***TEVFIK OZGU (150180082***

𝑦 = F (, , ,) = ∪1 (0,1,2,4,7,10,13) + ∪∅ (5,8,14)

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

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 1 |  | 1 |
| 1 | ∅ | 1 |  |
|  | 1 |  | ∅ |
| ∅ |  |  | 1 |

00 01 11 10

00

01

11

10

***Prime Implicants:*** ’’, ’’, ’, , ’’

1. **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:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ’’ | ’’ | ’ |  | ’’ |
| 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.

1. **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 (, , ,) = ’’ + ’’ + ’ +

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

Num. Num.

1. 0 0 0 0 √ 0,1 0 0 0 -

0,2 0 0 - 0

1. 0 0 0 1 √ 0,4 0 - 0 0
2. 0 0 1 0 √ 0,8 - 0 0 0

4 0 1 0 0 √

8 1 0 0 0 √ 2,10 - 0 1 0

1,5 0 - 0 1

5 0 1 0 1 √ 4,5 0 1 0 -

10 1 0 1 0 √ 8,10 1 0 - 0

7 0 1 1 1 √ 5,7 0 1 - 1

13 1 1 0 1 √ 5,13 - 1 0 1

14 1 1 1 0 √ 10,14 1 - 1 0

Num. Num.

0,1 0 0 0 - √ 0,1,4,5 0 - 0 -

0,2 0 0 - 0 √ 0,2,8,10 - 0 - 0

0,4 0 - 0 0 √ 0,4,1,5 0 - 0 - These 2 one

0,8 - 0 0 0 √ 0,8,2,10 - 0 - 0 are same!

2,10 - 0 1 0 √ Prime Implicants: ’’, ’’, ’

1,5 0 - 0 1 √ , ’’

4,5 0 1 0 - √

8,10 1 0 - 0 √ So My answer at Question 1 is correct!!

5,7 0 1 - 1

5,13 - 1 0 1

10,14 1 - 1 0

**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.

|  |  |  |  |
| --- | --- | --- | --- |
| 1 |  | 1 |  |
|  | ∅ |  | 1 |
| ∅ | ∅ |  |  |
|  |  | 1 | 1 |

C-)

00 01 11 10

00

01

11

10

***Since “don’t care” values cannot be grouped with result 1 points they are not of any use!***