**CSC 244 Fall 2022 Homework 3**

**Karnaugh Maps**

**Due: Wednesday, Sept. 14 before 9 am to D2L**

1. Calculate the minimal sum-of-products (SOP) and product-of-sums (POS) using Karnaugh Maps for the truth tables

|  |  |
| --- | --- |
| a) | b) |
| |  |  |  | | --- | --- | --- | | A | B | Y | | 0 | 0 | 0 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 1 | | |  |  |  |  | | --- | --- | --- | --- | | A | B | C | Y | | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | | 0 | 1 | 0 | 0 | | 0 | 1 | 1 | 0 | | 1 | 0 | 0 | 0 | | 1 | 0 | 1 | 0 | | 1 | 1 | 0 | 1 | | 1 | 1 | 1 | 1 | |

1. What is the **cost** of the two circuits? State which is cheaper, SOP or POS.
2. Find minimal Boolean equations for the truth table below using both SOP and POS forms using K-maps.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | D | Y |
| 0 | 0 | 0 | 0 | X |
| 0 | 0 | 0 | 1 | X |
| 0 | 0 | 1 | 0 | X |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | X |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | X |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | X |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | X |
| 1 | 1 | 1 | 1 | 1 |

* 1. Determine which circuit is cheaper
  2. Draw the circuit for the **cheapest implementation** using only NAND gates (if sum-of-products form) or NOR gates (if product-of-sums form). You may also use inverters if needed.

1. Calculate the minimal SOP and POS for the following function using K-maps:
   1. Write two sentences on your solution to SOP; is it unique?

F(A,B,C,D) = (0,1,2,4,8,15)