Name: Id#

COE 202, Term 201

Digital Logic Design

Quiz# 4 Solution

Date: Thursday, Oct. 22, 2020

**Question 1: (14 points)**

1. (**2 points**) Given the function *f* (*a*, *b*, *c*, *d*) = ∑*m*(1, 5, 8, 12, 15) + ∑*d*(4, 10, 13), draw the K-map of *f*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *f* | | *c d* | | | |
| 0 0 | 0 1 | 1 1 | 1 0 |
| *a b* | 0 0 |  | **1** |  |  |
| 0 1 | **X** | **1** |  |  |
| 1 1 | **1** | **X** | **1** |  |
| 1 0 | **1** |  |  | **X** |

1. (**2 points**) Given the function *f* (*a*, *b*, *c*, *d*) = (a’ + b)(a + c’ +d)(b + d), draw the K-map of *f*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *f* | | *c d* | | | |
| 0 0 | 0 1 | 1 1 | 1 0 |
| *a b* | 0 0 | **0** | **1** | **1** | **0** |
| 0 1 | **1** | **1** | **1** | **0** |
| 1 1 | **1** | **1** | **1** | **1** |
| 1 0 | **0** | **0** | **0** | **0** |

**c)** **(10 points)** Given the following K-map of the function *g* (*a*, *b*, *c*, *d*), where **X** is a don't-care:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *g* | | *c d* | | | |
| 0 0 | 0 1 | 1 1 | 1 0 |
| *a b* | 0 0 | **1** |  |  | **1** |
| 0 1 | **X** | **X** | **X** | **X** |
| 1 1 | **1** | **1** |  |  |
| 1 0 | **X** | **1** |  | **X** |

1. **(5 points)** Write the terms of **all Prime Implicants** of *g.*
2. **(1 points)** Write the terms of **all Essential Prime Implicants** of *g.*
3. **(2 points)** Find **ALL** minimum **Sum-of-Products** expressions of *g*.
4. **(2 points)** Find **ALL** minimum **Product-of-Sums** expressions of *g*.

**Solution i:**

**Five Prime Implicants: *ac’*, *bc’*, *c’d’*, *a’d’*, *b’d’***

**Solution ii:**

**One essential prime Implicant: *ac’***

**Solution iii: Two Solutions**

***g = ac’ + b’d’***

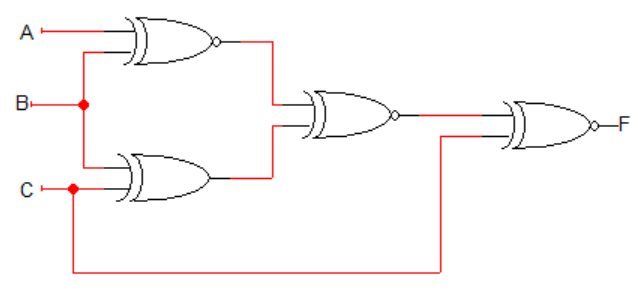
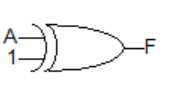
***g = ac’ + a’d’***

**Solution iv: Only one solution**

***g =* (*a’ + c’*) (*a + d’*)**

**Question 2: (4 points)**

Reimplement the circuit given below using **ONLY** **minimum number of 2-input XOR gates**:

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**F = [[(A ⊕ B)’ ⊕ (B⊕C)]’ ⊕ C]’ = [[(A ⊕ B) ⊕ (B⊕C)] ⊕ C]’ = [[A⊕C] ⊕ C]’ =[A]’**