

Lab #5

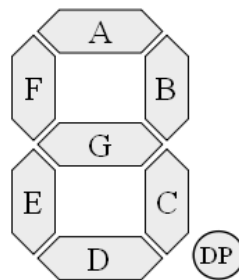
TECH 3232

Fall 2018

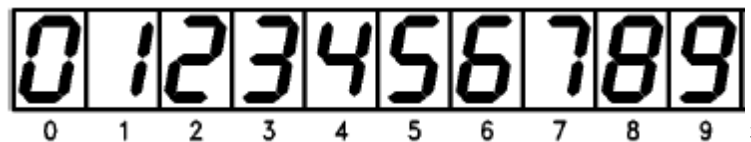
This is a **FORMAL LAB** due Nov 7 at beginning of lab in both Electronic AND paper form. Report guidelines are found at http://tech-uofm.info/fall_2018/TECH3232/Lab_Report_Format.pdf.

Background:

Seven segment displays are commonly used in calculators to display each decimal digit. Each segment of a digit is controlled separately, and when all seven of the segments are on, the number 8 is displayed. The center segment of the display (called segment G) comes on when displaying the numbers 2, 3, 4, 5, 6, 8, 9.¹



You can see how each number is formed in the table below:



Your task for this lab is to design the circuit required to create the circuit required to generate the outputs for SEGMENT d (bottom segment) given a BCD input.

Lab Exercise:

Step 1: Determine the Truth Table for the segment

Step 2: Determine the Standard SOP Boolean equation from the Truth Table Above:

¹ Digital Electronics, William Kleitz Prentice Hall 2006

² http://upload.wikimedia.org/wikipedia/commons/0/02/7_segment_display_labeled.svg

³ http://www.datasheetcatalog.org/datasheets/120/375650_DS.pdf

Step 3: Now minimize the equation using K-maps. Do TWO k-maps: one for the BCD values only (Binary values 1010 to 1111 should be treated as 0's in the K-Map), the second with don't cares (for the binary 1010 – 1111) shown as X's.

Step 4: Determine the two equations from the minimized K-maps.

Step 5: determine the circuit you wish to build (with or without don't cares) be ready to justify why you built the chosen circuit and the advantages and disadvantages over the other (Must be included in formal report discussion)

Step 6: Draw and test a simulation of your chosen circuit and check for errors.

Step 7: Draw a proper, fully labeled schematic for the circuit you are going to build.

Step 8: Build and demo the circuit to the instructor.

Make sure to include the following in the report:

- All equations MUST be in equation editor
- All diagrams must be computer drawn and embedded in the document file (all parts, including switches, resistors and LED's are required – use Altium, Cadence, Eagle Cad or other professional package. Paint, Visio or similar programs should **not** be used)
- All K-maps must be electronically produced and circled. Suggest making k-maps using tables within Word OR Excel.
- Background must include explanation of how a 7seg display works and MUST BE IN YOUR OWN WORDS (not copied from this lab, the internet or the textbook)
- Justification for the circuit you chose to build needs to be included in the discussion/results.
- Objective of the lab and the procedure should both be in paragraph form and should NOT be copied directly from this lab handout. Bullet points or numbered steps are NOT permitted.