**Punto I**

Diseñar un circuito combinacional binario a siete segmentos.

**Tabla de verdad**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ENTRADAS** | | | | **SALIDAS** | | | | | | |
| **NÚMERO** | **A** | **B** | **C** | **D** | **F0** | **F1** | **F2** | **F3** | **F4** | **F5** | **F6** |
| **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** |
| **1** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **1** | **1** | **1** |
| **2** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **0** | **0** | **1** | **0** |
| **3** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **1** | **1** | **0** |
| **4** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **1** | **1** | **0** | **0** |
| **5** | **0** | **1** | **0** | **1** | **0** | **1** | **0** | **0** | **1** | **0** | **0** |
| **6** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** |
| **7** | **0** | **1** | **1** | **1** | **0** | **0** | **0** | **1** | **1** | **1** | **1** |
| **8** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **9** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** |
| **A** | **1** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** |
| **b** | **1** | **0** | **1** | **1** | **1** | **1** | **0** | **0** | **0** | **0** | **0** |
| **C** | **1** | **1** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **1** |
| **d** | **1** | **1** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **1** | **0** |
| **E** | **1** | **1** | **1** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** |
| **F** | **1** | **1** | **1** | **1** | **0** | **1** | **1** | **1** | **0** | **0** | **0** |

Para encontrar las respectivas ecuaciones de cada salida utilizamos el Método Quine-McCluskey.

**Salida F0**

**Paso 1**

Vamos a organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino, una vez realizado el proceso, nos damos cuenta que no podemos seguir con los siguientes pasos ya que con los grupos no se pueden agrupar y por lo tanto la función sale directamente y queda:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1** | **0** | **0** | **0** | **1** |
|  | **M4** | **0** | **1** | **0** | **0** |
|  |  |  |  |  |  |
| **2** | **Mb** | **1** | **0** | **1** | **1** |
|  | **Md** | **1** | **1** | **0** | **1** |







**(1)**

Por el teorema de De Morgan se tiene que:

**(0)**

Por lo tanto, la ecuación (1) puede ser representada de la siguiente manera:

**(2)**

**Salida F1**

**Paso 1**

Organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino.

Tabla 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M5** | **0** | **1** | **0** | **1** |
|  | **M6** | **0** | **1** | **1** | **0** |
|  | **MC** | **1** | **1** | **0** | **0** |
|  |  |  |  |  |  |
| **2** | **Mb** | **1** | **0** | **1** | **1** |
|  | **ME** | **1** | **1** | **1** | **0** |
|  |  |  |  |  |  |
| **3** | **MF** | **1** | **1** | **1** | **1** |

Donde M5 es un implicante primo ya que no se repite.

**Paso 2**

Buscar diferencias de solo un bit entre los grupos

Tabla 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M6-ME** | **-** | **0** | **0** | **1** |
|  | **MC-ME** | **1** | **1** | **-** | **0** |
|  |  |  |  |  |  |
| **2** | **Mb-MF** | **1** | **-** | **1** | **1** |
|  | **ME-MF** | **1** | **1** | **1** | **-** |

**Salida F2**

**Paso 1**

Organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino.

Tabla 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M2** | **0** | **0** | **1** | **0** |
|  |  |  |  |  |  |
| **2** | **MC** | **1** | **1** | **0** | **0** |
|  |  |  |  |  |  |
| **3** | **ME** | **1** | **1** | **1** | **0** |
|  |  |  |  |  |  |
| **4** | **MF** | **1** | **1** | **1** | **1** |

Donde M2 es un implicante primo ya que no se repite.

**Paso 2**

Buscar diferencias de solo un bit entre los grupos

Tabla 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **2** | **MC-ME** | **1** | **1** | **-** | **0** |
|  |  |  |  |  |  |
| **3** | **ME-MF** | **1** | **1** | **1** | **-** |

**Salida F3**

**Paso 1**

Organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino.

Tabla 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1** | **0** | **0** | **0** | **1** |
|  | **M4** | **0** | **1** | **0** | **0** |
|  |  |  |  |  |  |
| **2** | **MA** | **1** | **0** | **1** | **0** |
|  |  |  |  |  |  |
| **3** | **M7** | **0** | **1** | **1** | **1** |
|  |  |  |  |  |  |
| **4** | **MF** | **1** | **1** | **1** | **1** |

Dónde M1, M4, MA son implicantes primos ya que no se repiten.

**Paso 2**

Buscar diferencias de solo un bit entre los grupos

Tabla 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **3** | **M7-MF** | - | **1** | **1** | **1** |

**Salida F4**

**Paso 1**

Organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino.

Tabla 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1** | **0** | **0** | **0** | **1** |
|  | **M4** | **0** | **1** | **0** | **0** |
|  |  |  |  |  |  |
| **2** | **M3** | **0** | **0** | **1** | **1** |
|  | **M5** | **0** | **1** | **0** | **1** |
|  | **M9** | **1** | **0** | **0** | **1** |
|  |  |  |  |  |  |
| **3** | **M7** | **0** | **1** | **1** | **1** |

**Paso 2**

Buscar diferencias de solo un bit entre los grupos

Tabla 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1-M3** | **0** | **0** | **-** | **1** |
|  | **M1-M5** | **0** | **-** | **0** | **1** |
|  | **M1-M9** | **-** | **0** | **0** | **1** |
|  | **M4-M5** | **-** | **0** | **0** | **1** |
|  |  |  |  |  |  |
| **2** | **M3-M7** | **0** | **-** | **1** | **1** |
|  | **M5-M7** | **0** | **1** | **-** | **1** |

**Paso 3**

Se buscan diferencias de 2 bits entre los grupos.

Tabla 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1-M3-M5-M7** | **0** | **-** | **-** | **1** |
|  |  | 0 | **-** | **-** | **1** |

**Salida F5**

**Paso 1**

Organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino.

Tabla 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1** | **0** | **0** | **0** | **1** |
|  | **M2** | **0** | **0** | **1** | **0** |
|  |  |  |  |  |  |
| **2** | **M3** | **0** | **0** | **1** | **1** |
|  |  |  |  |  |  |
| **3** | **M7** | **0** | **1** | **1** | **1** |
|  | **Md** | **1** | **1** | **0** | **1** |

**Paso 2**

Buscar diferencias de solo un bit entre los grupos

Tabla 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M1-M3** | **0** | **0** | **-** | **1** |
|  | **M2-M3** | **0** | **0** | **1** | **-** |
|  |  |  |  |  |  |
| **2** | **M3-M7** | **0** | **-** | **1** | **1** |

**Salida F6**

**Paso 1**

Organizar todos los minterminos de acuerdo al número de unos que tiene cada mintermino.

Tabla 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **MINTERMINOS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **0** | **M0** | **0** | **0** | **0** | **0** |
|  |  |  |  |  |  |
| **1** | **M1** | **0** | **0** | **0** | **1** |
|  |  |  |  |  |  |
| **2** | **MC** | **1** | **1** | **0** | **0** |
|  |  |  |  |  |  |
| **3** | **M7** | **0** | **1** | **1** | **1** |

**Paso 2**

Buscar diferencias de solo un bit entre los grupos

Tabla 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GRUPO** | **PARES DE PAREJAS** | **REPRESENTACIÓN BINARIA** | | | |
| **A** | **B** | **C** | **D** |
| **1** | **M0-M1** | **0** | **0** | **0** | **-** |