Digital Design Lab

ECE 315

Lab/Project 1B

Sequence Generator

Group # 9

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Overview

The purpose of this lab is to design and implement a tone generator. The tone generator is determined by the sequence generator which cycles through 10 different states that are then passed to the tone generated. These states then create a tone for each state cycling through each. determines the tone heard by the tone generator.

Equipment

Tool	Quantity
74LS169 Binary Counter	1
555 Timer	1
7476	1

Description

The first step in this project was completed in the previous lab, which consisted of designing and implementing a sequence generator on a breadboard. The sequence generator should have four variables (A, B, C, D), and increment through a set sequence in the correct order.

The next step was to use the output of this sequence generator to generate a pitch. We sent the outputs of the previous circuit into a new circuit consisting of a 74169 chip, a 7476 chip, a clock and two resistors (The full circuit is depicted below). We able to find the necessary resistances using the equation, and then we implemented the circuit. The result was a circuit which outputted a high pitched tone on a tone generator, with varying pitches depending on the input variables A, B, C, D (the output variables of the previous circuit).

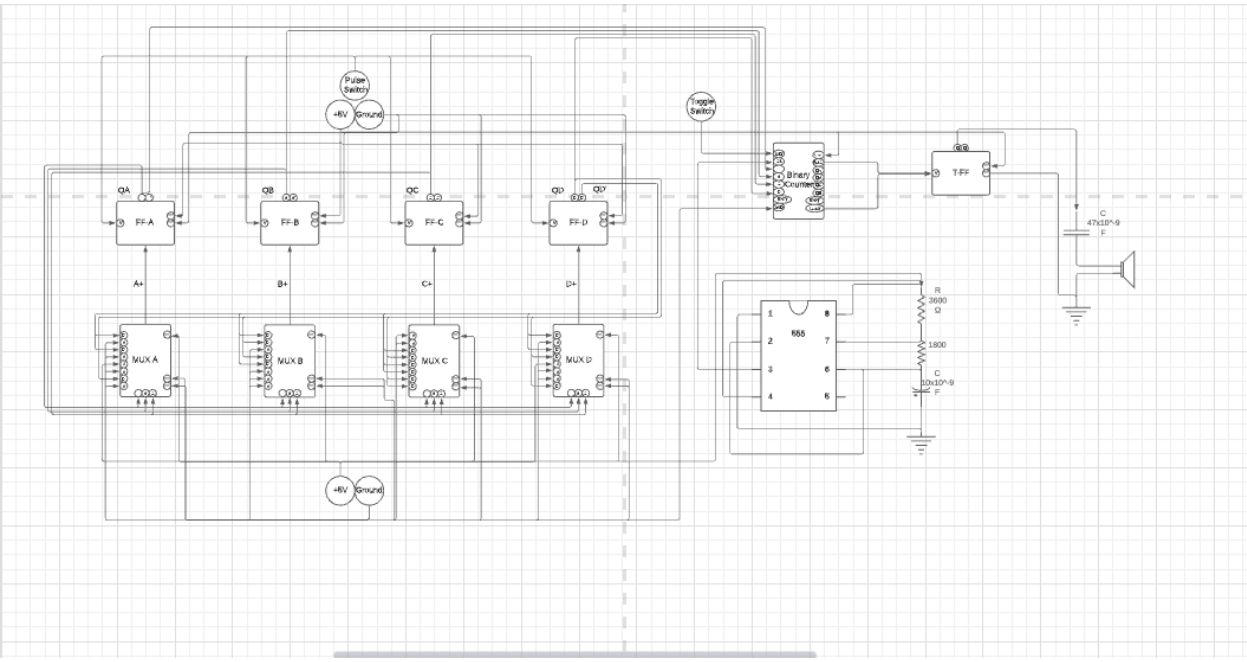
Design Synthesis

$T = t_H + t_L$ $t_H = 0.693(R_A + R_B)C$ $T = 1/Frequency$ $t_L = 0.693R_BC$

$duty\ cycle = t_H/T\ *\ 100$ Where duty cycle = 60% and C = 10nF

Using these equations we find that the required resistance is: $R_A = 1800$, $R_B = 3600$

Complete Logic Diagram



Results and Simulations

Tone Generator Circuit

Tone Generator Video: https://vimeo.com/676707448

Conclusion

In this lab, we used the outputs of the circuit designed in the previous lab in order to produce a pitch on the board, as pictured above. These outputs would be fed into a new circuit that would then produce a pitch based on the value of the four inputs.

Our main setback during this lab was that our previous circuit had been disassembled. We therefore opted to use the switches on the very bottom of the board to manually produce the input, which can be seen in the video. Although this made the automatic pitch change impossible, we were still able to successfully implement the circuit that was to be designed for this lab, as we still had four manually controlled inputs.

In this lab we learned how to produce a pitch using an electrical circuit and some logic. Unfortunately we were unable to demonstrate the automatic pitch changes, however it was easy to see the idea behind it even with our manual inputs. It seems very likely to me that similar concepts to the ones in this lab are used frequently in systems such as alarms, sirens on emergency vehicles, and any other application that involves outputting tones on a rhythm.