ASSIGNMENT 2

College of Engineering and Technology

Département of Computer science

Digital Logic Design (EENG2041)

Computer Science Year/semester: II/I (GROUP 1 & 2)

1. Simplify each of the following functions and implement them with NAND gates.

(a) F1 = AB′ + AB′C + A′BD + ABE′+ A′BE′+ A′D

(b) F2 = (A + C) (A′ + B′ + C) (A′ + B′ + C + D) (B′ + C + D′)

2. Obtain the simplified expressions in sum of products and product of sums.

(a) x′ z′ + y′ z′ + yz′ + x y z

(b) (A + B′ + D) (A′ + B + D) (C + D) (C′ + D′)

3. Simplify the following equation by using K-Map method and implement using two-variable NAND gates

a) F (A, B, C) = ∑m (0, 2, 4) + ∑d (1, 3, 5, 6, 7)

b) f (w, x, y, z) = ∑m (0, 1, 2, 8, 12, 13, 14) + ∑d (3, 5, 10, 15)

c) F (A, B, C, D, E) = ∑m (1,4,5,7,9,11,13,16,18,22,23,24) + ∑d (2,6,8,14,20)

4. A combinational circuit has four inputs and one output. The output is equal to 1 when all the inputs are equal to 1 or none of the inputs are equal to 1 or an odd number of inputs are equal to 1.

(a) Obtain the truth table.

(b) Find the simplified output function in sum of products.

(c) Find the simplified output function in product of sums.

(d) Draw the two logic diagrams.

5. Construct a 16 x 1 multiplexer with two 8 x 1 and one 2 x 1 multiplexers. Use block diagrams.

6. Design a counter that counts in the sequence: 0, 2, 4, 6, 8. Use JK flip-flops and draw the state diagram, truth table, and the circuit diagram.

7. Describe the operation of the following types of flip-flops SR Flip-Flop, D Flip-Flop, JK Flip-Flop, T Flip-Flop and draw the characteristic table and characteristic equation for a SR, D, JK, T Flip- Flops?

8. Design a **4-bit up/down counter** using JK flip-flops. The counter should count up or down based on the control input. Provide the state diagram, state table, excitation table, and logic diagram.

9. How can basic shift registers, serial-in serial-out (SISO) registers, and serial-in parallel-out (SIPO) registers be compared in terms of their definition, key functions, primary applications, and examples? (Chapter 8 reading assignment)

10. How can the basics of semiconductor memory, including Random Access Memory (RAM), Read-Only Memory (ROM), Programmable ROMs (PROM, EEPROM), and Flash memory, be compared across various factors such as their definition, key functions, primary applications, and examples? (Chapter 9 reading assignment)

11. How do the principles of Boolean algebra, combinational and sequential circuits, and hardware description languages (HDLs) integrate to design and optimize modern digital systems? In what ways are these concepts applied in real-world systems like processors, memory, and embedded devices, and how do optimization techniques such as Karnaugh maps contribute to enhancing system performance and resource efficiency? (Over-all perception of digital logic design course)

Presentation date January 29 and 30/2025

Rules & Regulations

1. Copy of assignment from another students/group is strictly not allowed.
2. Number of students in one group is minimum 5-6.
3. Assignment must be strictly submitted by the advertised deadline. (*January 28*/2025G.c)
4 Assignment cover sheet should be attached as the first page of your assignment