

1. Diseñe un circuito que eleve al cuadrado un número de tres bits, e implemente mediante compuertas lógicas.

| A | B | C | a | b | c | d | e | f |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |

| | |
|--|---------------------------------------|
| | Numero binario |
| | Numero binario elevado al cuadrado |

Para el bit mas significativo (a).

| AB \ C | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | | | 1 | |
| 1 | | | 1 | |

$$a = AB$$

Para b.

| AB \ C | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | | | | 1 |
| 1 | | | 1 | 1 |

$$b = AB' + AC$$

Para c.

| AB \ C | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | | | | |
| 1 | | 1 | | 1 |

$$c = A'BC + AB'C$$

$$c = C(A'B + AB')$$

Para d.

| AB \ C | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | | 1 | 1 | |
| 1 | | | | |

$$d = BC'$$

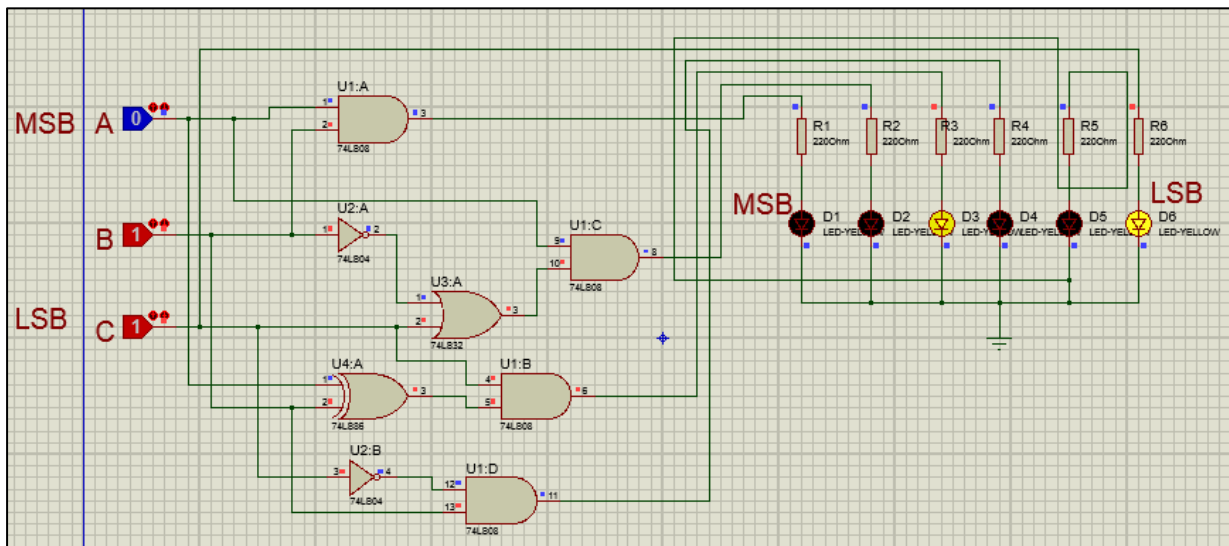
Para e.

$$e = 0$$

Para f el LSB.

| AB \ C | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | | | | |
| 1 | 1 | 1 | 1 | 1 |

$$f = C$$

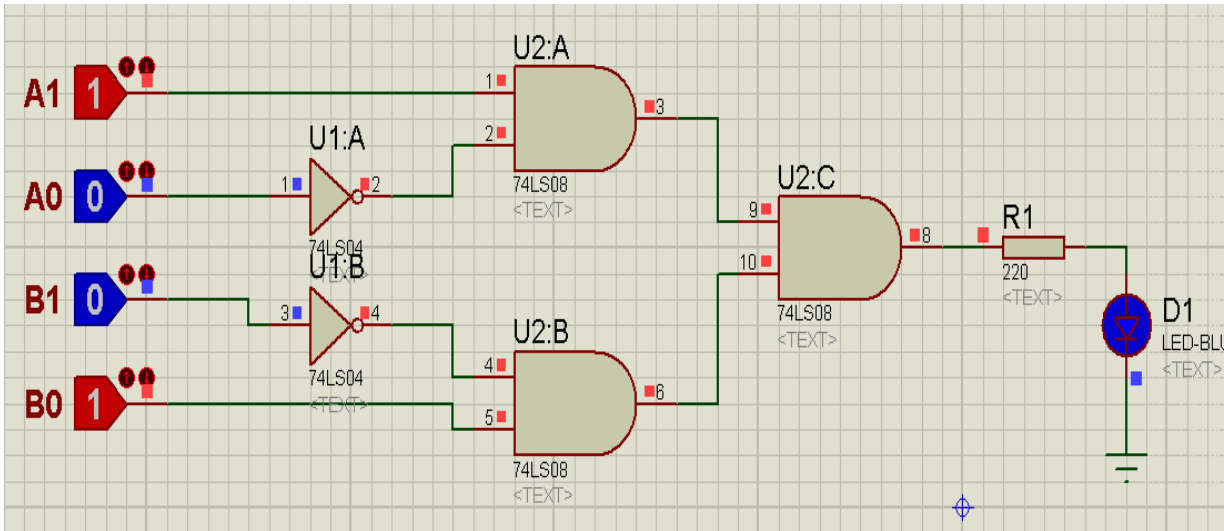


2. Diseñar un circuito combinacional que tenga como entrada dos números de 2 bits $A=A_0A_1$ y $B=B_0B_1$, cada uno y que encienda una salida cada vez A sea el doble de B , e implemente mediante compuertas lógicas.

| A1 | A0 | B1 | B0 | SALIDA |
|----|----|----|----|--------|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 |

| A1A0 \ B1B0 | 00 | 01 | 11 | 10 |
|-------------|----|----|----|----|
| 00 | | | | |
| 01 | | | | 1 |
| 11 | | | | |
| 10 | | | | |

$$f(A_1A_0B_1B_0) = A_1A_0'B_1'B_0$$



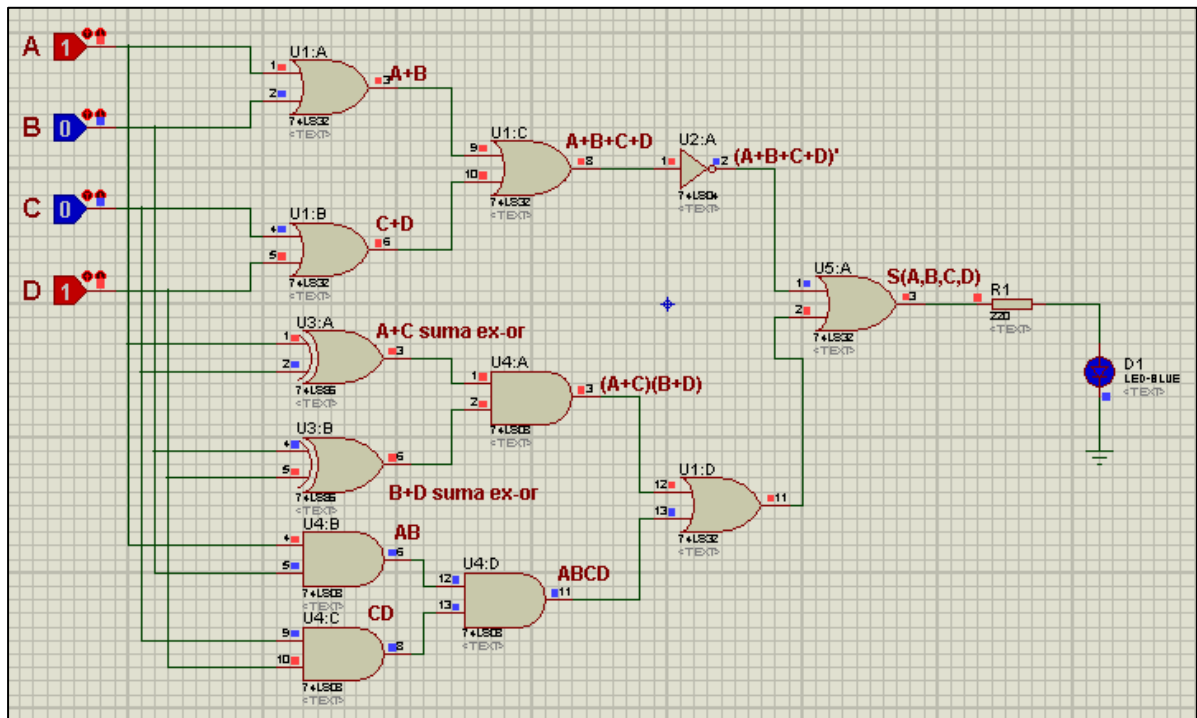
3. Diseñar un circuito combinacional que tiene como entrada un número de 4 bits y que se encienda una salida cada vez que el número sea múltiplo de 3, incluido el cero, e implemente mediante compuertas lógicas.

| A | B | C | D | S(A,B,C,D) |
|---|---|---|---|------------|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |

$$S(A,B,C,D) = A'B'C'D' + A'B'CD + A'BCD' + AB'C'D + ABC'D' + ABCD$$

$$S(A,B,C,D) = (A + B + C + D)' + A'C(B'D + BD') + AC'(B'D + BD') + ABCD$$

$$S(A,B,C,D) = (A + B + C + D)' + (B'D + BD')(A'C + AC') + ABCD$$



4. Un circuito Lógico tiene cinco entradas y una salida. Cuatro de las entradas A,B,C y D representan un dígito decimal en BCD. la quinta entrada es de control, cuando el control esté en 0 lógico, la salida está en 1 lógico si el número decimal es par y en 0 lógico si es impar. Cuando el control está en 1 lógico, la salida es 1 cuando la entrada es un múltiplo de 3 y en 0 lógico cuando no es múltiplo de 3. Diseñar el circuito utilizando puertas lógicas.

El numero 0 cuenta como numero par y como múltiplo de tres.

$$\text{cuando } E = 0 \left\{ \begin{array}{l} 1 \text{ cuando el \#BCD es par} \\ 0 \text{ cuando el \#BCD no es par} \end{array} \right\}$$

$$\text{cuando } E = 1 \left\{ \begin{array}{l} 1 \text{ cuando el \#BCD es multiplo de 3} \\ 0 \text{ cuando el \#BCD no es multiplo de 3} \end{array} \right\}$$

| A | B | C | D | E | S(A,B,C,D,E) |
|---|---|---|---|---|--------------|
| 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | X |
| 1 | 0 | 1 | 0 | 1 | X |
| 1 | 0 | 1 | 1 | 0 | X |
| 1 | 0 | 1 | 1 | 1 | X |
| 1 | 1 | 0 | 0 | 0 | X |
| 1 | 1 | 0 | 0 | 1 | X |
| 1 | 1 | 0 | 1 | 0 | X |
| 1 | 1 | 0 | 1 | 1 | X |
| 1 | 1 | 1 | 0 | 0 | X |
| 1 | 1 | 1 | 0 | 1 | X |
| 1 | 1 | 1 | 1 | 0 | X |
| 1 | 1 | 1 | 1 | 1 | X |

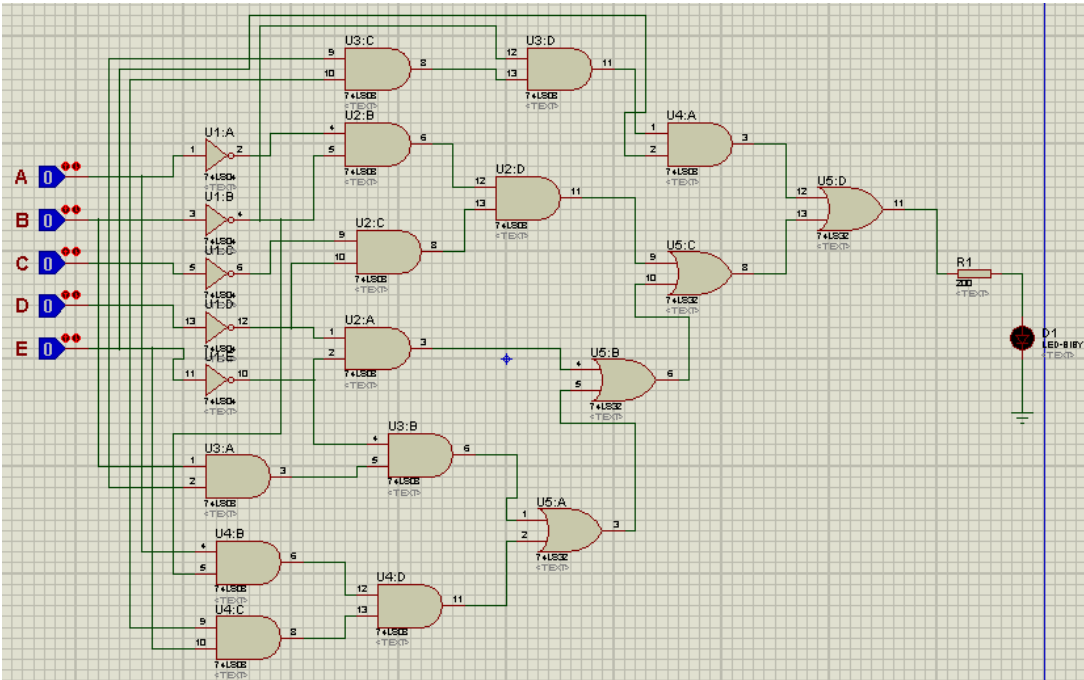
A=0

| BC \ DE | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 1 | 1 | 1 | 1 |
| 01 | 1 | | 1 | |
| 11 | | 1 | | |
| 10 | | | | |

A=1

| BC \ DE | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 1 | x | x | X |
| 01 | | x | x | X |
| 11 | 1 | X | x | x |
| 10 | | x | x | X |

$$S(A,B,C,D,E) = D'E' + A'B'C'D' + BCD' + B'CDE + AB'DE$$



5. Emplear un diagrama de Karnaugh para simplificar las siguientes funciones:

a. $f(A,B,C,D) = AB'C' + A'D + B'D + C'D + A'C + A'B$

| AB \ CD | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 1 | 1 | | 1 |
| 01 | 1 | 1 | 1 | 1 |
| 11 | 1 | 1 | | 1 |
| 10 | 1 | 1 | | |

La nueva función será:
 $f(A,B,C,D) = A' + B'D + C'D + B'C'D'$

b. $f(A,B,C,D) = AB'CD' + B'C'D + A'C + A'$

| AB \ CD | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 1 | 1 | | |
| 01 | 1 | 1 | | 1 |
| 11 | 1 | 1 | | |
| 10 | 1 | 1 | | 1 |

La nueva función será:

$$f(A,B,C,D) = A' + B'C'D + B'CD'$$

c. $f(A,B,C,D) = \Sigma m(0,1,4,5,9,11,14,15)$

| AB \ CD | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 1 | 1 | | |
| 01 | 1 | 1 | | 1 |
| 11 | | | 1 | 1 |
| 10 | | | 1 | |

La función será:

$$f(A,B,C,D) = A'C' + AB'D + ABC$$

d. $f(A,B,C,D) = \Sigma m(1,4,7,10,13)$

| AB \ CD | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | | 1 | | |
| 01 | 1 | | 1 | |
| 11 | | 1 | | |
| 10 | | | | 1 |

La función será:

$$f(A,B,C,D) = A'BC'D' + A'C'B'D + AC'BD + A'CBD + AB'CD'$$

$$f(A,B,C,D) = A'C'(BD' + DB') + BD(AC' + A'C) + ACB'D'$$

$$f(A,B,C,D) = A'C'(B \oplus D) + BD(A \oplus C) + ACB'D'$$

- e. $F(A,B,C,D,E,F) = \Sigma m(0,1,4,5,11,16,17,20,21,24,28,32,33,35,36,37,39,42,49,51,58,60,62)$
 Además de los términos no importa, d (2,3,6,7,10,18,30,26,48,52,55,61,63)

| ABC \ DEF | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|
| 000 | 1 | | 1 | 1 | x | | | 1 |
| 001 | 1 | | | 1 | 1 | | | 1 |
| 011 | x | 1 | | | 1 | | | 1 |
| 010 | x | x | x | x | | 1 | 1 | |
| 110 | x | | x | | | 1 | | |
| 111 | x | | | | x | x | | 1 |
| 101 | 1 | | | 1 | | x | | 1 |
| 100 | 1 | | 1 | 1 | x | 1 | | 1 |

$$F(A,B,C,D,E,F):$$

$$= A'B'C' + A'BCF' + E'F'C' + B'C'F + ABCD + CD'EF' + ABC'D'F + A'BC'E' + A'B'D'E$$