Retrospect Exam

2022/10/11

1. (**15 points**) Number conversion
   Please convert decimal number 156 to
   a. (5 pts) Binary
   b. (5 pts) Hexadecimal
   c. (5 pts) BCD code

2. (**20 points**) Design of parity bit generator & checker
   Assume we would like to equip our 3-bit data with 1-bit even parity protection.
   Please use XOR and XNOR gates to design the parity bit generator and checker.

3. (**24 points**) Gate minimization with K-Map
   Use the map method to minimize the following Boolean functions
   a. (8 pts) $F(a, b, c, d) = \sum (0, 2, 5, 8)$, $d(a, b, c, d) = \sum (1, 4, 12)$
   b. (8 pts) $F(a, b, c, d) = a'b'cd + a'bc'd' + abc'd + abcd + abc'd' + a'b'c'd + ab'cd'$
   c. (8 pts) $F(a, b, c, d) = \sum (0, 1, 8, 9, 10, 11, 12, 13)$, $d(a, b, c, d) = \sum (2, 3)$

4. (**52 points**) Designing Combinational Circuit
   Assume we have a seven segment as shown in Figure 1. Please implement a English letter display, where 0->A, 1->B, 2->C, 3->D, 4->E, 5->F, 6->G, 7->H, 8->I, and 9->J. The display of letters is shown in Figure 2.
   a. (8 pts) Show the truth table for implementing the letter display decoder.
   b. (24 pts) Show the K-map minimization and circuit implementation of displaying A, I, and J.
   c. (20 pts) Show the implementation of all letters by a 3-to-8 decoder as shown in Figure 3.

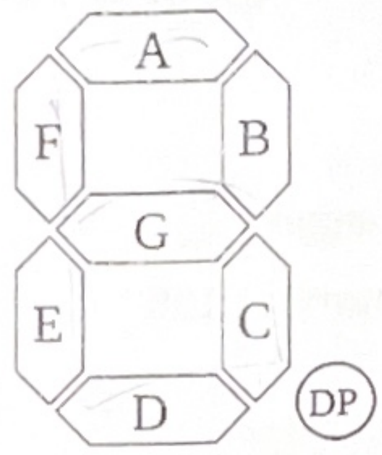

Figure 1 Seven Segment Display.

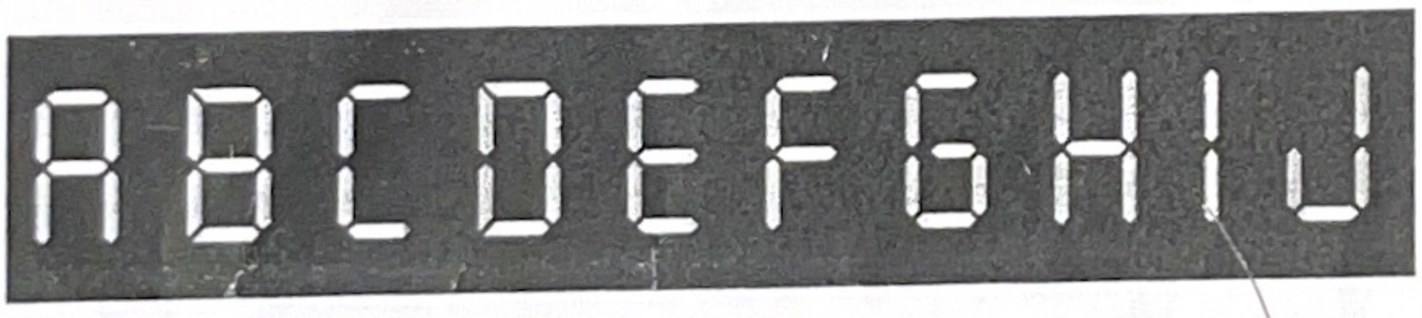

Figure 2 Presentation of letters with 7-segement display.

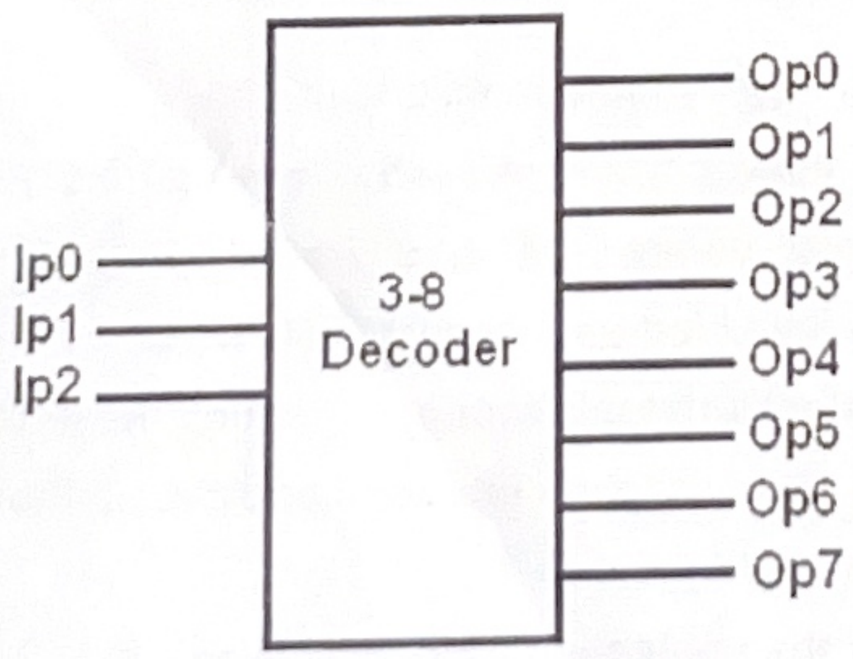

Figure 3 3-to-8 Decoder.