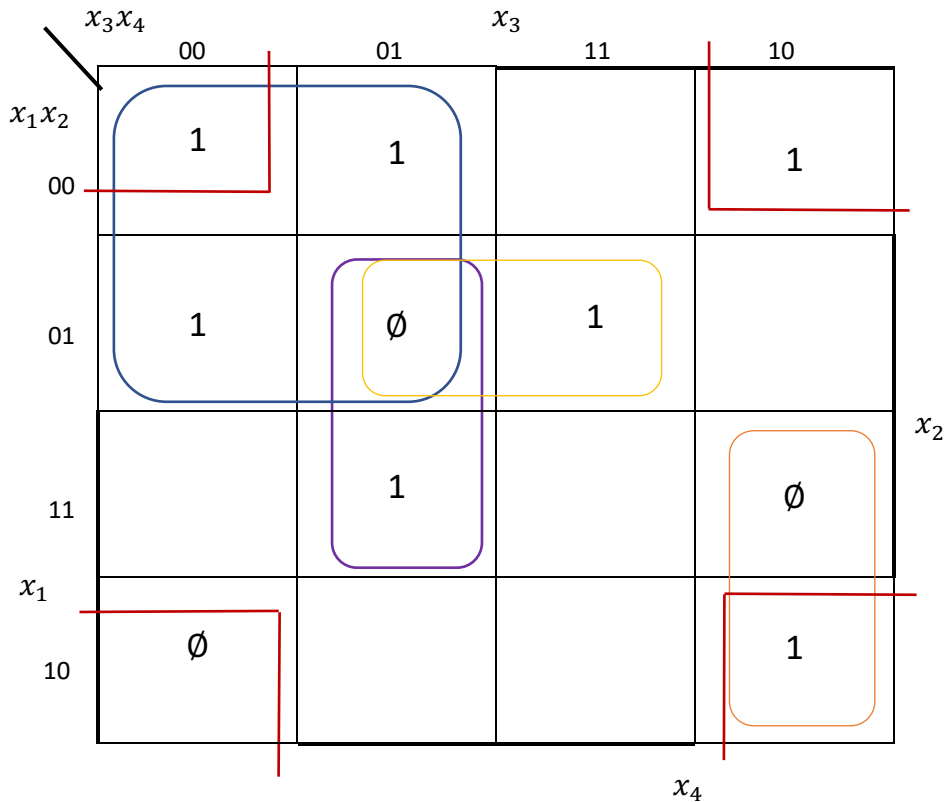


$$y = F(x_1, x_2, x_3, x_4) = \cup_1 (0,1,2,4,7,10,13) + \cup_{\emptyset} (5,8,14)$$

1. Use a Karnaugh map to find the set of all prime implicants.



Prime Implicants: $x_4' x_2'$, $x_1' x_3'$, $x_1' x_2 x_4$, $x_2 x_3' x_4$, $x_1' x_3 x_4'$

2. Simplify the prime implicant chart to find the least cost expression of F. Show the steps of your work. (Note: The cost criteria are 2 units per variable and 1 unit per complement.)


Table of the prime implicants:

	$x_4' x_2'$	$x_1' x_3'$	$x_1' x_2 x_4$	$x_2 x_3' x_4$	$x_1' x_3 x_4'$
Symbols:	A	B	C	D	E
Costs:	6	6	7	7	8
Points covered:	0,2,10	0,1,4	7	13	10

PRIME IMPLICANT CHART:

	0	1	2	4	7	10	13	Cost
A	X		X			X		6
B	X	X		X				6
C					X			7
D							X	7
E						X		8

In this chart 1, 2, 4, 7, 13 are the distinguished points. So A, B, C, D are essential prime implicants. These products added to final set.



	0	1	2	4	7	10	13	Cost
A	X		X			X		6
B	X	X		X				6
C					X			7
D							X	7
E						X		8

Since A, B, C, D are essential prime implicants, their rows and columns that they cover are removed from the chart. There is no need to continue since all covered points are selected.

3. Write down the expression and its cost.

1-) Selected prime implicants: A , B , C , D

2-) Total cost = 6+6+7+7 = 26

3-) $F(x_1, x_2, x_3, x_4) = x_4' x_2' + x_1' x_3' + x_1' x_2 x_4 + x_2 x_3' x_4$

4. Find the set of all prime implicants using the Quine-McCluskey method. Verify that your answer in Question 1 is correct.

Num.	$x_1 x_2 x_3 x_4$	
0	0 0 0 0	✓
1	0 0 0 1	✓
2	0 0 1 0	✓
4	0 1 0 0	✓
8	1 0 0 0	✓
5	0 1 0 1	✓
10	1 0 1 0	✓
7	0 1 1 1	✓
13	1 1 0 1	✓
14	1 1 1 0	✓

Num.	$x_1 x_2 x_3 x_4$	
0,1	0 0 0 -	
0,2	0 0 - 0	
0,4	0 - 0 0	
0,8	- 0 0 0	
2,10	- 0 1 0	
1,5	0 - 0 1	
4,5	0 1 0 -	
8,10	1 0 - 0	
5,7	0 1 - 1	
5,13	- 1 0 1	
10,14	1 - 1 0	

Num.	$x_1 x_2 x_3 x_4$	
0,1	0 0 0 -	✓
0,2	0 0 - 0	✓
0,4	0 - 0 0	✓
0,8	- 0 0 0	✓
2,10	- 0 1 0	✓
1,5	0 - 0 1	✓
4,5	0 1 0 -	✓
8,10	1 0 - 0	✓
5,7	0 1 - 1	
5,13	- 1 0 1	
10,14	1 - 1 0	

Num.	$x_1 x_2 x_3 x_4$	
0,1,4,5	0 - 0 -	
0,2,8,10	- 0 - 0	
0,4,1,5	0 - 0 -	
0,8,2,10	- 0 - 0	

These 2 one are same!

Prime Implicants: $x_4' x_2'$, $x_1' x_3'$, $x_1' x_2 x_4$, $x_2 x_3' x_4$, $x_1' x_3 x_4'$

So My answer at Question 1 is correct!!

5. Answer the following questions in 1 or 2 brief sentences.

A. In your own words, explain why drawing rectangles of 4 units is better than drawing rectangles of 2 units on a Karnaugh map.

B. Explain why we take the "don't care" values as 1 when finding the prime implicants and 0 when simplifying the prime implicant chart.

C. Give an example of a Karnaugh map where the don't care value(s) is/are not of any use. Explain. (Note: DON'T solve, just draw the map.)

A-) If we choose rectangles of 2 units, it causes more prime implicants with more variables. Because of that, it is more expansive. If we choose 4-unit rectangles, there is less prime implicants with less variables. It is cheaper.

B-) Since drawing rectangles with 4 units is cheaper solution, we take the "don't care" values as 1 and since they are "don't care" values, we take it 0 when simplifying.

C-)

		x_3x_4			
		00	01	11	10
x_1x_2	00	1		1	
	01		\emptyset		1
	11	\emptyset	\emptyset		
	10			1	1

Since "don't care" values cannot be grouped with result 1 points they are not of any use!