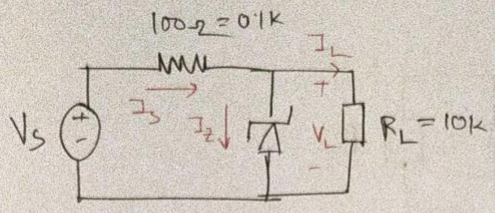
1.

(2)



Zener diode specification: $V_{Z_0} = 3V$

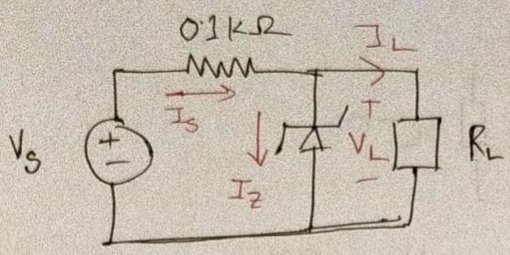
$r_z = 0\Omega$

$I_{ZK} = 1mA.$

Find the minimum value of V_s for which the Zener diode maintain its regulation.

2.

(3)



Zener diode specification: $V_{Z_0} = 3V,$

$r_z = 0\Omega$

$I_{ZK} = 1mA$

The source V_s has a nominal value of 5V and can vary ±10%.

Find the worst case/minimum value of R_L so that regulation is maintained.

3. Hint: For **NAND** gate, when one input is HIGH, the gate will behave like a **NOT** gate/Inverter.

Consider a two input MOSFET NAND gate (S-model) with $V_T = 1\ V$ and $V_S = 5\ V$. For what value(s) of V_{IL} the following specification will adhere to static discipline for the given circuit:
$V_{OH} = 4.4\ V, V_{OL} = 0.5\ V, V_{IH} = 3.9\ V$?
There might be mutiple correct answers or no correct answers at all

- [ ] 0.8
- [ ] 0.7
- [ ] 1.3
- [ ] 0.4
- [ ] 1.2
- [ ] None of the above

4. Hint: For **NOR** gate, when one input is LOW, the gate will behave like a **NOT** gate/Inverter.

Consider a two input MOSFET NAND gate (S-model) with $V_T = 1\ V$ and $V_S = 5\ V$. For what value(s) of V_{IL} the following specification will adhere to static discipline for the given circuit:
$V_{OH} = 4.4\ V, V_{OL} = 0.5\ V, V_{IH} = 3.9\ V$?
There might be mutiple correct answers or no correct answers at all

- [ ] 0.8
- [ ] 0.7
- [ ] 1.3
- [ ] 0.4
- [ ] 1.2
- [ ] None of the above

5.

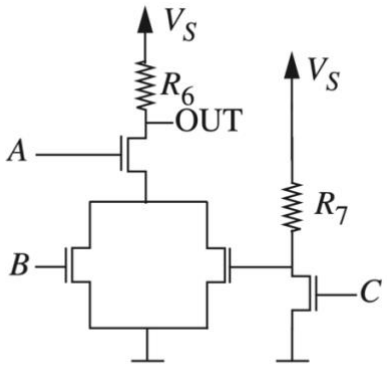
Consider the following specification for a NOT gate (SR-Model) with circuit parameters $V_s = 5\ V,$ and $R_L = 14\ k\Omega$ and MOSFET parameters $V_T = 1\ V,$ and $R_{ON} = 1\ k\Omega$:
$V_{OH} = 4.5\ V,\ V_{OL} = 0.5\ V,\ V_{IH} = 4\ V,$ and $V_{IL} = 0.9\ V.$
Does this specification satisfies the static discipline for the given NAND gate?

- ◯ Yes
- ◯ No

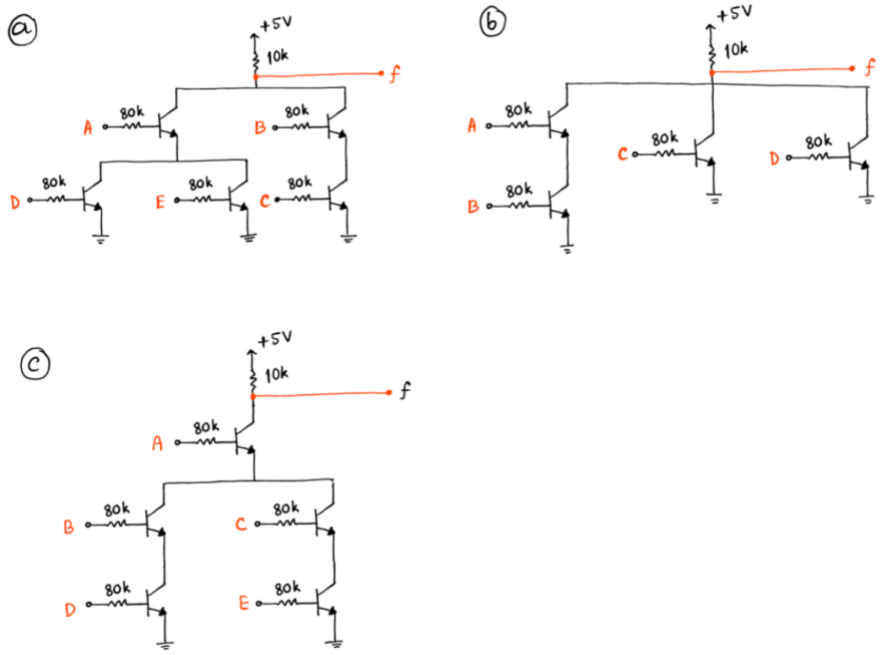
If No, find the minimum value of R_L, assuming all the other parameters are constant, that will make the specification satisfy the static discipline.

kΩ

6. Find out the logic function of OUT in terms of **A**, **B**, and **C**

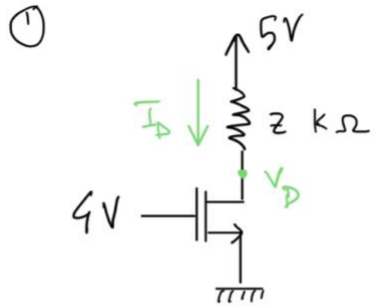


7. Find the logic functions f as function of the Boolean inputs A, B, C, D, and E for the following three BJT circuits. **Use the S-model for the BJT**.



8. Implement the following functions using BJT/MOSFET:
   a. $f = A.B + C$
   b. $f = A.(B + \overline{C})$
   c. $f = \overline{\overline{AB} + \overline{(C + D)}}$

9.

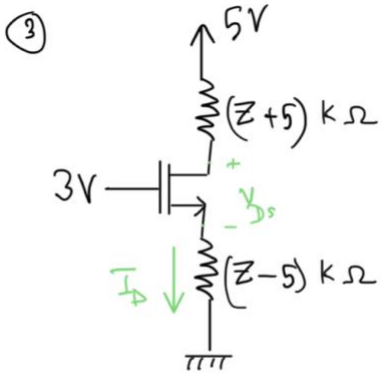


$V_T = 0.5V$

$K_n' = 2mA/V^2$

Find I_D and V_D using method of assumed state. You must verify your assumptions. z = 5 + last two digits of your ID

10.



$V_T = 0.5V$

$K_n' = 2mA/V^2$

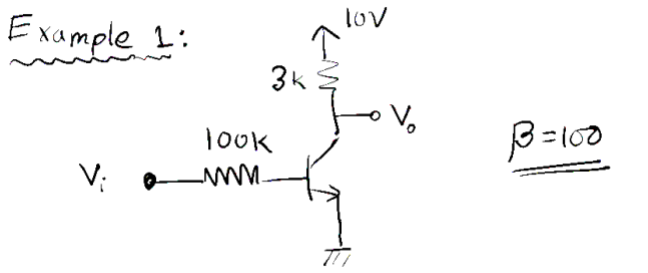
Find I_D and V_{DS} using method of assumed state. You must verify your assumptions. z = 5 + last two digits of your ID

HINT: Use I_D as the unknown x.

Using ohm's law, you can find V_D and V_S in terms of x. For example,

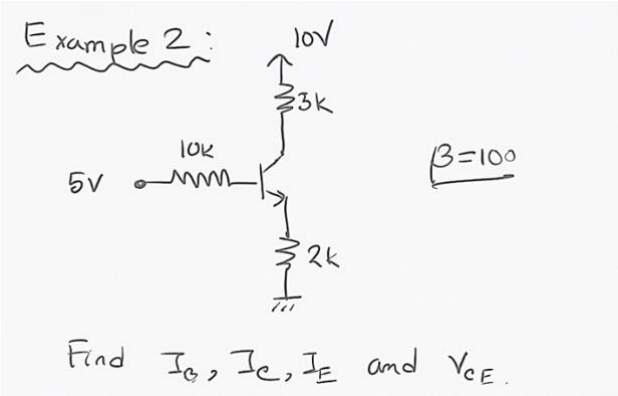
$$\frac{5 - V_D}{(z+5)} = I_D = x \Rightarrow \boxed{V_D = (\ )x + (\ )}$$

11.



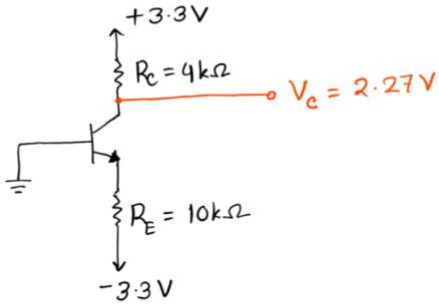
Find V_o for (i) $V_i = 1V$ (ii) $V_i = 5V$

12.



13.

For the following BJT, $V_{BE\ (active)} = 0.7\ V$, $V_{BE\ (saturation)} = 0.8\ V$, and $V_{CE\ (saturation)} = 0.2\ V$.



Use method of assumed state to find the following (note that you MUST verify your assumption):

(i) I_C
(ii) I_E
(iii) I_B
(iv) β
(v) α