National Taiwan Normal University
Department of Computer Science and Information Engineering

CSU0007 - Basic Electronics

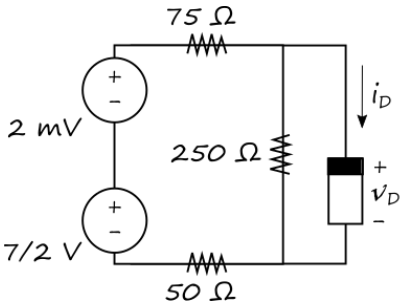
Homework 3

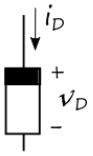
100 points total. Due on 9AM, Monday, 5/11/2020.
Submit your answer via Moodle. Clearly state your analysis to earn full score.

1 (40 points) Answer the following two questions:

1.1 (20 points) In the midterm exam, the corrected answer of Question 5c shows that v_O=1.75V, not 2V. Why does the voltage across the diode become smaller than 2V? State your qualitative opinion.

1.2 (20 points) For the following circuit, apply the small-signal analysis to find current i_D . Recall that you may apply Thévenin's theory to help simply the analysis.





$i_D = \begin{cases} K \cdot v_D^2 & \text{for } v_D > 0 \\ 0 & \text{otherwise} \end{cases}$

Assuming $K = 1\ mA/V^2$

2 (60 points) Answer the following two questions regarding the mapping between voltage levels and logic values in the static discipline, given thresholds V_{IL}=1.8V, V_{IH}=2.3V, V_{OL}=1V, and V_{OH}=4V, and assume the highest voltage level is 5V:

2.1 (30 points) Suppose a sender sent a logic 0 by placing V_{OUT}=0.9V, and the noise during transmission added 0.7V to the signal. Would its receiver be able to correctly interpret the signal as a logic 0? Give a quantitative reason.

2.2 (30 points) For the electronic system working under the given static discipline, can the following electronic device work correctly with the system? The device produces voltage level V_{OUT}=0.8V for sending a logic 0 and V_{OUT}=4.5V for sending a logic 1. The device will interpret all input signals between 0V and 2V as a logic 0 and all input signals between 2.5V and 5V as a logic 1. Show your quantitative analysis.