In-Class Exercise: Schmitt-Trigger.

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Figure 1 shows the schematic of the Schmitt-Trigger circuit. It is essentially an OpAmp used as a comparator (hence the output can only be plus or minus V_{sat}), but the output is fed back to the non-inverting input terminal.

To analyze how the circuit works, first we need the general OpAmp equation which reads:

$$V_O = A_{OL}\left(V^+ - V^-\right) \tag{1}$$

Where A_{OL} is the open loop amplification factor of the OpAmp which is about 10^6. We also need to assign values to the saturation voltage. Let's assume that the $V^{cc} = \pm 12V$ and therefore $V_{sat} = \pm 10V$

Fill in the table below.

1. Calculate $V^+(k)$ from $V_O(k)$ using the voltage divider rule.
2. Calculate $V_O(k+1)$ using the OpAmp equation.
3. Calculate $V^+(k+1)$ from $V_O(k+1)$ using the voltage divider rule.
4. Copy the (k+1) values into the (k) values of the next row, and repeat steps 2-4.

	$V^-(k)$	$V^+(k)$	$V^+(k+1)$	$V_0(k)$	$V_0(k+1)$	
a	0			+10		
b	+6					
c	+6					
d	-6					
e	-6					

Draw the input signal $V^-(k)$ in Figure 2. Then draw the response (output signal V_O)) in the figure as well. Cross-hatch the dead band in the figure.

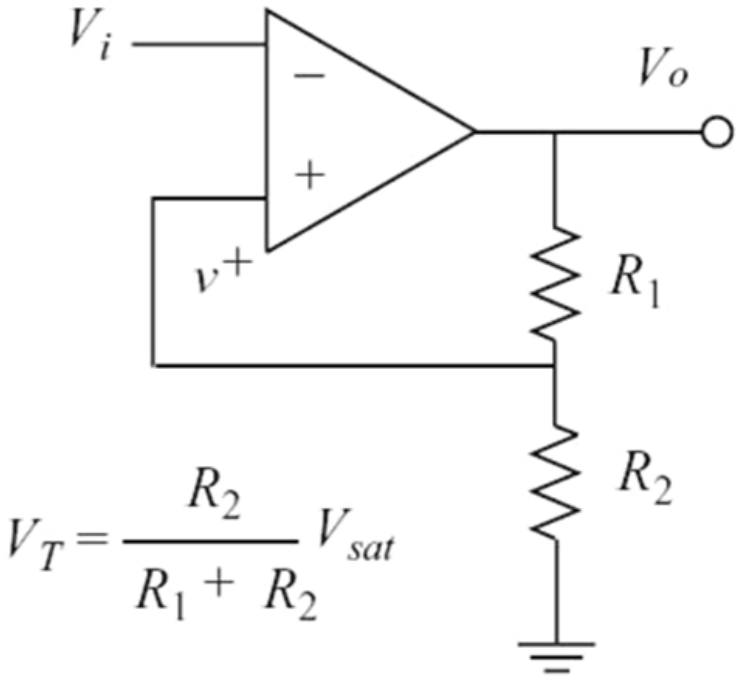

Figure 1: The Schmitt-Trigger circuit is shown here, note that $V_T = V^+ = \frac{R_2}{R_1 + R_2} V_O$.

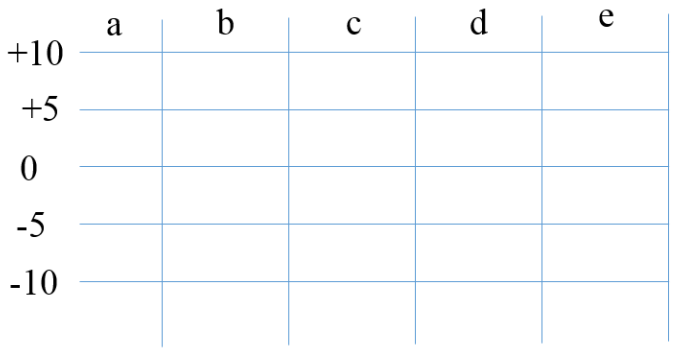

Figure 2: Draw the input signal ($V^-(k)$) as well as the output into this graph.