1)

Sentsoreak: motorea martxan edo geldi dagoen detektatzen da (A), Segurtasun uhala lotuta dagoen a al ez detektatzen dueña (B).

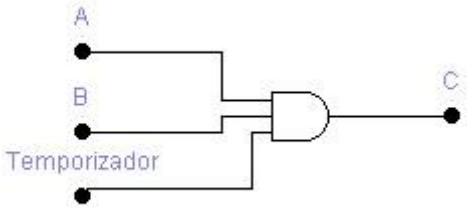
Alarma katibatzeko (C)

A = 1 Motorea martxan

B= 1 ez-lotuta

C = 1 Alarma aktibatu behar da

Tenporizadorea= 30 segundu

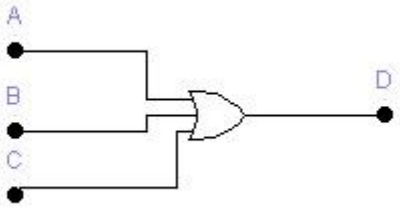



2) Sentosreak: Lehia edo atea zabalik dauden (A, B, C)

Eragingailua: Alarma (D)

A=B=C=1 atea edo lehioa zabalik

D=1 arrotza detektatu da



3)

(3) a) $f_1(ABCD) = \bar{A}\bar{C} + A\bar{C}D + \bar{A}BCD$

$f_1 = \bar{A}\bar{C}D + \bar{A}\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D} + \bar{A}BCD$

$f_1 = \bar{A}B\bar{C}D + \bar{A}\bar{B}\bar{C}D + \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D} + AB\bar{C}D + A\bar{B}\bar{C}D + \bar{A}BCD$

0101 0001 0100 0000 1101 1001 0111

$f_1 = \bar{5} + 1 + 4 + 0 \mid + 13 + 9 + 7$

$f = \Sigma(0,4,5,7,1,13,9) = \Sigma(0,1,4,5,7,9,13)$

b) $f_2 = \bar{A}\bar{C}\bar{D} + AC + ABC$

$f = \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D} + ABC + AB\bar{C} + ABCD + ABC\bar{D}$

$f = \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D} + ABCD + ABC\bar{D} + A\bar{B}CD + A\bar{B}C\bar{D} + ABCD + ABC\bar{D}$

0100 0000 1111 1110 1011 1010 1111 1110

4 0 15 14 11 10 15 14

$f = \Sigma(0,4,10,11,14,15)$

c) $f_3 = \bar{A}B + AC$

$f = \bar{A}BC + \bar{A}B\bar{C} + ABC + A\bar{B}C$

011 010 111 101

$f = \Sigma(2,3,5,7)$

$(A+B+\bar{D}) = (A+B+C+\bar{D})(A+B+\bar{C}+\bar{D})$ (0 0 0 1 / 0 0 1 1)

$(A+\bar{B}+\bar{D}) = (A+\bar{B}+C+\bar{D})(A+\bar{B}+\bar{C}+\bar{D})$ (0 1 0 1 / 0 1 1 1)

1, 3, 5, 7

d) $f_4 = (\bar{B}+\bar{D})(\bar{B}+A)(C+\bar{D})(\bar{D}+A) = \Pi(1,3,4,5,6,7,9,13,15)$

$(\bar{B}+\bar{D}) = (\bar{A}+\bar{B}+\bar{D})(A+\bar{B}+\bar{D})$

$\to (\bar{A}+\bar{B}+\bar{D}) = (\bar{A}+\bar{B}+\bar{C}+\bar{D})(\bar{A}+\bar{B}+C+\bar{D})$ (1 1 0 1 / 1 1 1 1)

$\to (A+\bar{B}+\bar{D}) = (A+\bar{B}+\bar{C}+\bar{D})(A+\bar{B}+C+\bar{D})$ (0 1 1 1 / 0 1 0 1)

$\Rightarrow 15, 13, 7, 5$

$(A+\bar{B}) = (A+\bar{B}+\bar{C})(A+\bar{B}+C)$

$A+\bar{B}+\bar{C} = (A+\bar{B}+\bar{C}+\bar{D})(A+\bar{B}+\bar{C}+D)$ (0 1 1 1 / 0 1 1 0)

$A+\bar{B}+C = (A+\bar{B}+C+\bar{D})(A+\bar{B}+C+D)$ (0 1 0 1 / 0 1 0 0)

$\Rightarrow 7, 6, 5, 4$

$(C+\bar{D}) = (A+C+\bar{D})(\bar{A}+C+\bar{D})$

$A+C+\bar{D} = (A+B+C+\bar{D})(A+\bar{B}+C+\bar{D})$ (0 0 0 1 / 0 1 0 1)

$\bar{A}+C+\bar{D} = (\bar{A}+B+C+\bar{D})(\bar{A}+\bar{B}+C+\bar{D})$ (1 0 0 1 / 1 1 0 1)

$\Rightarrow 1, 5, 9, 13$

$\bar{x}_1 x_2 = \bar{x}_1 x_2 x_3 + \bar{x}_1 x_2 \bar{x}_3$

$\bar{x}_1 x_2 x_3 = \bar{x}_1 x_2 x_3 x_4 + \bar{x}_1 x_2 x_3 \bar{x}_4$

→ $\bar{x}_1 x_2 x_3 x_4 \bar{x}_5 + \bar{x}_1 x_2 x_3 x_4 x_5$ (0 1 1 1 0 / 0 1 1 1 1) — m

→ $\bar{x}_1 x_2 x_3 \bar{x}_4 \bar{x}_5 + \bar{x}_1 x_2 x_3 \bar{x}_4 x_5$ (0 1 1 0 0 / 0 1 1 0 1) — M

14, 15, 12, 13

$\bar{x}_1 x_2 \bar{x}_3 = \bar{x}_1 x_2 \bar{x}_3 x_4 + \bar{x}_1 x_2 \bar{x}_3 \bar{x}_4$

→ $\bar{x}_1 x_2 \bar{x}_3 x_4 \bar{x}_5 + \bar{x}_1 x_2 \bar{x}_3 x_4 x_5$ (0 1 0 1 0 / 0 1 0 1 1)

→ $\bar{x}_1 x_2 \bar{x}_3 \bar{x}_4 \bar{x}_5 + \bar{x}_1 x_2 \bar{x}_3 \bar{x}_4 x_5$ (0 1 0 0 0 / 0 1 0 0 1)

10, 11, 8, 9

$\bar{x}_1 \bar{x}_3 = \bar{x}_1 x_2 \bar{x}_3 + \bar{x}_1 \bar{x}_2 \bar{x}_3$

$\bar{x}_1 x_2 \bar{x}_3 = \bar{x}_1 x_2 \bar{x}_3 x_4 + \bar{x}_1 x_2 \bar{x}_3 x_4$

→ $\bar{x}_1 x_2 \bar{x}_3 \bar{x}_4 \bar{x}_5 + \bar{x}_1 x_2 \bar{x}_3 x_4 x_5$ (0 1 0 0 0 / 0 1 0 0 1)

→ $\bar{x}_1 x_2 \bar{x}_3 x_4 \bar{x}_5 + \bar{x}_1 x_2 \bar{x}_3 x_4 x_5$ (0 1 0 1 0 / 0 1 0 1 1)

8, 9, 10, 11

$\bar{x}_1 \bar{x}_2 x_3 = \bar{x}_1 \bar{x}_2 x_3 \bar{x}_4 + \bar{x}_1 \bar{x}_2 x_3 x_4$

→ $\bar{x}_1 \bar{x}_2 x_3 \bar{x}_4 \bar{x}_5 + \bar{x}_1 \bar{x}_2 x_3 \bar{x}_4 x_5$ (0 0 1 0 0 / 0 0 1 0 1)

→ $\bar{x}_1 \bar{x}_2 x_3 x_4 \bar{x}_5 + \bar{x}_1 \bar{x}_2 x_3 x_4 x_5$ (0 0 1 1 0 / 0 0 1 1 1)

4, 5, 6, 7

$x_2 x_4 = \bar{x}_1 x_2 x_4 + x_1 x_2 x_4$

$x_1 x_2 x_4 = x_1 x_2 x_3 x_4 + x_1 x_2 \bar{x}_3 x_4$

→ $x_1 x_2 x_3 x_4 \bar{x}_5 + x_1 x_2 x_3 x_4 x_5$ (1 1 1 1 0 / 1 1 1 1 1)

→ $x_1 x_2 \bar{x}_3 x_4 \bar{x}_5 + x_1 x_2 \bar{x}_3 x_4 x_5$ (1 1 0 1 0 / 1 1 0 1 1)

30, 31, 26, 27

$\bar{x}_1 x_2 x_4 = \bar{x}_1 x_2 x_3 x_4 + \bar{x}_1 x_2 \bar{x}_3 x_4$

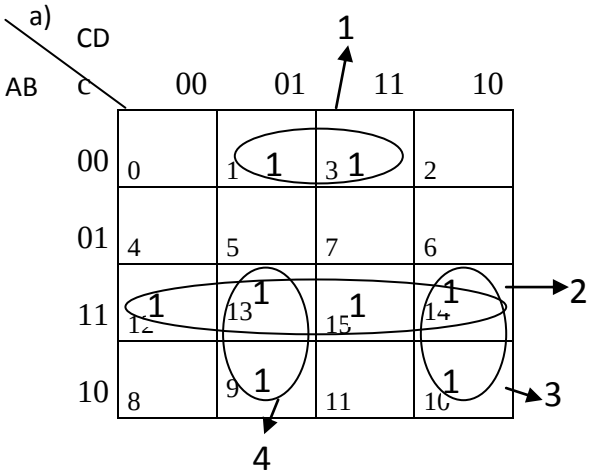
→ $\bar{x}_1 x_2 x_3 x_4 \bar{x}_5 + \bar{x}_1 x_2 x_3 x_4 x_5$ (0 1 1 1 0 / 0 1 1 1 1)

→ $\bar{x}_1 x_2 \bar{x}_3 x_4 \bar{x}_5 + \bar{x}_1 x_2 \bar{x}_3 x_4 x_5$ (0 1 0 1 0 / 0 1 0 1 1)

14, 15, 10, 11

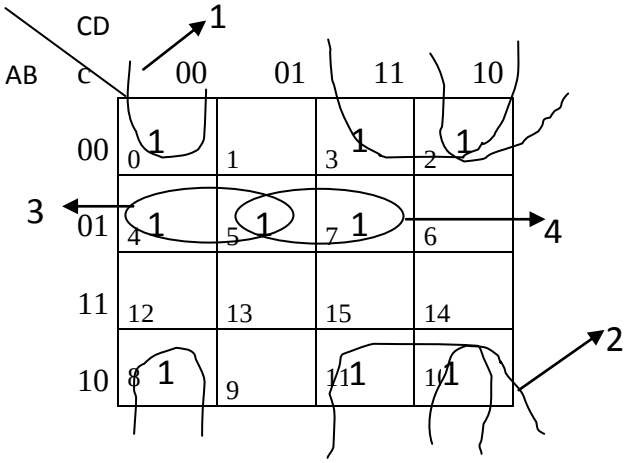
4)

a)



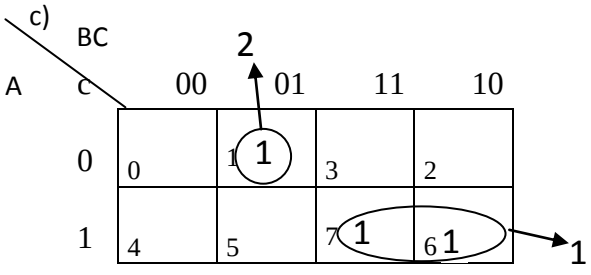

$$f = \overline{A}\,\overline{B}\,D + AB + AC\overline{D} + A\overline{C}D$$

b)



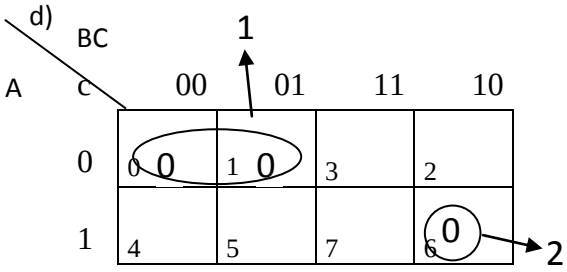

$$f = \overline{B}C + \overline{D}\,\overline{B} + \overline{A}\,B\,\overline{C} + \overline{A}\,BD$$

c)



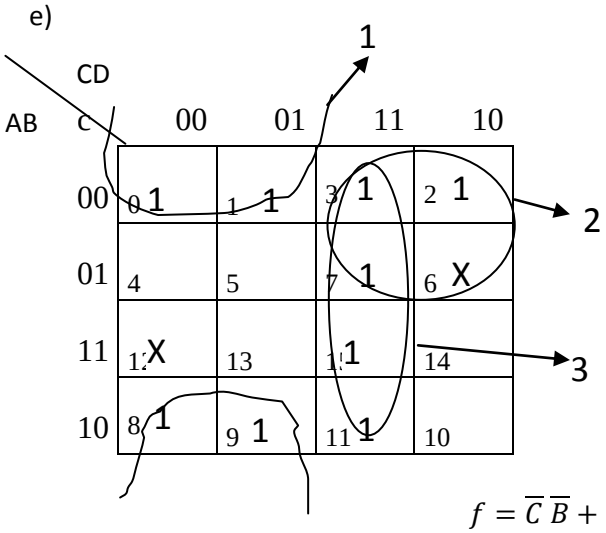

$$f = AB + \overline{A}\,\overline{B}\,C$$

d)



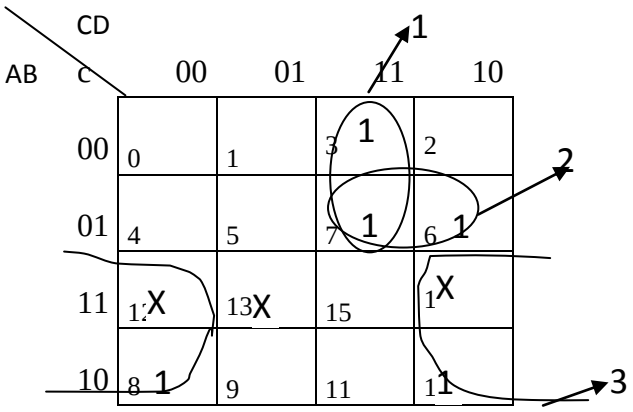

$$f = (A + B)(\overline{A} + \overline{B} + C)$$

e)



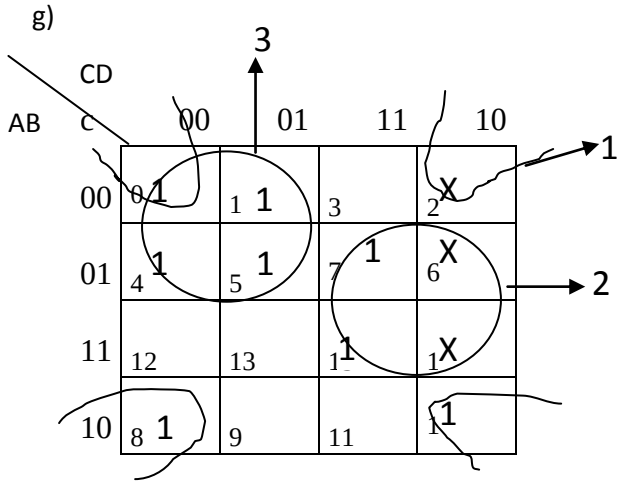

$$f = \overline{C}\,\overline{B} + CD + C\,\overline{A}$$

f)



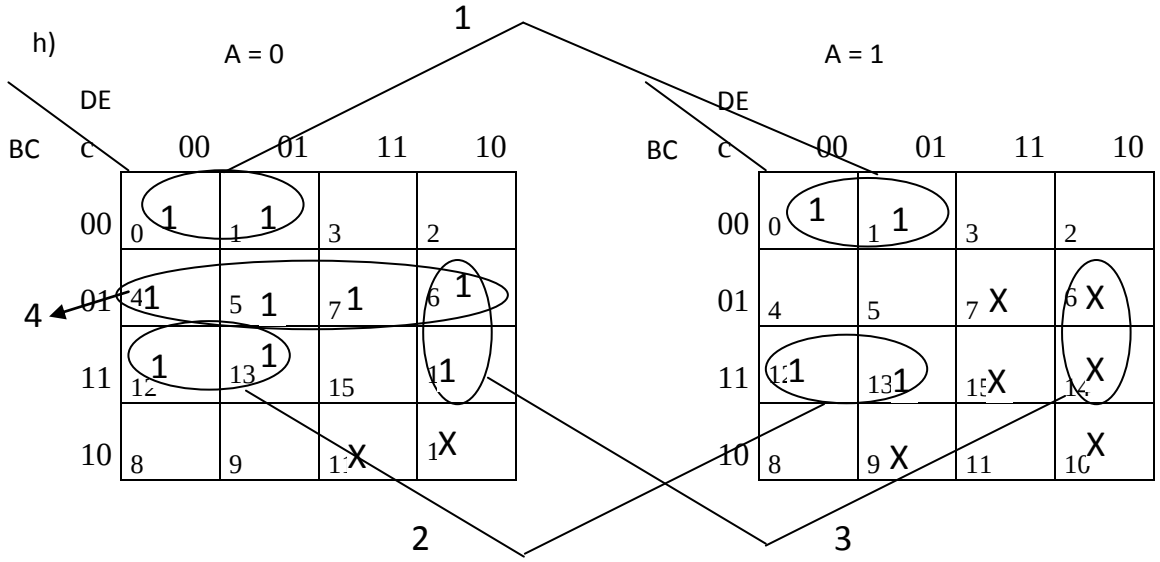

$$f = A\overline{D} + \overline{A}BC + \overline{A}CD$$

g)




$$f = A\overline{C} + BC + \overline{BD}$$

h)




$$f = \overline{DCB} + BC\overline{D} + CD\overline{E} + \overline{A}\,\overline{B}\,C$$

5)

(5) a) $f = ABC + DE$

$$f = \overline{ABC \cdot DE} = \overline{\overline{AB} \cdot C \cdot \overline{DE}}$$

b) $f = \overline{ABC + \overline{D} + \overline{E}}$

$$f = \overline{ABC \cdot \overline{\overline{D}} \cdot \overline{\overline{E}}} = \overline{\overline{\overline{AB} \cdot C} \cdot D \cdot E} = \overline{\overline{\overline{AB} \cdot C} \cdot \overline{DE}}$$

c) $f = \overline{\overline{ABC}} = \overline{\overline{AB} \cdot C}$

d) $f = \overline{\overline{AB} + \overline{\overline{D}}} = \overline{\overline{AB} \cdot \overline{ED}}$

e) $f = (\overline{\overline{A+B}})(\overline{C+D})$

$$f = (\overline{A \cdot B})(\overline{C \cdot D}) = \overline{\overline{A \cdot B} \cdot \overline{CD}}$$

f) $f = AB[C(\overline{DE} + \overline{AB}) + \overline{BCE}]$

$$f = \overline{\overline{AB}}\,[C(\overline{\overline{DE} + \overline{AB}}) + \overline{BCE}]$$

$$f = \overline{\overline{AB}}\,[C(\overline{DE \cdot AB}) + \overline{BCE}]$$

$$f = \overline{\overline{AB}}\,[\overline{C \cdot \overline{DEAB} + \overline{BCE}}]$$

$$f = \overline{\overline{AB}}\,[\overline{C \cdot \overline{DEAB} \cdot \overline{BCE}}]$$

$$f = \overline{\overline{AB}}\,[\overline{C \cdot \overline{\overline{DEAB} \cdot \overline{BCE}}}]$$

g) $f = B(C\overline{D}E + \overline{E}FG)(\overline{AB} + C)$

$$f = B(\overline{C\overline{D}E + \overline{E}FG}) \cdot (\overline{\overline{AB} + C})$$

$$f = B(\overline{C\overline{D}E \cdot \overline{E}FG}) \cdot (\overline{\overline{AB} \cdot \overline{C}})$$

$$f = B(\overline{\overline{C\overline{D}E} \cdot \overline{\overline{E}FG}}) \cdot (\overline{\overline{AB} \cdot \overline{C}})$$

6)

| | TTL | TTL LS | TTL ALS | CMOS |
|---|---|---|---|---|
| **$MR_H$** | **0.4** | 0.7 | 0.7 | 1 |
| **$MR_L$** | **0.4** | 0.3 | 0.4 | 1 |
| **$FO_H$** | **10** | 20 | 20 | 72000*[1] |
| **$FO_L$** | **10** | 22 | 20 | 176000*[2] |
| **FO** | **10** | 20 | 20 | <50*[3] |

*1: **$I_{IH}$: 0.005µA → $I_{OH}$: n. $I_{IH}$ → n = 360/ 0.005 = 72000**

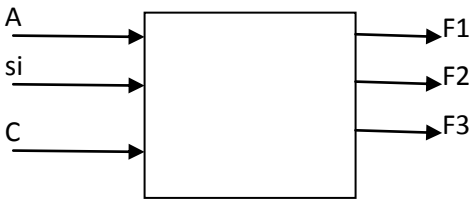
**$I_{OH}$: 360 µA**

*2: **$I_{OL}$: n. $I_{IL}$ → n = $0.88.10^{-3}$/ $0.005.10^{-6}$ = $176\ 10^3$**

*3: CMOS-ak FO altua du, baina ateen sarreren kapazitantziak direla eta (karga eta deskarga denborak, noski), mugatuta dago FO-a.

7) Abiadura, zaratarekiko inmunitatea eta disipazio ezaugarriak TTL LS edo ALS ateetan hobe dira. Alabaina, irteera-korronteak txikiagoak direnez aztertu beharko litzateke zenbat sarrera elika ditzakeen TTL irteera estandarra eta konparatu LS eta ALS-rekin.

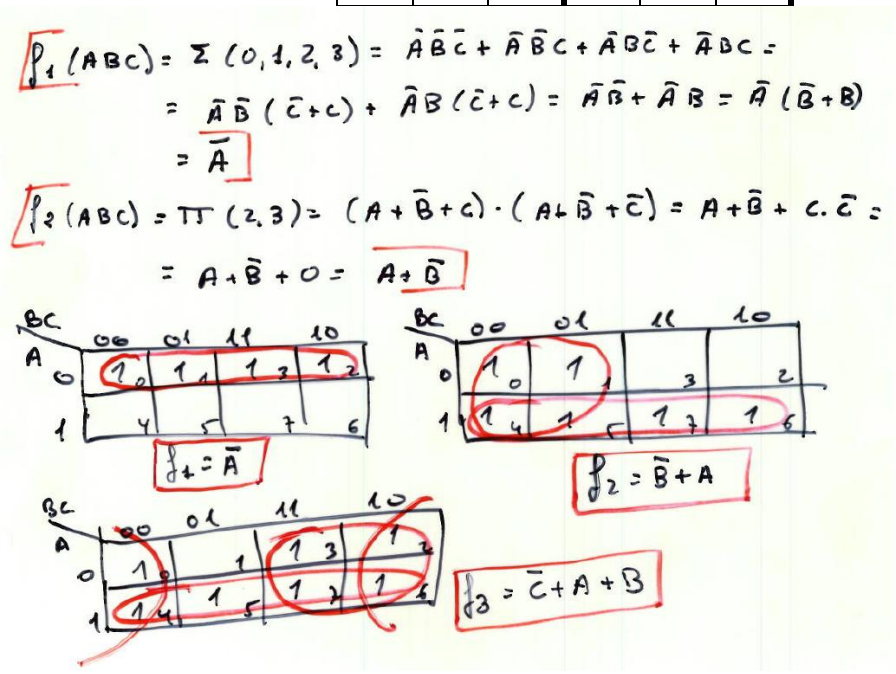
8)




A, B, C = sentsoreen irteera= 1 kotxea dagoenean.

F1, F2, F3 = semaforoak aktibatzeko seinalea = 1 semaforoa gorriz jarri.

| Sarrerak | | | Irteerak | | |
|---|---|---|---|---|---|
| **A** | **B** | **C** | **F1** | **F2** | **F3** |
| 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 |



9) A, B, C, D = etengailuen irteera = 1 alde.

F = LED-a aktibatzeko seinalea = 1 proposamena onartzen da (> 50%)

| A | B | C | D | F |
|---|---|---|---|---|
| 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 | 1 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

$$f(ABCD) = \Sigma(6,7,10,11,12,13,14,15)$$

$$f = \bar{A}BC\bar{D} + \bar{A}BCD + A\bar{B}CD + A\bar{B}C\bar{D} + AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D} + ABCD$$

$$f = \bar{A}BC(\bar{D}+D) + A\bar{B}C(\bar{D}+D) + AB\bar{C}(\bar{D}+D) + ABC(\bar{D}+D)$$

$$f = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$$

$$f = \bar{A}BC + A\bar{B}C + AB$$

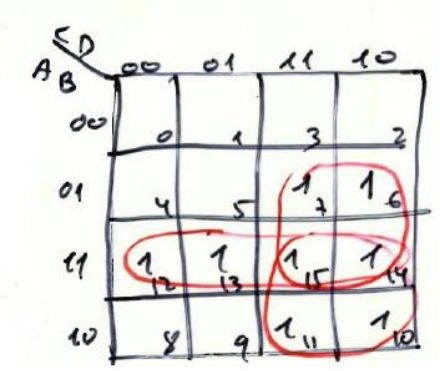
$$f = \bar{A}BC + A(\underbrace{\bar{B}C + B}_{B+C})$$

$$f = \bar{A}BC + A(B+C)$$

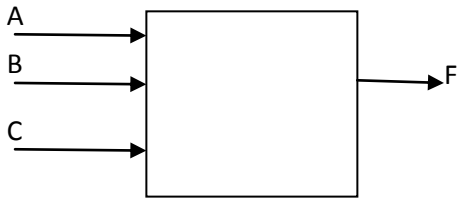
$$f = \bar{A}BC + AB + AC$$

$$f = B(\underbrace{\bar{A}C + A}_{A+C}) + AC$$

$$f = B(A+C) + AC = BA + BC + AC$$



10)




A, B, C = sentsoreen irteea = 1 puntuaren azpitik baldin badago

F = alarma aktibatzeko seinalea = 1 alarma dago.

| A | B | C | F |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

$f(ABC) = \Sigma(3,5,6,7)$

$f = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$

$f = \bar{A}BC + A\bar{B}C + AB$

$f = \bar{A}BC + A(\bar{B}C + B) =$

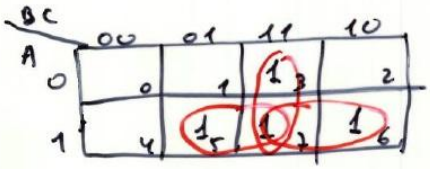
$f = \bar{A}BC + A(C + B) =$

$f = \bar{A}BC + AC + AB$

$f = B(\bar{A}C + A) + AC$

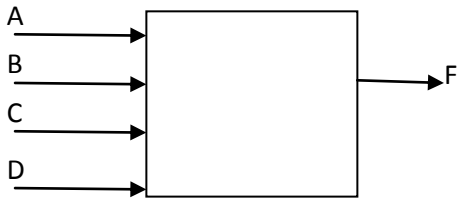
$f = B(A + C) + AC$

$f = BA + BC + AC$




$f = AB + BC + AC$

11)




A, B, C, D = sarrera-aldagaiak.

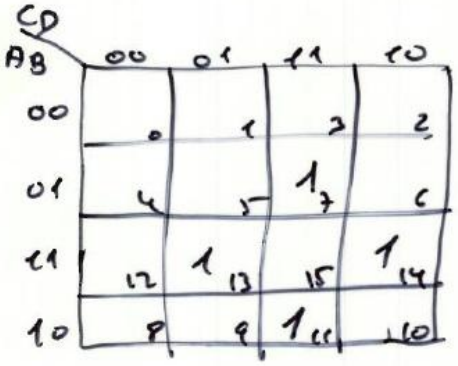
F = irteera aldagaia

| A | B | C | D | F |
|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |

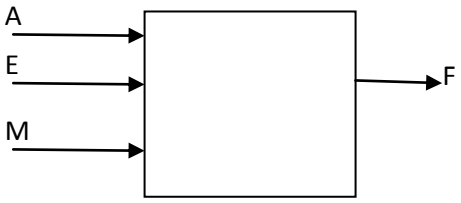
$$f(ABCD) = \bar{A}BCD + A\bar{B}CD + AB\bar{C}D + ABC\bar{D}$$

$$f = (\bar{A}B + A\bar{B}).CD + AB(\bar{C}D + C\bar{D})$$

$$f = (A \oplus B).CD + AB(C \oplus D)$$



12)



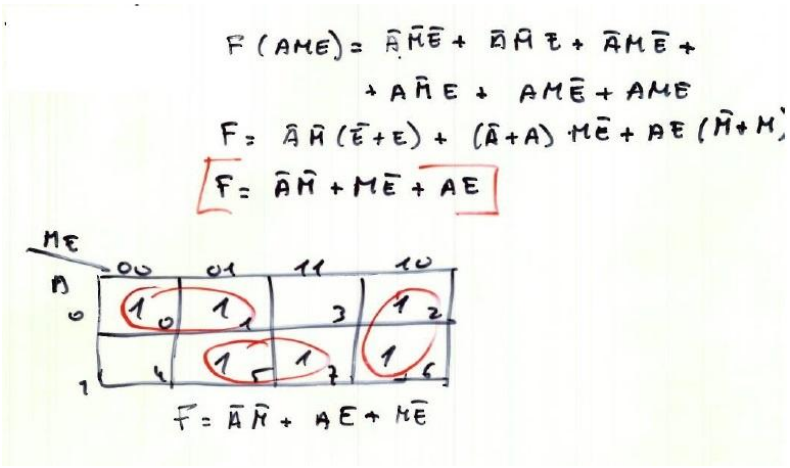

A = atea zabalik ala itxita dagoen asierazteko = 1 zabalik

E = eskaera dagoen adierazteko = 1 eskaera dago

M = mugimendua dagoen adierazteko = 1 mugimendua dago

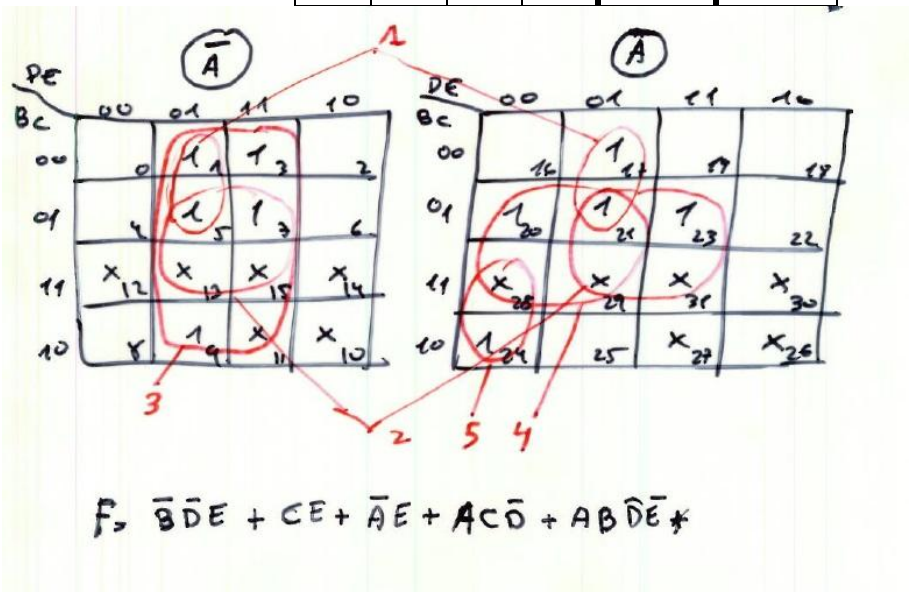
F = funtzionamenduan akatsik egon den alarma aktibatzeko seinalea = 1 alarma

| A | M | E | F |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

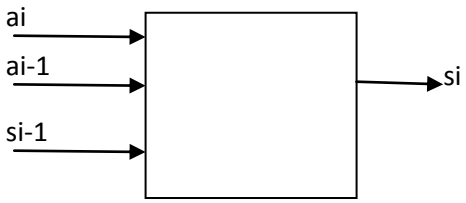


13)

| B | C | D | E | F (A=0) | F (A=1) |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 | X | X |
| 1 | 0 | 1 | 1 | X | X |
| 1 | 1 | 0 | 0 | X | X |
| 1 | 1 | 0 | 1 | X | X |
| 1 | 1 | 1 | 0 | X | X |
| 1 | 1 | 1 | 1 | X | X |

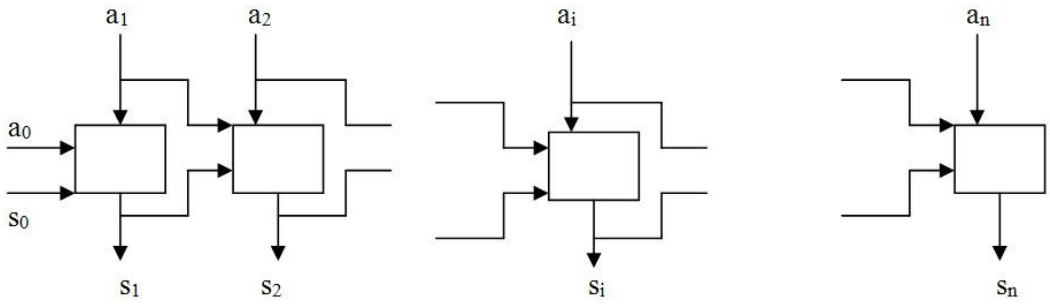


14)




| $s_{i-1}$ | $a_i$ | $a_{i-1}$ | $s_i$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

$$s_i = \overline{s_{i-1}} a_{i-1} + s_{i-1} \overline{a_i}$$




$a_0$ eta $s_0$ sarreren balioa zirkuituaren espezifikazioen araberakoak dira.

15)

| Sarrera-aldagaiak | | Irteera-aldagaiak | |
|---|---|---|---|
| A(Emaztea) | 0 = Ados<br>1 = Aldaranztu | | |
| B(Lehendak) | 0 = kontra<br>1 = Alde | Z | 0 = Atzera bota<br>1 = Onartu da |
| C,D,E<br>(Bokalak) | 0 = Kontra<br>1 = Alde | | |

| A | B | C | D | E | Z |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 |

| A | B | C | D | E | Z |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 |

16)

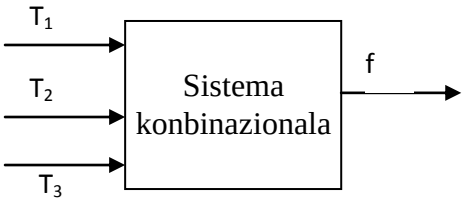
| Sarrera-aldagaiak | | Irteera-aldagaiak | |
|---|---|---|---|
| X | 0 = Td < Tf<br>1 = Td ≥ Tf | B | 0 = Ponpa desaktibatuta<br>1 = Ponpa aktibatuta |
| Y | 0 = Tp< Tf<br>1 = Tp ≥ Tf | Vp | 0 = Panel-balbula itxita<br>1 = Panel-balbula zabalik |
| Z | 0 = Td < Tp<br>1 = Td ≥ Tp | Vg | 0 = galdara-balbula itxita<br>1 = = galdara-balbula zabalik |

| X | Y | Z | B | Vp | Vg |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | X | X | X |
| 1 | 0 | 0 | X | X | X |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |

17)

$T_i$ { 0 $P < t_i$ ; 1 $P >= t_i$

f { 0 Besteak ; 1 $t_1 < P < t_2$ o $P >= t_3$




| $T_3$ | $T_2$ | $T_1$ | f |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | X |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | X |
| 1 | 0 | 1 | X |
| 1 | 1 | 0 | X |
| 1 | 1 | 1 | 1 |

$P < t_3$; $P<t_2$; $P<t_1 \Rightarrow P<t_1$

$P < t_3$; $P<t_2$; $P \geq t_1 \Rightarrow t_1<P<t_2$

$P < t_3$; $P>t_2$; $P<t_1 \Rightarrow$ ezinezkoa

$P < t_3$; $P>t_2$; $P>t1 \Rightarrow t_2<P<t_3$

$P > t_3$; $P<t_2$; $P<t_1 \Rightarrow$ ezinezkoa

$P > t_3$; $P<t_2$; $P>t_1 \Rightarrow$ ezinezkoa

$P > t_3$; $P>t_2$; $P<t_1 \Rightarrow$ ezinezkoa

$P > t_3$; $P>t_2$; $P>t_1 \Rightarrow P>t_3$

a)

$$f = \sum(1,7) + k(2,4,5,6) = \overline{T_3}\,\overline{T_2}T_1 + T_3T_2T_1 + k(2,4,5,6)$$

$$f = \prod(0,3).k(2,4,5,6) = (T_3 + T_2 + T_1)\left(T_3 + \overline{T_2} + \overline{T}_1\right).k(2,4,5,6)$$

b)

$$f = \overline{T_2}T_1 + T_3$$

$$f = (T_1)\left(T_3 + \overline{T_2}\right)$$

c)

$$f = \overline{\overline{\overline{T_2}T_1 + T_3}} = \overline{\overline{\overline{T_2}T_1} + T_3} = \overline{\left(\overline{T_2 + \overline{T}_1}\right) + T_3}$$

$$f = \overline{(T_1)\left(T_3 + \overline{T_2}\right)} = \overline{\overline{T_1} + \left(T_3 + \overline{T_2}\right)}$$

18)

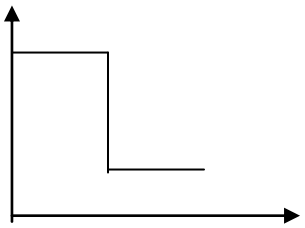
A) 18) T.D.= [1.25, 2.6]

B) $V_{IH}$ = [ 2.6, 5] $V_{OH}$ = [4.6 , 4.8]
$V_{IL}$ = [0 , 1.25] $V_{OL}$ = [0.2 , 0.8]

C) Zarata-tartea zenbat eta handiagoa izan hobe. Hortaz, zarata-tartea lortzeko adierazpenen arabera:

$$ZT_H = V_{OH} - V_{IH}$$
$$ZT_L = V_{IL} - V_{OL}$$

Zarata-tartea handitzeko nahikoa da $V_{IH}$ txikitzea ZTH kasuan eta handitzekoa $V_{IL}$ ZTL kasuan.



19)

Familia ezberdinak elkar konektatu daitezke kitzikapen ateen irteeren maila logikoak karga-ateen tarte logikoen barne baldin badaude, hau da, $V_{OHmin} > V_{IHmin}$ y $V_{OLmax} < V_{ILmax}$.

Hortaz, konektatu ezin direnak dira TTL-HCMOS eta AS- HCMOS.

Fan-out kitzikapen-atearen irteeren korronte eta karga atearen sarreren korrontearen menpe dago. Alabaina, CMOS ateetan karga atearen sarreren kapazitantziaren menpekoa da. Fan-out-a maila altuan zein baxuan kalkulatu behar da eta murrizgarriena txikiena izango da.

20)A)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | Konbinazioa onartua |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Debekatuta 2 zerra aktibo |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Debekatuta zinta lubrikaziorik gabe |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | Debekatuta zinta eta ebaketa |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Debekatuta zinta lubrikaziorik gabe |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Debekatuta 2 zerra aktibo |
| 1 | 0 | 0 | 0 | 1(0) | 0 | 0 | 0 | Konbinazioa onartua |
| 1 | 0 | 0 | 1 | 1(0) | 0 | 0 | 1 | Konbinazioa onartua |
| 1 | 0 | 1 | 0 | 1(0) | 0 | 1 | 0 | Konbinazioa onartua |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Debekatuta 2 zerra aktibo |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | Konbinazioa onartua |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | Debekatuta zinta eta ebaketa |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | Konbinazioa onartua |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Debekatuta dena aktibo |

**Oharra**: M1 funtzioaren arabera ontzat ematen dira parentesi arteko eukerak

$$M_1 = I_1(\overline{I_2} + \overline{I_4})(\overline{I_3} + \overline{I_4})$$
$$M_2 = I_1.I_2.\overline{I_4}$$
$$M_3 = I_3.\overline{I_4}.(I_1 + \overline{I_2})$$
$$M_4 = I_4.\overline{I_3}.\overline{I_2}$$

B)

74151

$$Y = D_0\overline{S}_2\overline{S_1}\overline{S_0} + D_1\overline{S}_2\overline{S_1}S_0 + D_2\overline{S}_2S_1\overline{S_0} + D_3\overline{S}_2S_1S_0 +$$
$$D_4S_2\overline{S}_1\overline{S}_0 + D_5S_2\overline{S}_1S_0 + D_6S_2S_1\overline{S}_0 + D_7S_2S_1S_0$$

$$M_1(I_1I_2I_3I_4) = 0.\overline{I}_1\overline{I}_2\overline{I}_3\overline{I}_4 + 0.\overline{I}_1\overline{I}_2\overline{I}_3I_4 + 0.\overline{I}_1\overline{I}_2I_3\overline{I}_4 + 0.\overline{I}_1\overline{I}_2I_3I_4 +$$
$$0.\overline{I}_1I_2\overline{I}_3\overline{I}_4 + 0.\overline{I}_1I_2\overline{I}_3I_4 + 0.\overline{I}_1I_2I_3\overline{I}_4 + 0.\overline{I}_1I_2I_3I_4 +$$
$$1.I_1\overline{I}_2\overline{I}_3\overline{I}_4 + 1.I_1\overline{I}_2\overline{I}_3I_4 + 1.I_1\overline{I}_2I_3\overline{I}_4 + 0.I_1\overline{I}_2I_3I_4 +$$
$$1.I_1I_2\overline{I}_3\overline{I}_4 + 0.I_1I_2\overline{I}_3I_4 + 1.I_1I_2I_3\overline{I}_4 + 0.I_1I_2I_3I_4$$

Helburua da Y = $M_1$ izatea, hortaz:

I4 = S0 I3 = S1 I2 = S2

$D_0$ = I1 $D_1$ = I1 $D_2$ = I1 $D_3$ = 0

$D_4$ = I1 $D_5$ = 0 $D_6$ = I1 $D_7$ = 0

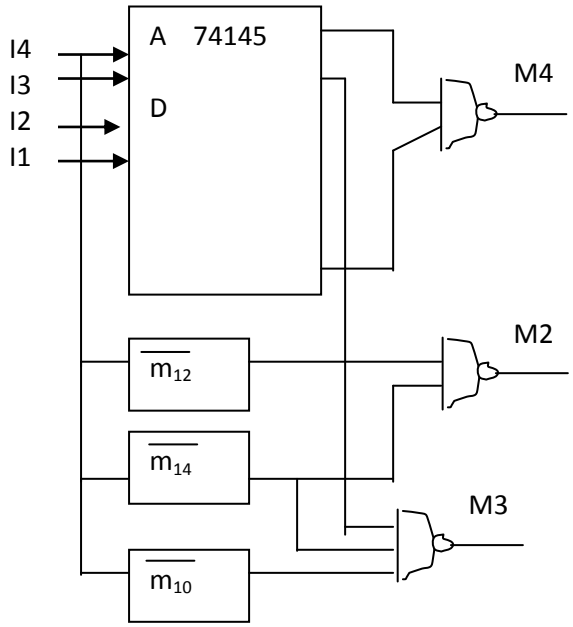
Oharra: Egi-taulatik zuzenean ondoriozta daiteke.

74145

$$M_2 = \overline{\overline{m_{12} + m_{14}}} = \overline{\overline{m_{12}}}.\overline{\overline{m_{14}}}$$

$$M_3 = \overline{\overline{m_2 + m_{10} + m_{14}}} = \overline{\overline{m_2}}.\overline{\overline{m_{10}}}.\overline{\overline{m_{14}}}$$

$$M_4 = \overline{\overline{m_1 + m_9}} = \overline{\overline{m_1}}.\overline{\overline{m_9}}$$



21)

**a.1)** $V_{cc}$ eta lurraren artean inpedantzia baxuko bidea osa daiteke eta korronteak integratua izorra dezake.

AND atearen irteera H moduan egon dadin eta NOT L –ra behartzen dituzten konbinazioak, edo alderantziz.

Konbinazio arriskutsua izango litzateke A = B = 1 y C = 0, adibidez.

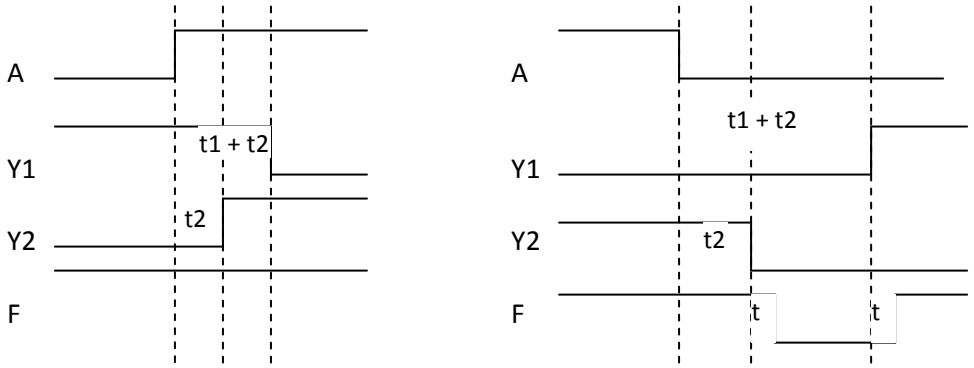
**a.2)** Kolektore edo drenadore zabaleko ateak jarriko genituzke.

Horiek duten ezbeharra da gailu extra behar dutela (Pull-up erresistentzia)

**b.1)** Logika erredundantea erabiltzen da, hots, behar ez diren ateak gehhitzen dira irteeran *glitchak* ager ez daitezen.

Zirkutuak funtzio hau osatzen du:F = A´BD+AC = Σ (5, 7, 10, 11 14 15). Beha daiteke A-ren trantsitzioetan (0 ↔ 1) arriskkua dagoela B = C = D =1 denean, talde batetik bestera saltoa ematen delako. Hortaz, trantsizio hori egiten duen taldea gehitzen da. Talde hori BCD gaia da eta zirkuituari gehhitzen zaio:.⇒ F = A´BD+AC + **BCD**

**b.2)** A-ren bi trantsizioak (0 ↔ 1) arriskutsuak dira B = C = D =1 denean. Alabaina, batek bakarrik sortzen du *glitch*, hau da, A : 1 → 0 trantsizioak.




**b.3)** -Gehitu atzerapenak

- Transitorioa eliminatu

22)
Sarrerak:
dm = 0 habea ez dago kokatuta
b1, b2, b3, b4 = 1 habea detektatzen dute
Ci = 1 Ci biltegira doa
A = 1 sentsoreen informazioa ezinezka delako akatsa dago

| | | | | Dm = 1 | | | | | Dm = 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **B4** | **B3** | **B2** | **B1** | **C1** | **C2** | **C3** | **C4** | **A** | **C1** | **C2** | **C3** | **C4** | **A** |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

**Oharrak**:

1) Taula honetan, kotxe laburra detektatzeko h2 aktibatuta egon behar da soilik. Kotxe laburra detektatzeko h2-h3 bakarrik aktibatzea edo bi kasuak eraberan (h2 eta h3-h2) erabili duenak ontzat eman dira. Gaizki dagoena, h1-h2-ren aktibazioak kotxe labur moduan hartzea da, kasu honetan ezin dugulako jakin kotxea laburra ala luzea den.
2) Taulan "X" gaiak erabili duenak, taula hori ontzat emateko, gai horien esanahia azaldu behar izan du *Karnaught* mapetan sinplifikatzeko erabili izan baditu. Kasu horietan 1 edo 0 moduan aktibatuko bait dute funtzioa.
3) Irteera moduan P1,P2,P3, P4 *peaje* mota bakoitzari irteera bat esleitu beharrean, *peaje* bakoitzari kode bat eman ahal zaio. Adibidez: P1 = 00, P1 = 01, P2= 10, P3 = 11, horrela bi irteera izango genituzke.

23)

a)

| A | B | C | D | M |
|---|---|---|---|---|
| 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 | 1 |
| 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 | 1 |
| 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 |

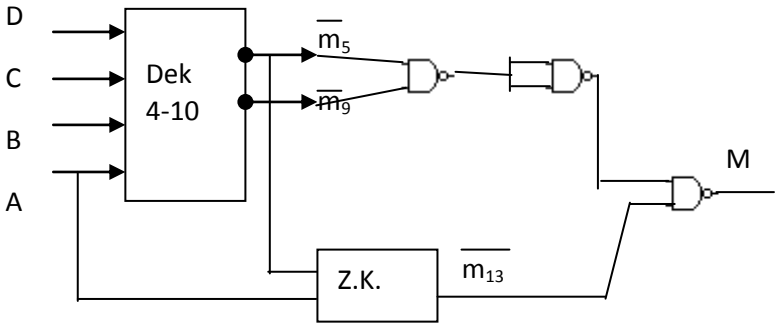
$M = \overline{C}D(B + A)$

b) $M = \overline{\overline{B\overline{C}D}.\overline{A\overline{C}D}}$

c)

$$M = m_5 + m_9 + m_{13} = \overline{\overline{m_5 + m_9 + m_{13}}} = \overline{\overline{m_5}.\overline{m_9}.\overline{m_{13}}} = \overline{\overline{m_5}.\overline{m_9}.\overline{m_{13}}}$$

$$\overline{m_{13}} = \overline{A.\overline{m_5}}$$



24) A) Sarrerak: N, S, E, W = 1 norabidea aktibatua.
Irteerak: a, b, c, d, e, f = 1 segmentua aktibatua.

| N | S | E | W | a | b | c | d | e | f |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | X | X | X | X | X | X |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | X | X | X | X | X | X |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | X | X | X | X | X | X |
| 1 | 1 | 0 | 0 | X | X | X | X | X | X |
| 1 | 1 | 0 | 1 | X | X | X | X | X | X |
| 1 | 1 | 1 | 0 | X | X | X | X | X | X |
| 1 | 1 | 1 | 1 | X | X | X | X | X | X |

b) Funtzioen sinplifikazioak:

a = *N*

b = $\overline{S}E$

c = $\overline{N}E$

d = *S*

e = $\overline{N}W$

f = $\overline{S}W$

g = *D*

25)

a) Funtzio logikoen sinplifikazioa Booleren algebraren hurrengo arauetan oinarritzen dira: $a + \bar{a} = 1$ $a.\bar{a} = 0$. Eta ac + ab = a.(c+b ), hots, faktore komuna ateratzen. Hortaz, funtzio logiko baten bi gaiek aldagai baten bakarrik ezberdintzen badira, aldagai hori sinplifikagarria izango da eta bi gai horiek kenduko dira bakar bat utziz. Sinplifikatu diren bi gai horiek ondoz-ondoko gaiak direla esaten da, hau da, haine arteko ezberdintasun bakarra aldagai bat denean.

Karnaugh tauletan ondoz-ondoko gai horiek ondoz-ondoko laukitxoetan kokatzen dira, bai horizontalki edo baita bertikalki ere. Horrela, erraz ikusgarri dira sinplifikagarriak diren gaiak.

b) Zarata handiak dauden lantegian zarata tardea handia duen teknologia beharrezkoa da.

Zarata-tardea kalkulatzen da::

| | HCMOS | TTL | LS TTL | S TTL | AS TTL |
|---|---|---|---|---|---|
| VNH | 1.75 | 0.4 | 0.7 | 0.7 | 0.7 |
| VNL | 0.9 | 0.4 | 0.4 | 0.3 | 0.3 |

HCMOS egokiena da.

c) Abiadura-potenzia ezaugarriari dagokionez, baliorik txikiena duena hartu beharko da. Hori lortzeko atzerapen denborak eta potentziaren disipazioa kalkulatu behar dira:

| | A | B | C |
|---|---|---|---|
| Tph (ns) | 1.1 | 4.5 | 10 |
| C(pJ) | 16.5 | 36 | 5 |

Hortaz, C egokiena da.

Maiztasunik handiena har dezakeena A izango da, bere atzerapen denbora txikiena baita.

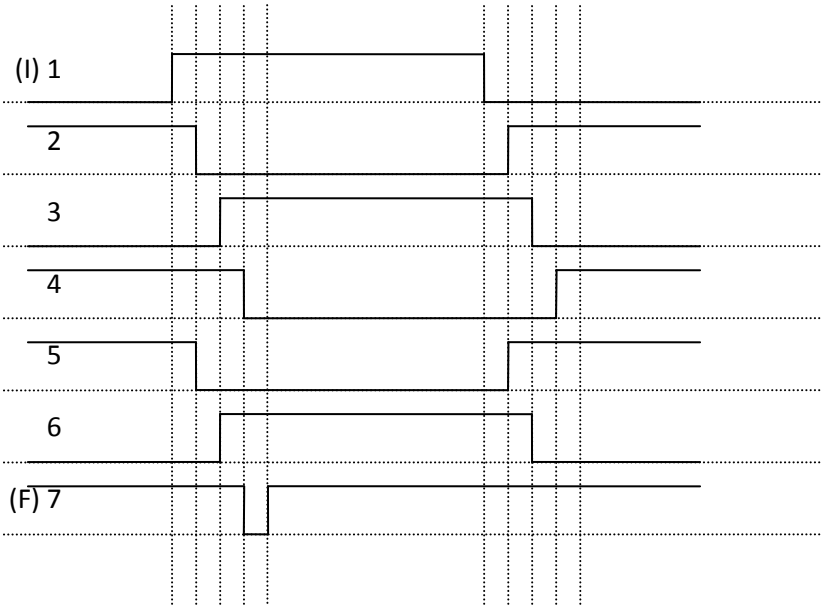
26)

**a)**

Atzerapen-denbora: 16 ns

Kronograma:

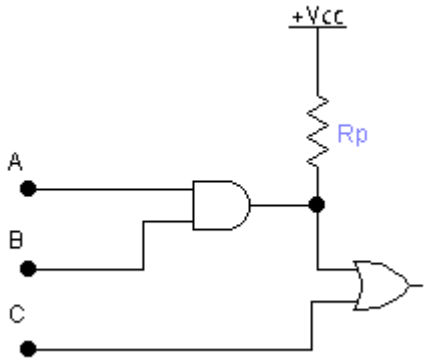
(I)1: Sarrera da
2, 3, 4: goiko zatiaren ateen irteerak
5, 6: beheko zatiaren ateen irteerak
(F) 7: zirkuituaren irteera.




a) Zirkuitu 1: ez da baliogarria AND atearen Vohmin ez delako nahikoa Or atea kitzikatzeko
Voh min < Vih min

Zirkutu 2 ondo.

b) AND atearen Vohmin handitzeko pull-up erresistentzia jarri behar da




$$Rp = \frac{Vcc - VoL\,\min}{IoL + nIiL} = \frac{5-0}{4{,}4\mathrm{E}^{-3} - 1 \cdot 0{,}36\mathrm{E}^{-3}}$$

$Rp$ =123,76 Ω

27)

a)

| Sarrerak | | | | Irteerak | |
|---|---|---|---|---|---|
| **I3** | **I2** | **I1** | **I0** | **Z1** | **Z0** |
| 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | X | X |
| 1 | 1 | 0 | 0 | X | X |
| 1 | 1 | 0 | 1 | X | X |
| 1 | 1 | 1 | 0 | X | X |
| 1 | 1 | 1 | 1 | X | X |

$$Z_1 = (I_3 + I_2 + I_0)(I_3 + I_1 + \bar{I}_0)(\bar{I}_2 + \bar{I}_1)$$

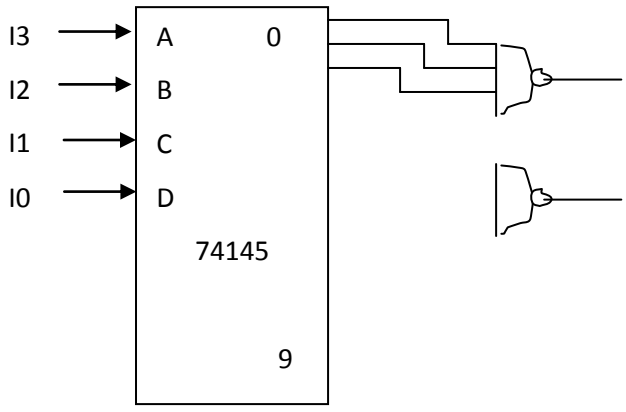
$$Z_0 = \bar{I}_2(\bar{I}_1 + \bar{I}_0)$$

**NAND:**

$$Z_1 = \overline{\bar{I}_3 I_2 \bar{I}_1 I_0 \bar{I}_2 I_1 I_0}$$

$$Z_0 = \overline{\bar{I}_2 \bar{I}_0 \bar{I}_2 \bar{I}_1}$$

b)




$$Z_1 = \overline{M_0.M_1.M_2.M_5.M_6.M_7}$$

$$Z_0 = \overline{M_3.M_4.M_5.M_6.M_7}$$

28)

1) Ez da behar inolako interfazerik sarrera eta irteera tentsio mailak aztertu ondoren

.

2) Hiru egoeretako ateak osatzen duten zirkuitua da, hau da, H, l eta inpedantzia altuz (Z) egoerak dituzten ateak.

Integratuak lau ateak osatzen duten bi taldeetan antolatuta dago, hori dela eta OE (OE1 eta OE2) sarrerarekin talde osoaren inpedantiza altuko egoera aktibatzen da..

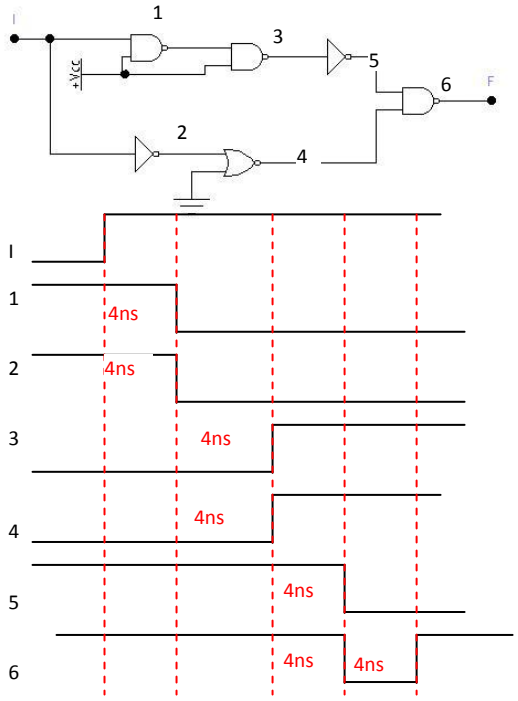
OE1-aren balioa 0 bada, talde horren ateak inbertsoreak dira , baina bere balioa 1 denean, inpedantzia latuko egoeran egonogo dira.

OE2-aren balioa 1 bada, talde horren ateak inbertsoreak dira , baina bere balioa 0 denean, inpedantzia latuko egoeran egonogo dira.

Beha daiteke pinek sarrera eta irteera moduan konfigura daitezkela. Hori dela eta, talde biek ezin dute eraberean funtzionatzen egon, hau da, bata aktibatuta dagoenean bestean inpedantzia altuan egon behar da. OE1 funtzionatzen dagoenean 3,4,5,6 pinak sarrerak dira eta 10,11,9,8 pinak irteera.

Zirkuitu hauek data-busera sarrera emateko erabiltzen dira.

3) 4 ate zeharkatu behar dira (biderik luzeena): 4 * 4 = 16ns.




4)

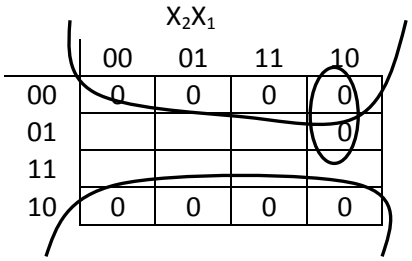
| 0-5 | 0-15 |
|---|---|
| $V_{OH}$= 4,95 (5); $V_{OL}$= 0 | $V_{OH}$= 14,95 (15); $V_{OL}$= 0,05 |
| $V_{IH}$ = 3,5; $V_{IL}$ = 1.5 | $V_{IH}$ = 11: $V_{IL}$ = 4 |
| 1,5; 15 | 4 ; 4 hobe |

29) $x_1$ argia piztu; $x_2$ argia itzalli ; $x_3$ emergentzia
$x_4$ kalean dagoen argia adierazten du.

a)

| $X_4$ | $X_3$ | $X_2$ | $X_1$ | L |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

$L = \Pi\,(0,1,2,3,6,8,9,11,12)$




$$L = X_3\left(X_4 + \overline{X}_2 + X_1\right)$$

b) 74151A = MUX , 3 aukeratze-sarrera dituena$\Rightarrow$

$$Y_{MUX} = D_0\overline{C}\,\overline{B}\,\overline{A} + D_1\overline{C}\,\overline{B}A + D_2\overline{C}B\overline{A} + D_3\overline{C}BA + D_4C\overline{B}\,\overline{A} + D_5C\overline{B}A + D_6CB\overline{A} + D_7CBA$$
$$Y_{MUX} = D_0m_0 + D_1m_1 + D_2m_2 + D_3m_3 + D_4m_4 + D_5m_5 + D_6m_6 + D_7m_7$$

$$L = \sum(4,5,7,12,13,14,15)$$
$$L = \overline{X}_4X_3\overline{X}_2\overline{X}_1 + \overline{X}_4X_3\overline{X}_2X_1 + \overline{X}_4X_3X_2X_1 + X_4X_3\overline{X}_2\overline{X}_1 + X_4X_3\overline{X}_2X_1 + X_4X_3X_2\overline{X}_1 + X_4X_3X_2X_1$$
$$L = \overline{X}_4m_4' + \overline{X}_4m_5' + \overline{X}_4m_7' + X_4m_4' + X_4m_5' + X_4m_6' + X_4m_7'$$
$$L = m_4'\left(\overline{X}_4 + X_4\right) + m_5'\left(\overline{X}_4 + X_4\right) + m_7'\left(\overline{X}_4 + X_4\right) + X_4m_6'$$
$$L = 1.m_4' + 1.m_5' + 1.m_7' + X_4m_6'$$
$$CBA = X_3X_2X_1$$

$$Y_{MUX} = D_0m_0 + D_1m_1 + D_2m_2 + D_3m_3 + D_4m_4 + D_5m_5 + D_6m_6 + D_7m_7$$
$$L = 1.m_4' + 1.m_5' + 1.m_7' + X_4m_6'$$
$$D_0 = 0 \qquad D_1 = 0 \qquad D_2 = 0 \qquad D_3 = 0$$
$$D_4 = 1 \qquad D_5 = 1 \qquad D_6 = X_4 \qquad D_7 = 1$$