

ECE 320 - Quiz #5 - Name _____

555 Timers, Transistor Switch, Comparitors, Schmitt Triggers - Spring 2022

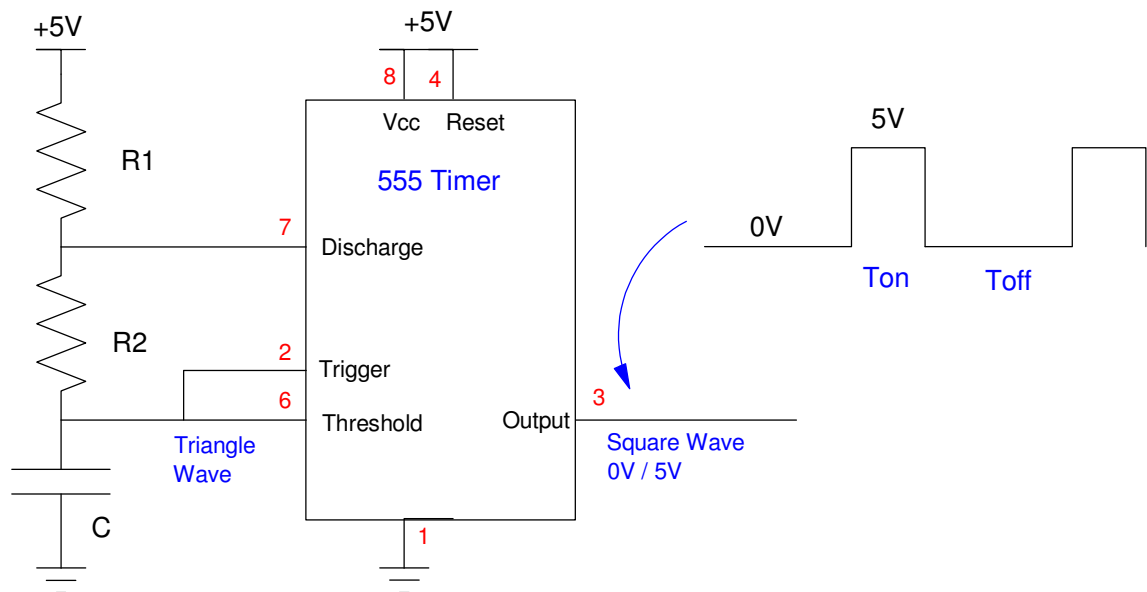
1) 555 Timers. Determine R1, R2, and C so that the 555 timer outputs a 60% duty cycle 220Hz square wave:

$$t_{on} = (R_1 + R_2) \cdot C \cdot \ln(2) = 2.727ms$$

$$t_{off} = R_2 \cdot C \cdot \ln(2) = 1.818ms$$

Let R1 be your birthday day (900 + 100*Month + Day)

R1 900 + 100*Month + Day	R2	C



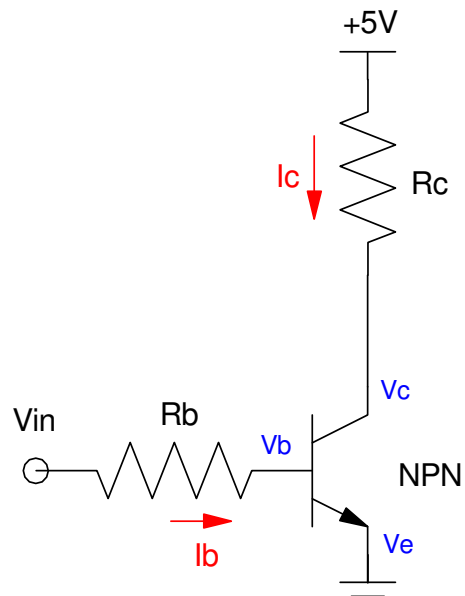
2) Transistor Switch: Design. Specify R1 and R2 so that when $V_{in} = 5.00V$,

- $I_c = (100 * \text{Birth Month} + \text{Birth Day}) \text{ mA}$.
- The transistor is saturated, and
- $I_b < 25\text{mA}$ (the maximum output of a 555 timer)

Assume 6144 transistors

- $|V_{be}| = 0.7V$
- $|V_{ce}| = 0.2V$ when saturated
- $\beta = 60$

$I_c \text{ (mA)}$ $100 * (\text{Mo}) + (\text{Day})$	R_c	min value of R_b	max value of R_b

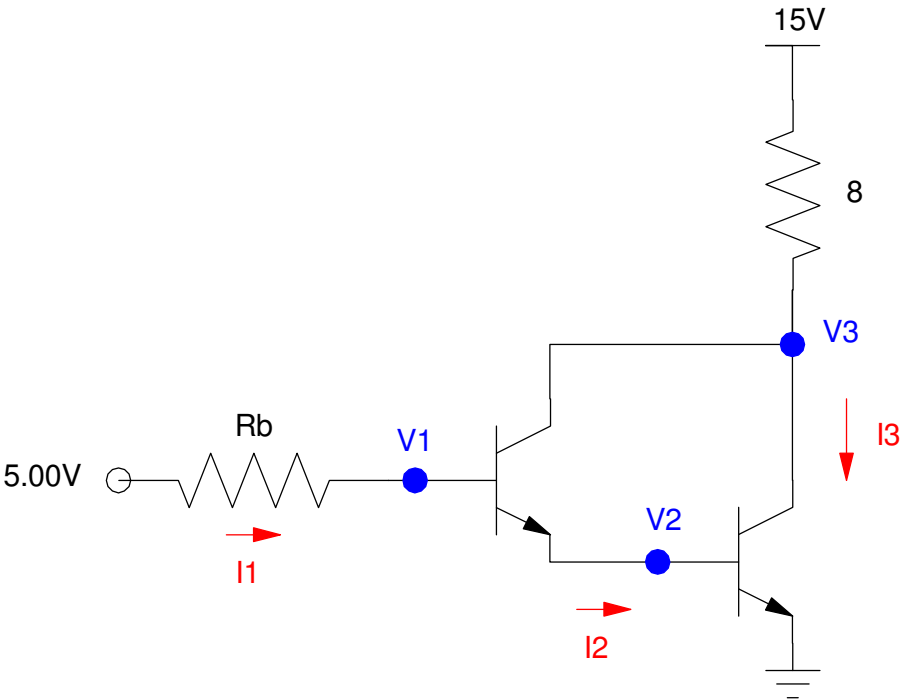


3) Darlington Pair (analysis). Assume two 6144 NPN transistors are connected as a Darlington pair.

- $|V_{be}| = 0.7V$
- $|V_{ce}| = 0.2V$ when saturated
- $\beta = 60$

Let R_b be $900 + 100(\text{Birth Month}) + \text{Birth Day}$. Find the currents and voltages.

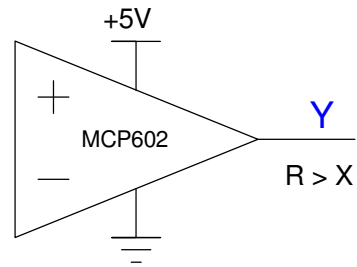
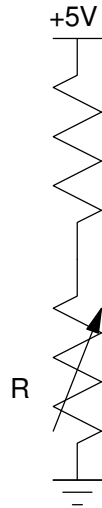
R_b $900 + 100 \cdot Mo + Day$	I_1	I_2	I_3
	V_1	V_2	V_3



4) Comparitor: Design a circuit which output

- 0V when $R < X$ Ohms
- 5V when $R > X$ Ohms

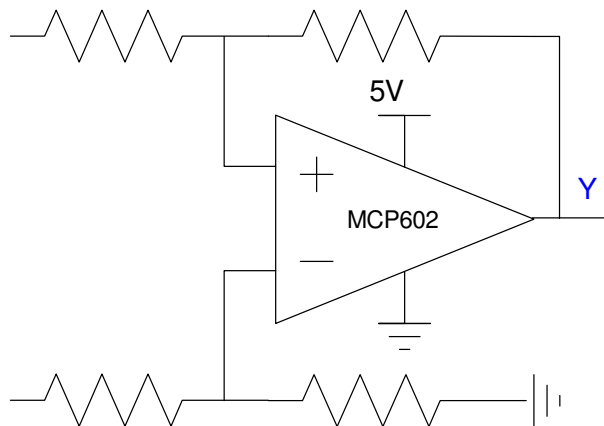
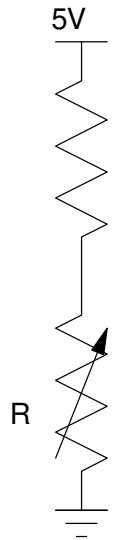
where X is $900 + 100 * (\text{Birth Month}) + (\text{Birth Day})$.



5) Schmitt Trigger: Design a circuit which output

- 0V when $R < X$ Ohms
- 5V when $R > X + 500$ Ohms
- No change for $X < R < X + 500$ Ohms

Let X be $900 + 100(\text{Birth Month}) + (\text{Birth Date})$.



6) Schmitt Trigger: Analysis. Determine the voltages and resistance where the following Schmitt trigger turns on and off. Assume R_x is $900 + 10 * (\text{Birth Month}) + (\text{Birth Day})$.

R_x 900 + 100*Mo + Day	On (V ₂ = +5V)		Off (V ₂ = 0V)	
	V1	R	V1	R

