



Assignment 3

CSE260: Digital Logic Design

Department of Computer Science and Engineering

Semester : Fall 25

Marks: 5

Graded (5 marks)

1. Implement the $F(A,B,C,D) = \sum(0,1,2,6,10,13,14)$ boolean function using a single 8:1 mux. Use external gates if required. [1]
2. Build an 8-bit parallel adder-subtractor using 4-bit parallel adders. Label each input and output properly. [1]
3. Draw a circuit using a 4-bit parallel adder that follows the following condition -
If A is greater than 3 and B is odd, perform A-B, else perform A+B [1]
4. You have been recruited by the Central Intelligence Agency for a classified project. Your task: design a **special-purpose 4-to-2 encoder** that appears faulty to anyone who doesn't know its hidden rules. Only those who understand the logic will realize it's working exactly as intended. The encoder must follow these operational rules:
 1. **Single Active Input:** If exactly one input line is active (say, line x), the encoder outputs the code for the next line ($x+1$), except when the highest line is active; in that case, the output remains unchanged.
 2. **Double Active Inputs:** If exactly two input lines are active, no matter which lines, the encoder always produces the lowest possible output code of the encoder (Not the lowest code among the active lines).
 3. **Triple Active Inputs:** If exactly three input lines are active, the encoder outputs the code corresponding to the one inactive line.
 4. **All Inputs Active:** If all input lines are active, the output is treated as don't care.
 5. **No Inputs Active:** If no input lines are active, the encoder outputs the maximum possible code of the encoder.

Your mission:

- Construct the truth table for this 4-to-2 encoder based on the rules above, derive the logic equations for each output bit, and draw the complete circuit diagram implementing your design. [2]

Ungraded

- Implement $F = \sum(0,2,3,6)$ using
 - a) 2:4 decoders only
 - b) 3:8 decoder only
- Consider A is a 4-bit number. Design A-7 (A minus 7) using a 4-bit parallel adder. Use external gates if required.
- Build an Excess-4 to BCD code converter using encoder(s) and decoder(s). Choose the device with the appropriate number of inputs and outputs.
- Build a 7-person voting system using adders. You can use full adders, half adders or 4-bit parallel adders as needed.