Lab 06

Part D – K-Map Game

Description

This lab module consists of a game similar to tic-tac-toe, except played with a K-Map. You and your lab group will play a few rounds of this game, derive the resulting equations, and implement them using `NAND` or `NOR` gates.

Procedure

Rules of the game

For two players

- Start with a blank 4×4 K-Map.
- One player enters `1`s and the other player enters `0`s.
- Whoever manages to form a group of four first wins.
  - If no player is able to get a group of four, then the game is a tie.
  - Recall that a group of four can be any of the following:
    - a square of four neighboring cells with the same value in the middle
    - a square of four neighboring cells that extends through the boundary between top and bottom or left and right
    - the four corners of the map
    - a row of four
    - a column of four
- Once a winner is declared, fill all the remaining cells with don't cares (`X`).
- Play the game five times and keep track of who wins.
- You are allowed to swap between playing `0`s and `1`s but keep track of who played which side each game, as this is important for later.

For three players

- If your lab group has three players, you may do either of the following:
  1. As a group, play three games where two members of the group play in each game.
     - Each round will have a different pairing of group members so that each member plays twice.
     - You may repeat this multiple times (for the activity, do this twice).
  2. As a group, play three games where the third person in your group places *don't care values* (`X`).
     - This player will go last in the turn order.
     - This player's goal is to make a group of four *don't care values* (not including `0` or `1`).
       - However, the other players *can* use your don't care values as part of a group to win, so this may be difficult because you are essentially playing both sides.
     - Rotate the players each time, so everyone gets a chance to play each "team" (`0`, `1`, and `X`).
     - Again, you may repeat this multiple times.

The Activity

1. Play five to six rounds of the K-Map game.
   - Each time you play the game, you should have a different distribution of `0`s and `1`s.
     - If you end up with the same distribution in two games, replay the last one.
   - If you are in a group of two, play at least five rounds. You may play more particularly if you have a tie and want to determine an overall winner.
   - If you are in a group of three, play two full sets of three rounds, so that everyone gets to play each side at least four times.
2. Determine the resulting boolean expressions from each round.
   - If you placed `1`s, you will find the sum-of-product (minterms) equation.
   - If you placed `0`s, you will find the product-of-sum (maxterms) equation.
   - If you are in a group of three, and placed `X`s or did not play, you do not have to write the equation for this game (though you can for good practice).
     - However, everyone should write equations at some point since you should be rotating positions.
3. Check your results with your team member.
   - This is important because if one of you is incorrect, you will all lose points regardless of whose expressions are incorrect.

4. Reflect on whether this game helped you to better understand K-Maps and boolean equations.

Deliverables

- Include as part of your **informal report**:
  - A scan or picture of your completed K-Map game (all rounds)
  - All of your group's boolean expressions
  - Reflection from Step 4

Grading

- You will get full credit if:
  - All of your SoP and PoS expressions are correct.
    - You should have at least ten total expressions (2 from each game, possibly more if you are in a group of 3).
  - You reflected on the content in the lab.
- Note that whether you win or not is just for fun (and bragging rights).
  - You will not get more or less points because you won or lost.

Outcomes

- Understand how to derive boolean equations from a truth table using Karnaugh Maps.