Chapter 1

TEXAS INSTRUMENTS WISH PROGRAM WEEK 1 - DIGITAL CIRCUITS

1.1 Day 1 - Combinational Circuits

Welcome to Day 1 of **DIGITAL CIRCUITS** week in the WISH program! These are the learning goals for today.

1. Refresh our understanding of combinational digital circuits
2. Design a combinational digital circuit from a problem description. Revise concepts such as Karnaugh maps and logic optimization.
3. Appreciate that the two-input NAND and two-input NOR gates are universal gates.
4. Understand how to use a schematic capture tool and logic simulation
5. Understand how to apply functional tests to verify a design

1.1.1 Reading

1. https://www.allaboutcircuits.com/
2. https://circuitverse.org/
3. https://www.circuitlab.com/

1.1.2 Problem

Anagha, Bina, Cathy, and Daneen are close friends and student interns in WISH. They have to decide whether they wish to go for a movie or not. Each of them votes "Yes" or "No" towards the decision.

1. The decision is "GO" if at least three votes are "Yes"

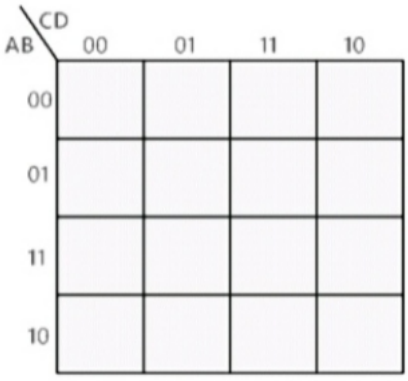
2. The decision is "NOGO" if at least three votes are "No"

3. The decision is "Draw" if two people vote "Yes" and the other two vote "No"

Our problem is to design a combinational circuit which takes as inputs signals A, B, C, D which represent the choices of the four students. The circuit must produce three outputs Go, $NoGo$, or $Draw$ as per the description above.

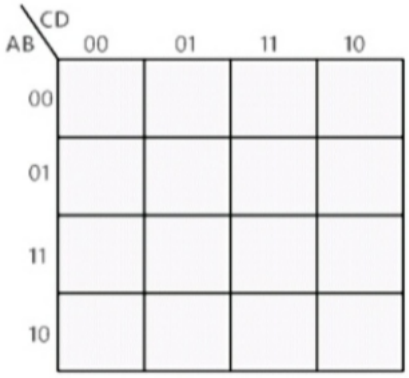
1.1.3 Assignment

1. Construct the Karnapugh map for GO.



2. Design a circuit for GO using only two-input gates. You may use two-input NAND, NOR, AND, OR, EXOR, EXNOR gates.

3. Construct the Karnapugh map for $Draw$



4. Design a circuit for *Draw* using only two-input gates. You may use two-input NAND, NOR, AND, OR, EXOR, EXNOR gates.

5. Use the online tool available from `https://circuitverse.org/` to enter the circuit for *GO* and *Draw*. When possible, find if common subexpressions exist between *GO* and *Draw* and optimize your logic further.

6. Generate *NOGO* from *GO* and *Draw*. Add the logic for *NOGO* in your circuit.

7. Verify that your design is correct by applying all possible inputs and checking the outputs.

8. Write down your learning for the day.