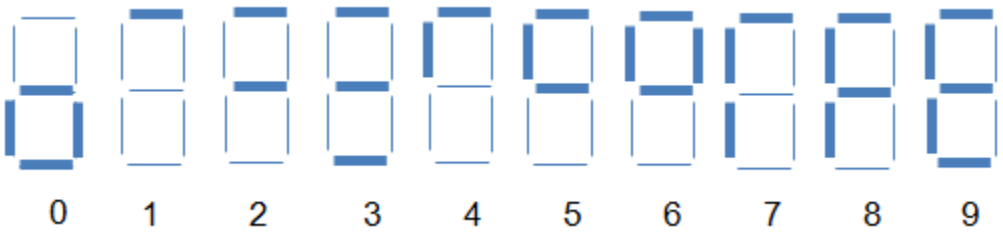
Project 3 CS 235 Kutztown

Topic: Design a complex combinatorial circuit using minimal gating
Points: 35; 15 for Circuit Design, 20 for Circuit Implementation
Due: TBA. ***Submit after deadline at your own risk.***
Overview: In this project, you will design a circuit to display the values from zero to 10, continuously, starting from a value set in the circuit, and counting upward by a value between one and three.

Your circuit will count, but it will not use the customary symbols for the values one through nine. Instead, it will use the following symbols (value below):



Design and implement the seven circuits necessary to permit display of the values output from a counter on a 7-segment device.

You are to first design each of the five circuits for values 0 – 0xA, using a Karnaugh map to develop the combinatorial functions of wires **A**-**D** in sum of products form. An Excel workbook is at URL: https://faculty.kutztown.edu/spiegel/CSc235/Programs/Kmaps.xlsx. You are to complete it, including distinctly marking your combinations and giving your sum of products formulas for each table. Then, submit it for the first part of this project. For the 2nd part, use Logisim to implement your circuit.

Notes:

- One of the segments will be done in class. You still should submit that circuit.
- All circuits must be properly commented and the segment being implemented must be clearly labeled.
- Circuits for the segments may only be implemented using NAND gates and inverters. Use sum of products logic as from class.
- The increment amount is set by the user in a well-labeled input. If changed during execution, the counter behavior should follow appropriately.
- The loading of the counter is via a 4-bit input. Use arithmetic devices or other methods to control the numeric sequencing.
- The circuitry must be well organized in a column-wise alignment. The counter and associated devices/elements should be on the left, the circuitry in the middle, and the 7-segment device on the (upper) right. Keep the circuit concise so it is entirely visible on the screen.
- You must use a clocked counter and a 7-segment display that takes separate inputs for each segment.
    - Use a 2nd display to show the current decimal value of the counter.
- Use tunnels to keep your circuits neat.

Deliverables:

1. K-maps and combinatorial functions in sum of products form are to be submitted in the K-maps drop box on D2L by the deadline announced in class.
2. The Logisim file containing the executable counter circuitry is to be submitted by the deadline announced in class in the Project 3 drop box on D2L