

Lab #6

TECH 3232

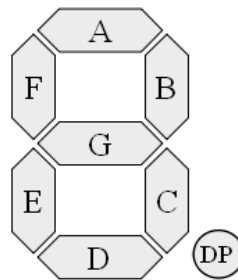
Fall 2024

This is a **FORMAL LAB** due at the start of lab in 2 weeks via online submission. The document should not contain any hand drawn or hand written elements (ie use equation editor, excel and electronic schematic capture program (e.g. KiCad). Report guidelines are found on the class website,

Since this might be your first Formal Report, the instructor will be glad to go over the rough draft for you and make notes. Drafts are due in by start of lab in one week (via online submission). It is **STRONGLY** recommended that you take advantage of this opportunity!

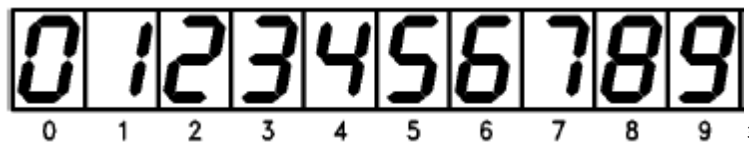
Background:

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 top segment of the display (called segment A) comes on when displaying the numbers 0, 2, 3, 5, 6, 7,8, 9.¹



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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 G (center segment) given a BCD input (making BINARY 10-15 DON'T CARES)

Lab Exercise:

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 1: Determine the Truth Table for the segment

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

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 equations from the minimized K-maps.

Step 5: Draw and simulate the circuits in SimcirJS.

Step 6: 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 7: Draw a proper, fully labeled schematic for the circuit you are going to build (via KiCad via program).

Step 8: Build and demo the circuit to the instructor via YouTube video with commentary (an active link to the video should be included in the formal report).

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 KiCad. Paint 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 use 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) and diagrams should be from your research (NOT from this handout).
- 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.

Submit:

- Electronic and paper copy of report. Make sure the simulations and schematic are embedded in the document and a FULL-SIZE version of the schematic is included in an appendix.
- Electronic version of SimcirJS simulations