Phys 3150/5190 Homework Assignment 8

Due Wednesday, November 28

1. Analyze the 7555 timer circuit from Lab 11. Starting from a state where $T = 0$, determine and sketch what T and Q do as a functions of time. It may be useful to keep track of the intermediate values α, β, and γ as well. Eventually, you should reach a periodic cycle. What is the period, in terms of R and C?

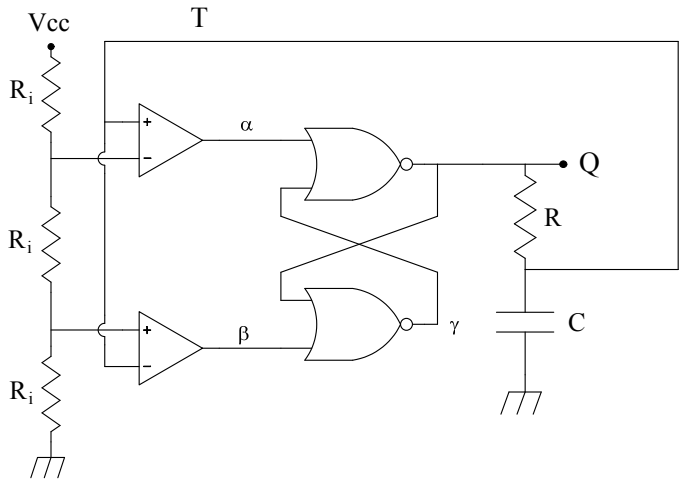
The op amps in the circuit are acting as comparators, producing a high (V_{cc}) output if the positive input is greater than the negative input, and a low (0) output if not. You can similarly assume that Q is either high (V_{cc}) or low (0). Recall that capacitors in an RC circuit charge and discharge exponentially, so when Q is high, T will increase as

$$T(t) = V_{cc} - [V_{cc} - T(0)]e^{-t/RC}$$

and when Q is low, T will decrease as

$$T(t) = T(0)e^{-t/RC}.$$

In either case, $T(0)$ is the inital value of T when Q switches states.



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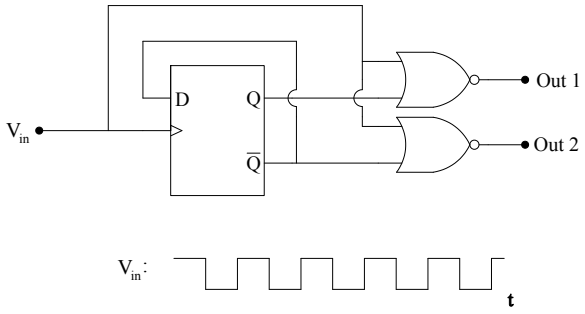
2. The input to the circuit below is a square wave as shown. Determine and sketch (on the same scale) the output signals Out 1 and Out 2.



3. The circuit shown is driven by a system clock consisting of a continuous digital square wave. A single pulse is applied on the trigger input, as shown. Prior to the trigger, $\overline{Q}$ was high. Analyze the circuit to determine the resulting behavior, and sketch the output signal produced.