Digital Logic Velocity Calculator

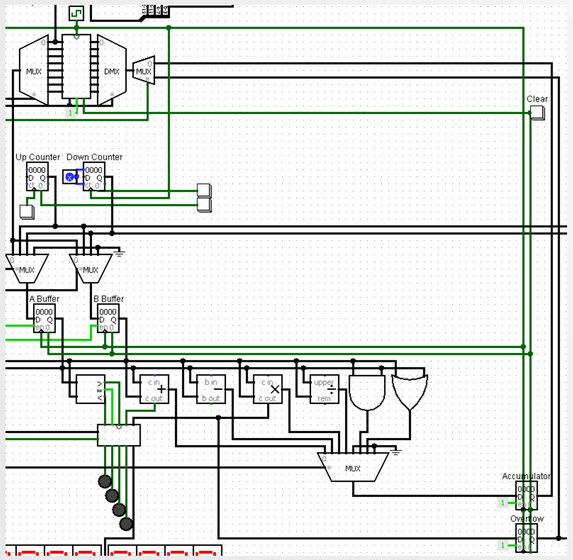
Chris Peeters, Alexander Barrow, Kelvin Jerry

Goal

For this project we had to create a specific digital circuit and implement a pipeline and a finite state machine. We also had to have the op-code that tells the circuit what to do. When this was completed we needed to have the program preform some type of mathematical equation.

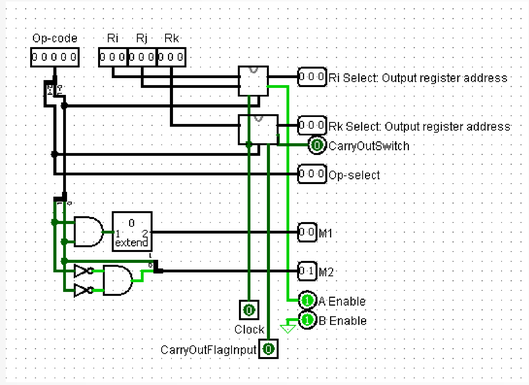
Logic Design

Starting on top we can see how the logic works. Data is taken out of the registers and then manipulated mathematically with the up and down counter. Then the data is stored back into the registers.



Control Logic

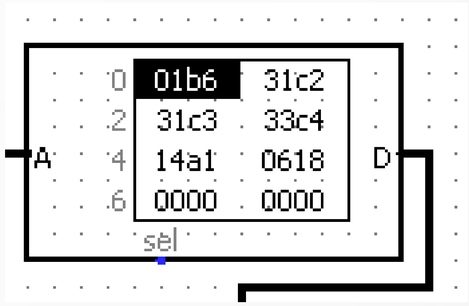
The control logic is interprets the op-code and tells the circuit what function to preform. The logic also specifies which registers to take data from and where to store it after the operations are complete. This is the heart of the logic design.



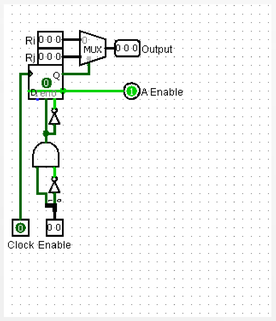
Op-Code

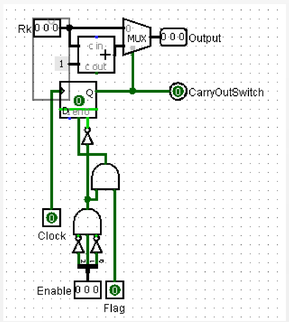
The op-code is a type of assembly language that is used in conjunction with the control logic. When writing the Op-code we had to decide what would be manipulated and where the results are stored. Our op-code works in this order:

- Grabs acceleration from up-counter and stores it
- Grabs initial velocity from up-counter and stores it
- Grabs time from down counter and stores it
- Multiplies acceleration and time and stores it
- Adds initial velocity to the results and stores it



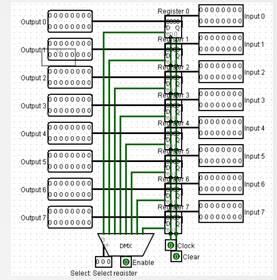
Finite State Machine



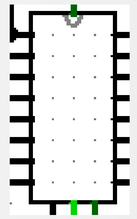


Condensing the Circuit

After we had a working prototype our next step was to simplify some of the parts of the circuit into big blocks that way the overall circuit looks cleaner. We did this with the registers and with the status register.



Registers Before



Registers After

Tests

To test the circuit we set the up counter to 2 for the acceleration and 5 for the initial velocity. The down counter would hit 4 for the time which should produce an answer of 13. After the program ran it did in fact produce the correct answer.

Acknowledgments

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