**HOMEWORK 5: CS 209 (INTRODUCTION TO DIGITAL LOGIC DESIGN)**

**DUE DATE: WEDNESDAY, OCTOBER 2nd, 2024**

**Homeworks must be turned in on paper, no blackboard submission is allowed.**

You must write down neatly showing steps and attach the cover page.

1. Find minterm or maxterm depending on the symbol given for each of the following cases:
2. Given 4 input variables: A, B, C, D

What would be expression for M11

(hints: Write 11 into binary using 4 bits, that will give you the values of A, B, C and D)

1. Given 3 inputs variables: x, y, z, find the expression for m4
2. Given 5 input variables: a, b, c, d, e, determine m21
3. Given 5 input variables, a, b, c, d, e, determine M7
4. Given 4 input variables X, Y, Z, U, determine m5
5. Given the following truth table for the function F where A, B and C are the input variables:

A B C F

0 0 0 0

0 0 1 0

0 1 0 1

0 1 1 1

1 0 0 0

1 0 1 0

1 1 0 1

1 1 1 1

1. Determine the minterm expansion using summation notation and then express it in terms of A, B and C
2. Determine the maxterm expansion using the product symbol and then write as a POS in terms of A, B and C
3. Now start with the sum of products expression obtained in part (a) and simplify that using the algebraic simplification theorems to get the minimum sum of the products form (to the simplest form).
4. The truth table for a binary subtractor given the two numbers A and B and also borrow bit C and two outputs: S and B\_OUT as below

A B C S B\_OUT

0 0 0 0 0

0 0 1 1 1

0 1 0 1 1

0 1 1 0 1

1 0 0 1 0

1 0 1 0 0

1 1 0 0 0

1 1 1 1 1

1. Write down the minterm expansion for S
2. Write down the minterm expansion for B\_OUT
3. Simplify S (if you can) and draw the circuit using NOT, AND and OR gates.
4. Simplify B\_OUT and draw the circuit for B\_OUT
5. Given the following maxterm expansion:

F(a, b, c, d) = ∏M(2, 3, 5, 8, 10, 11, 12)

1. Write this expression algebraically.
2. Simplify the expression obtained in problem a to get a minimum POS expression for the function F
3. What will be the corresponding minterm expansion for the function F, write using summation notation, as well as algebraically in terms of the input variables.
4. Given F(a, b, c) = ∑m(0, 1, 2, 3, 7)
5. Draw the Truth table with the information given
6. Expression the function F as a sum of product expression.
7. Express the function F as a products of sums expression
8. Simplify the minterm expansion to get the minimum SOP for F