**Task #1**: Simplify the following function using K-Map in

Sum of Product. (SOP)

Product of sum. (POS)

𝐹 (𝐴, 𝐵, 𝐶, 𝐷) = ∑(0, 1, 2, 5, 8, 9 ,10)

Verify Boolean function ‘F’ before and after K-Map simplification using truth table and design circuit on hardware / software.

**Solution (Sum of Product)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **D** | **SOP** |
| **0** | 0 | 0 | 0 | 0 | 1 |
| **1** | 0 | 0 | 0 | 1 | 1 |
| **2** | 0 | 0 | 1 | 0 | 1 |
| **3** | 0 | 0 | 1 | 1 | 0 |
| **4** | 0 | 1 | 0 | 0 | 0 |
| **5** | 0 | 1 | 0 | 1 | 1 |
| **6** | 0 | 1 | 1 | 0 | 0 |
| **7** | 0 | 1 | 1 | 1 | 0 |
| **8** | 1 | 0 | 0 | 0 | 1 |
| **9** | 1 | 0 | 0 | 1 | 1 |
| **10** | 1 | 0 | 1 | 0 | 1 |

**EQUATION:**

F = A’B’C’D’+A'B'C'D+A'B'CD'+A’BC'D+AB'C'D'+AB'C'D+AB'CD'



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **C’. D’** | **C’. D** | **C. D** | **C. D’** |
| **A’.B’** | 1 | 1 | 0 | 1 |
| **A’.B** | 0 | 1 | 0 | 0 |
| **A.B** | 0 | 0 | 0 | 0 |
| **A.B’** | 1 | 1 | 0 | 1 |

**SIMPLIFIED EQUATION:**

F = A'C'D+B'C'+B'D'

****



**(Product f Sum)**

F = C.D + B.D + A.B

|  |  |  |
| --- | --- | --- |
| F | = | C.D + B.D + A.B |

F = (C' + D') (B' + D) (A' + B')

****

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Truth Table** | | | | | |
|  | **A** | **B** | **C** | **D** | **F** |
| 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 2 | 0 | 0 | 1 | 0 | 1 |
| 3 | 0 | 0 | 1 | 1 | 0 |
| 4 | 0 | 1 | 0 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 | 1 |
| 6 | 0 | 1 | 1 | 0 | 0 |
| 7 | 0 | 1 | 1 | 1 | 0 |
| 8 | 1 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 | 1 |
| 10 | 1 | 0 | 1 | 0 | 1 |
| 11 | 1 | 0 | 1 | 1 | 0 |
| 12 | 1 | 1 | 0 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 | 0 |
| 14 | 1 | 1 | 1 | 0 | 0 |
| 15 | 1 | 1 | 1 | 1 | 0 |

**Task #2**: Simplify the Boolean Function using K-Map

𝐹 (𝐴, 𝐵, 𝐶, 𝐷) = ∑(1, 3, 7, 11, 15)

Which has the don’t care conditions

𝐷 (𝐴, 𝐵, 𝐶, 𝐷) = ∑(0, 2, 5)

Verify Boolean function ‘F’ before and after K-Map simplification using truth table and

design circuit on hardware / software.

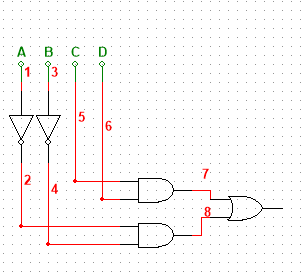
**Solution**

**K MAP**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **C’. D’** | **C’. D** | **C. D** | **C. D’** |
| **A’.B’** | X | 1 | 1 | X |
| **A’.B** | 0 | X | 1 | 0 |
| **A.B** | 0 | 0 | 1 | 0 |
| **A.B’** | 0 | 0 | 1 | 0 |

* **Sum of Product**

F = CD + A'B'



* **Product of Sum**

F = D + A.C

|  |  |  |
| --- | --- | --- |
| F | = | D + A.C |

F = (D) (A' + C)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Truth Table** | | | | | |
|  | **A** | **B** | **C** | **D** | **F** |
| 0 | 0 | 0 | 0 | 0 | x |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 2 | 0 | 0 | 1 | 0 | x |
| 3 | 0 | 0 | 1 | 1 | 1 |
| 4 | 0 | 1 | 0 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 | x |
| 6 | 0 | 1 | 1 | 0 | 0 |
| 7 | 0 | 1 | 1 | 1 | 1 |
| 8 | 1 | 0 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 | 0 |
| 10 | 1 | 0 | 1 | 0 | 0 |
| 11 | 1 | 0 | 1 | 1 | 1 |
| 12 | 1 | 1 | 0 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 | 0 |
| 14 | 1 | 1 | 1 | 0 | 0 |
| 15 | 1 | 1 | 1 | 1 | 1 |

**Task #3**: Simplify the Boolean Function using K-Map

𝐹 = 𝐸8 (Hex)

Verify Boolean function ‘F’ before and after K-Map simplification using truth table and design circuit on hardware / software.

**Solution**

**K MAP**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **B’. C’** | **B’. C** | **B. C** | **B. C’** |
| **A’** | 1 | 1 | 0 | 1 |
| **A** | 1 | 0 | 0 | 0 |

* **Sum of Product**

F = **B’C’+A’B’+A’C’**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **F** |
| 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 |
| 2 | 0 | 1 | 0 | 1 |
| 3 | 0 | 1 | 1 | 0 |
| 4 | 1 | 0 | 0 | 1 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 1 | 1 | 0 | 0 |
| 7 | 1 | 1 | 1 | 0 |