**ALU\_04**

**Diseñar una unidad aritmético-lógica de 4 bits que, en función de las señales de control S2, S1, S0 realice las operaciones aritméticas y lógicas mostradas en la tabla.**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **S2 = 0** | **S2 = 1** |
| **S1** | **S0** | **OPERACIONES LÓGICAS** | **OPERACIONES ARITMÉTICAS** |
| **0** | **0** | A’ XOR B | A - 4 |
| **0** | **1** | (B’ \* A) ’ | -A – B - 12 |
| **1** | **0** | (A+B’) XOR (A’ \* B) | -A - 7 |
| **1** | **1** | (A·B) ’ \* (A+B)’ | -B - A – 5 |

**Diseño de la unidad lógica**

|  |  |  |
| --- | --- | --- |
| **S1** | **S0** | **Operación Lógica** |
| 0 | 0 | Negación de A más(XOR) B |
| 0 | 1 | (Multiplicación lógica del complemento de B y A) NEGADO |
| 1 | 0 | (Suma lógica de A y el complemento de B) (AND)  Mas(XOR)  (Multiplicación lógica del complemento de A y B ) |
| 1 | 1 | (Multiplicación lógica de A y B (AND)) NEGADO  Por  (Suma lógica de A y B)  NEGADO |

Tabla de verdad

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S1** | **S0** | **Ai** | **Bi** | **SULi** |  |
| **0** | **0** | **0** | **0** | **1** | **I0 = B’** |
| **0** | **0** | **0** | **1** | **0** |
| **0** | **0** | **1** | **0** | **0** | **I1 = B** |
| **0** | **0** | **1** | **1** | **1** |
| **0** | **1** | **0** | **0** | **1** | **I2 = 1** |
| **0** | **1** | **0** | **1** | **1** |
| **0** | **1** | **1** | **0** | **0** | **I3 = B** |
| **0** | **1** | **1** | **1** | **1** |
| **1** | **0** | **0** | **0** | **1** | **I4 = 1** |
| **1** | **0** | **0** | **1** | **1** |
| **1** | **0** | **1** | **0** | **1** | **I5 = B’** |
| **1** | **0** | **1** | **1** | **1** |
| **1** | **1** | **0** | **0** | **1** | **I6 = B’** |
| **1** | **1** | **0** | **1** | **0** |
| **1** | **1** | **1** | **0** | **0** | **I7 = 0** |
| **1** | **1** | **1** | **1** | **0** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S1** | **S0** | **Ai** | **SULi** | **Entradas mux** |
| **0** | **0** | **0** | **B’** | **I0** |
| **0** | **0** | **1** | **B** | **I1** |
| **0** | **1** | **0** | **1** | **I2** |
| **0** | **1** | **1** | **B** | **I3** |
| **1** | **0** | **0** | **1** | **I4** |
| **1** | **0** | **1** | **B’** | **I5** |
| **1** | **1** | **0** | **B’** | **I6** |
| **1** | **1** | **1** | **0** | **I7** |
|  |  |  |  |  |

**Diseño de la unidad aritmética**

|  |  |  |
| --- | --- | --- |
| **S1** | **S0** | **OPERACIONES ARITMÉTICAS** |
| **0** | **0** | A - 4 |
| **0** | **1** | -A – B - 12 |
| **1** | **0** | -A - 7 |
| **1** | **1** | -B - A – 5 |

Sumando A + Sumando B + Sumando C + carry

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A - 4 | **A+4’+1** |  |  | **A+3’+1’+1** |
| -A – B - 12 | **A’+1+B’+1-12** | **A’+B’-10** |  | **A’+B’+10’+1** |
| -A - 7 | **A’+1-7** | **A’+1+7’+1** |  | **A’+1+7’+1** |
| -B - A – 5 | **B’+1+A’+1-5** | **B’+A’-3** |  | **B’+A’+3’+1** |

Sumando x + sumando y + sumando z + cin

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **S1** | **S0** | **OPERACIONES ARITMÉTICAS** | **EQUIVALENTE** | **X** | **Y** | **Z** | **Cin** |
| 0 | 0 | A - 4 | **A+3’+1’+1** | A | 3’ | 1’ | 1 |
| 0 | 1 | -A – B - 12 | **A’+B’+10’+1** | A’ | B’ | 10 | 1 |
| 1 | 0 | -A - 7 | **A’+1+7’+1** | A’ | 1 | 7’ | 1 |
| 1 | 1 | -B - A – 5 | **B’+A’+3’+1** | A’ | B’ | 3’ | 1 |

🡪 F1: Elegirá para Y: B (F2=0) o Numero (F2=1)

🡪 F2: Elegirá para X: Negará el contenido que entrará en X si F3=1, o la dejará sin negar si F2=0

🡪 F3: Elegirá para Y: Negará el contenido que entrará en Y si F4=1, o la dejará sin negar si F3=0

🡪 F4: Elegirá para Z: Negará el contenido que entrará en Z si F5=1, o la dejará sin negar si F4=0

TABLA DE FUNCIONES

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S1** | **S0** | **F1** | **F2** | **F3** | **F4** |
| **0** | **0** | **1** | **0** | **1** | **1** |
| **0** | **1** | **0** | **1** | **1** | **0** |
| **1** | **0** | **1** | **1** | **0** | **1** |
| **1** | **1** | **0** | **1** | **1** | **1** |

F1= S1’S0’+S1S0’=S0’(S1’+S1) = S0’

F2=S1+S0

F3= S1’+S0

F4= S1+ S0’

BLOQUE Z

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S1 | S0 | Numero | B3 | B2 | B1 | B0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 10 | 1 | 0 | 1 | 0 |
| 1 | 0 | 7 | 0 | 1 | 1 | 1 |
| 1 | 1 | 3 | 0 | 0 | 1 | 1 |

B3=S1’S0

B2=S1S0’

B1=S1+S0

B0=B3’

BLOQUE Y

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S1 | S0 | Numero | B3 | B2 | B1 | B0 |
| 0 | 0 | 3 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 |

B3=0

B2=0

B1=S1’S0’

B0= 1