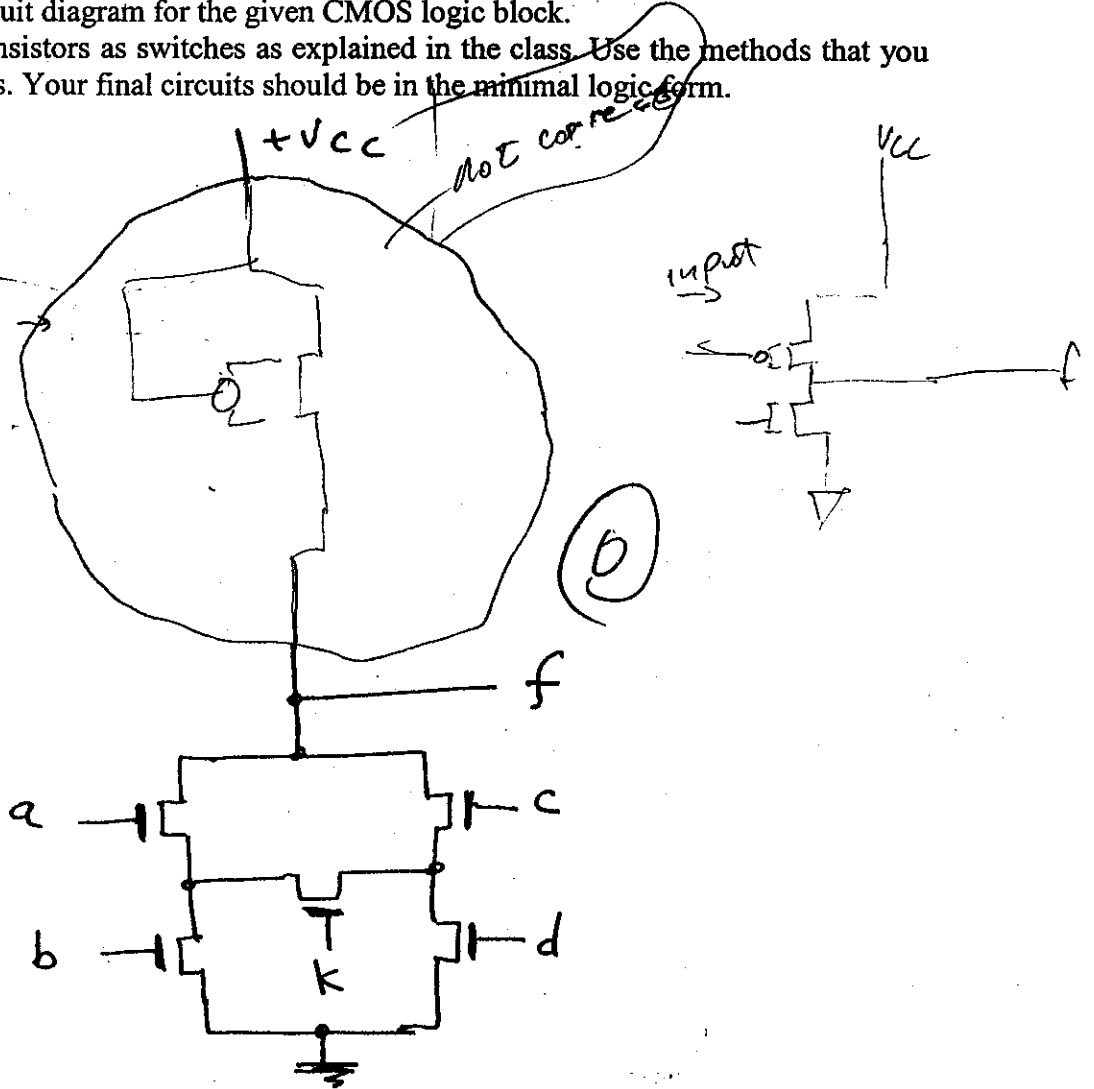
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(a)

CMOS
n & p type
Such that
current is minimum

When 1 is biased
 $f = +V_{CC}$
When 2 is biased
 $f = 0$



(b) Write the logical expression for f.

$$f = ab + cd + akd + bck = \bar{f}$$

0

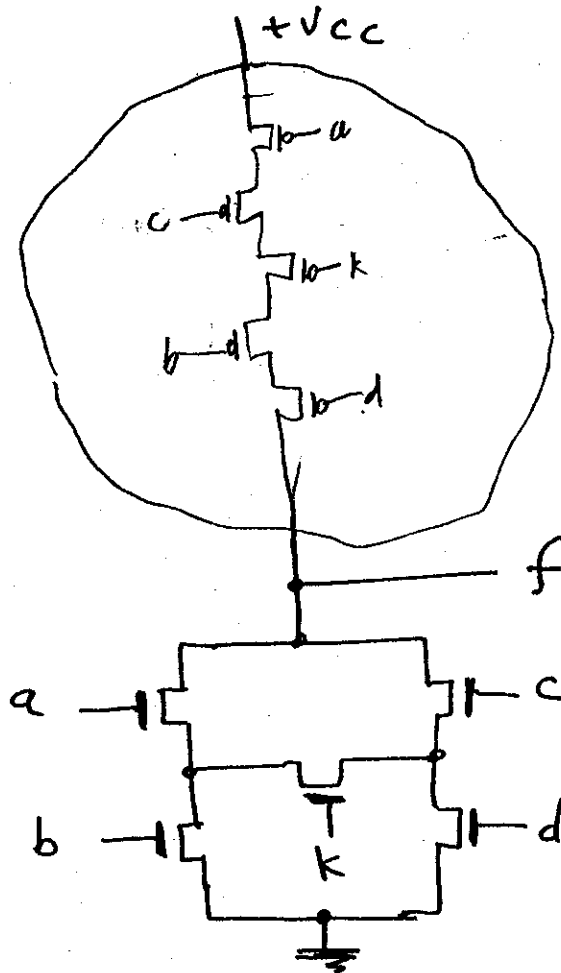
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You can treat transistors as switches as explained in the class. Use the methods that you learned in lectures. Your final circuits should be in the minimal logic form.

(a)



(b) Write the logical expression for f .

$$\begin{aligned}
 f &= \overline{a}b\overline{a}\overline{b} + \overline{a}\overline{b}akd + \overline{a}\overline{b}cd + \overline{a}\overline{b}ckb + \overline{c}\overline{d}eb + \overline{c}\overline{d}ab + \overline{c}\overline{d}akd \\
 &+ \overline{k}ab + \overline{k}cd + \overline{k}akd + \overline{k}ckb \\
 &= \overline{a}\overline{b}akd + \overline{a}\overline{b}cd + \overline{a}\overline{b}ck + \overline{d}b + \overline{a}\overline{b}\overline{c}\overline{d} + \overline{a}ck + \overline{a}b\overline{k} + \overline{c}\overline{d}\overline{k} + \overline{k}akd + bc \\
 &\overline{c}\overline{k}\overline{d} + bc + \overline{a}b\overline{k} + \overline{a}d
 \end{aligned}$$

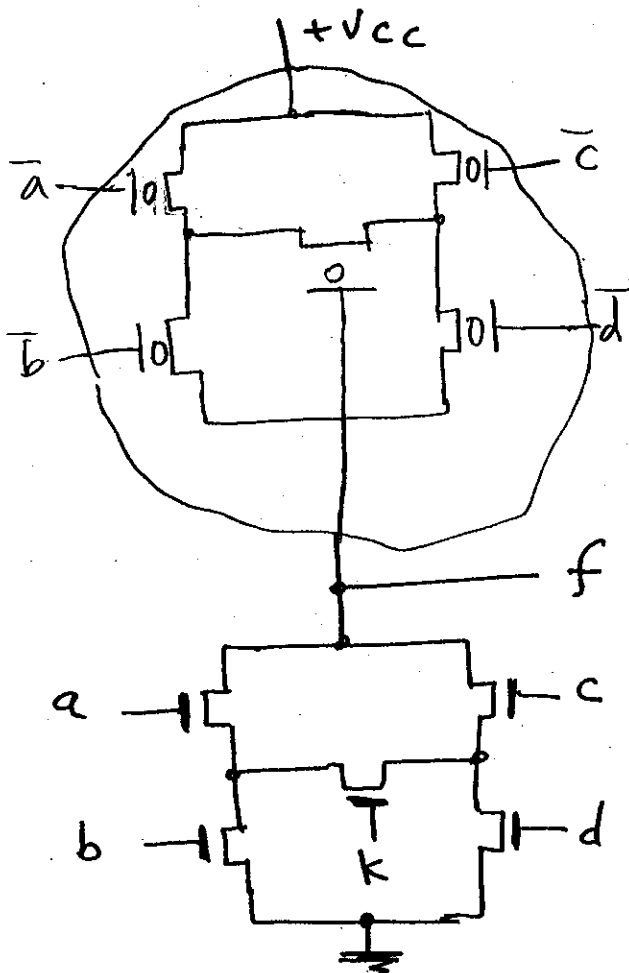
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(a)



(0)

(b) Write the logical expression for f.

$$\begin{aligned}
 f &= \text{pMOS} \cdot \text{nMOS} = (wx + yz) \cdot (ab + cd) \\
 &= (\overline{a}b + \overline{c}d) \cdot (ab + cd) = (\overline{a}b \cdot \overline{c}d) \cdot (ab + cd) \\
 &\text{what about k?} \quad \Rightarrow a + b + c + d + (a+b)(c+d) \\
 &= (a+b) \cdot (c+d)
 \end{aligned}$$

(0)

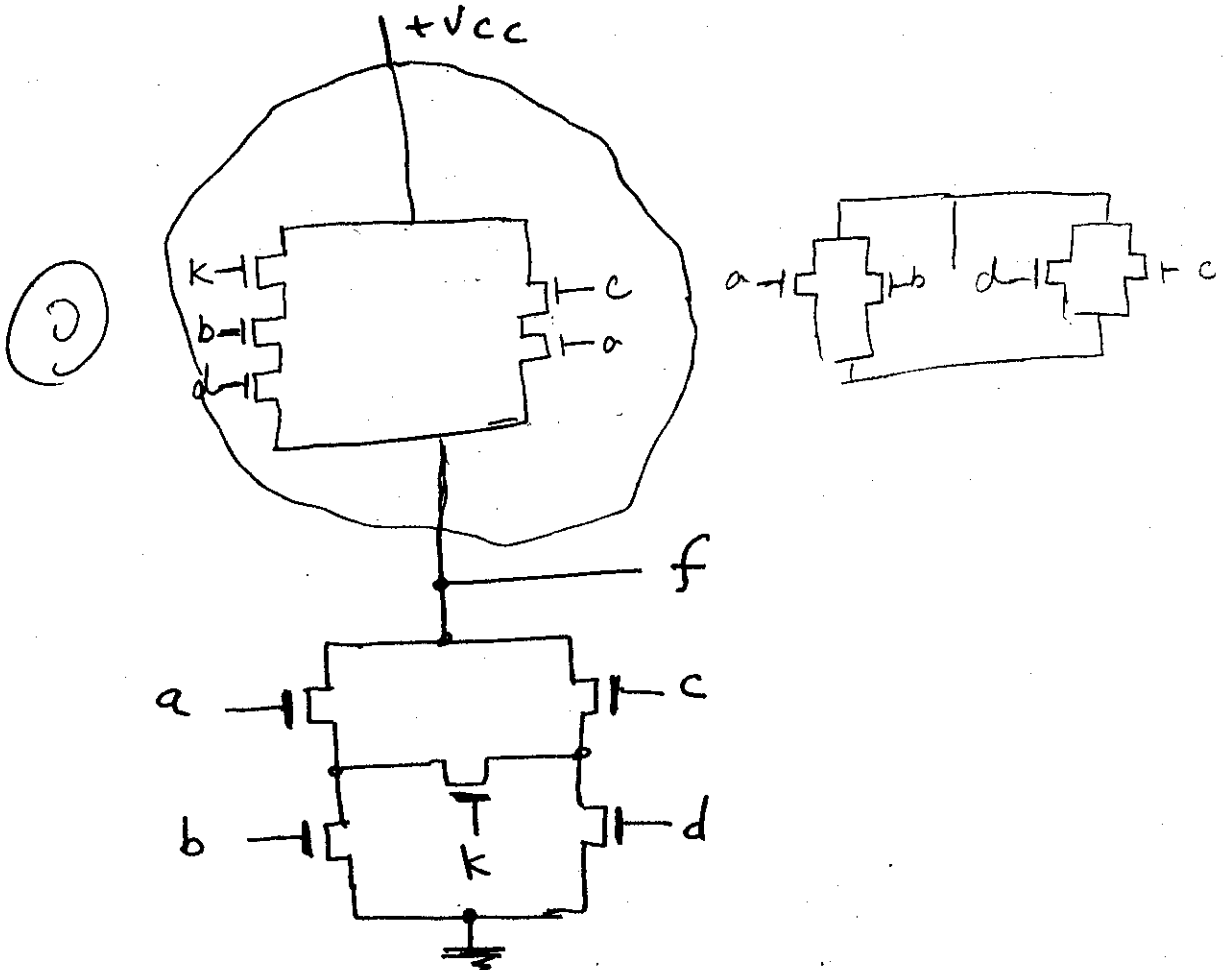
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(a)



(b) Write the logical expression for f.

$$f = (b + d + k) \cdot (c + a)$$

0