25

F Series: SPP = 3.3 ns × 6 mW = 19.8 pJ
LS Series: SPP = 10 ns × 2.2 mW = 22 pJ
ALS Series: SPP = 7 ns × 1.4 mW = 9.8 pJ
ABT Series: SPP = 3.2 ns × 17 μW = 0.0544 pJ
HC Series: SPP = 7 ns × 2.75 μW = 0.01925 pJ
AC Series: SPP = 5 ns × 0.55 μW = 0.00275 pJ
AHC Series: SPP = 3.7 ns × 2.75 μW = 0.010175 pJ
LV Series: SPP = 9 ns × 1.6 μW = 0.0144 pJ
LVC Series: SPP = 4.3 ns × 0.8 μW = 0.00344 pJ
ALVC Series: SPP = 3 ns × 0.8 μW = 0.0024 pJ

ALVC has the lowest value for the Speed-power Product.

26.

(a) ALVC
(b) AHC
(c) AC
(d) ALVC

27. $\underline{74F\,xx}$ (a) A, B to X : $3 \times 3.3ns = 9.9ns$

$t_p = 3.3ns$ C, D to X : $2 \times 3.3ns = 6.6ns$

(b) $\underline{74HC\,XX}$

$t_p = 7ns$

A to X_1, X_2, X_3 = $2 \times 7ns = 14ns$

B to X_1 = $7ns$

C to X_2 = $7ns$

D to X_3 = $7ns$

(c) 74AHC XX A, B to X : $3 \times 3.7ns = 11.1ns$

$t_p = 3.7ns$ C, D to X : $2 \times 3.7ns = 7.4ns$

28 (a) HC has a $f_{max} = 50\,MHz$

$$f_{clock} = \frac{1}{50ns} = 20\,MHz$$

(b) LS has a $f_{max} = 33\,MHz$

$$f_{clock} = \frac{1}{60ns} = 16.7\,MHz$$

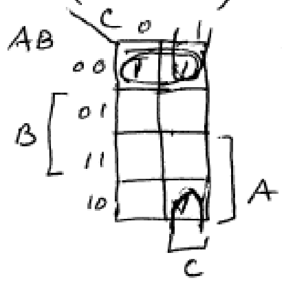
(c) AHC has a $f_{max} = 170\,MHz$

$$f_{clock} = \frac{1}{4ns} = 250\,MHz$$

Since $f_{clock} > f_{max}$ for AHC, the output will be eratic.

ch 4

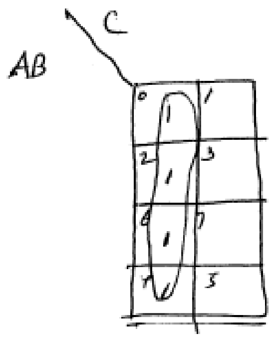
38 (a) $F = (\bar{A}\cdot\bar{B}\cdot\bar{C}) + (\bar{A}\cdot\bar{B}\cdot C) + (A\cdot\bar{B}\cdot C)$



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

No glitch

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



$F = \bar{C}$

No glitch

40 (d)

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

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

$$+ (A+\bar{A})\cdot(B\cdot\bar{C}\cdot D) + (A\cdot B\cdot C\cdot D)$$

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

$$+ \cancel{(A\cdot\bar{B}\cdot\bar{C}\cdot D)} + (A\cdot B\cdot C\cdot D) + \cancel{(A\cdot\bar{B}\cdot C\cdot D)} + (\bar{A}\cdot B\cdot C\cdot D)$$

$$+ (\bar{A}\cdot\bar{B}\cdot C\cdot D) + (A\cdot B\cdot\bar{C}\cdot D) + (\bar{A}\cdot B\cdot\bar{C}\cdot D) + (A\cdot B\cdot C\cdot D)$$

(drop two terms since $A+A=A$)

46 (b)

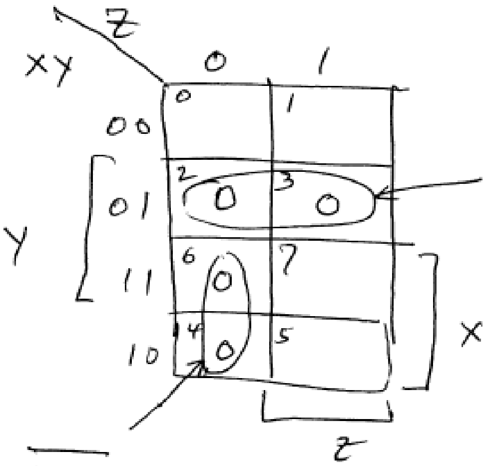
$$F = (x+\bar{y})\cdot(\bar{x}+z)\cdot(x+\bar{y}+\bar{z})(\bar{x}+\bar{y}+z)$$

$$= (x+\bar{y}+z\cdot\bar{z})\cdot(\bar{x}+z+y\cdot\bar{y})\cdot(x+\bar{y}+\bar{z})\cdot(\bar{x}+\bar{y}+z)$$

$$= (x+\bar{y}+z)\cdot(x+\bar{y}+\bar{z})\cdot(\bar{x}+y+z)\cdot(\bar{x}+\bar{y}+z)\cdot(x+\bar{y}+\bar{z})\cdot(\bar{x}+\bar{y}+z)$$

$$= M_2\cdot M_3\cdot M_4\cdot M_6\cdot M_3\cdot M_6$$

$$= M_2\cdot M_3\cdot M_4\cdot M_6$$



$$\overline{(\bar{x}\cdot y)} = (x+\bar{y})$$

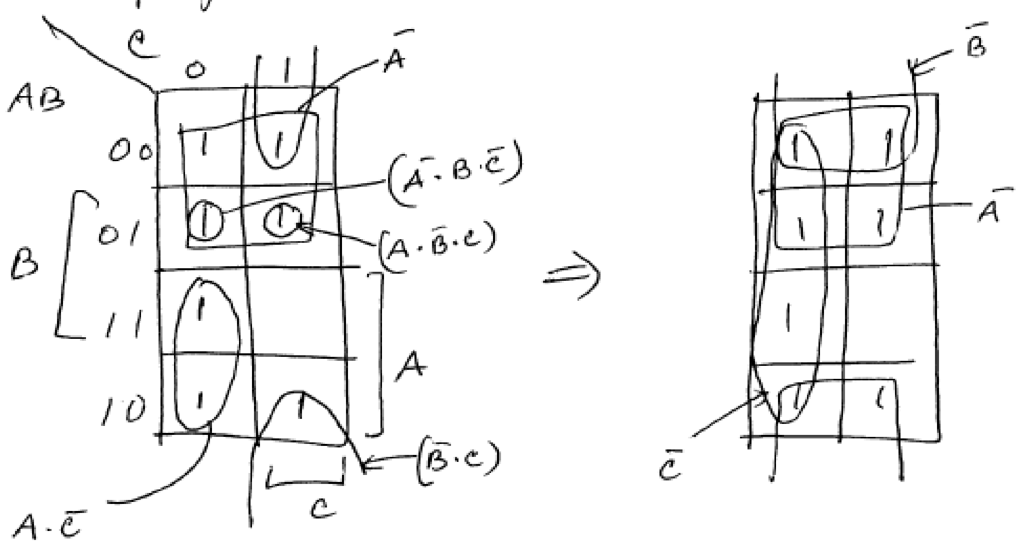
$$\overline{(x\cdot\bar{z})} = (\bar{x}+z)$$

$$\therefore F = (x+\bar{y})\cdot(\bar{x}+z)$$

46 (c) $F = A\cdot(B+\bar{C})\cdot(\bar{A}+C)\cdot(A+\bar{B}+C)\cdot(\bar{A}\cdot B\cdot\bar{C})$

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

∴ The K-map for $\bar{F}$ is

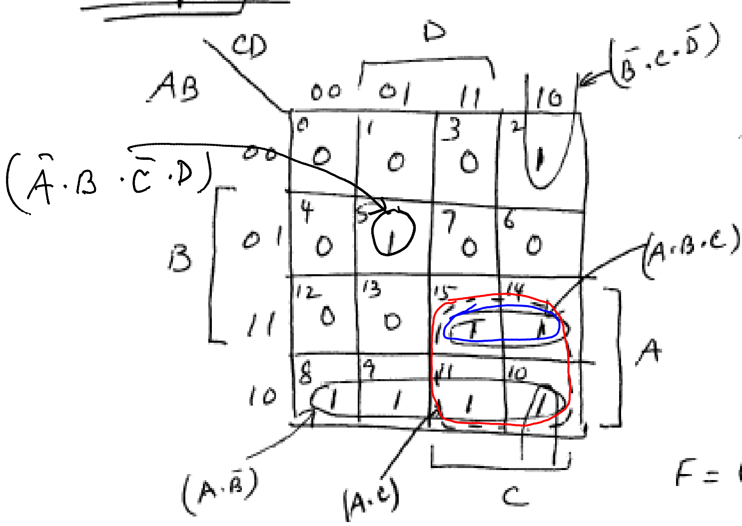


$$\therefore\ \bar{F} = \bar{A} + \bar{B} + \bar{C} \Rightarrow F = (A\cdot B\cdot C)$$

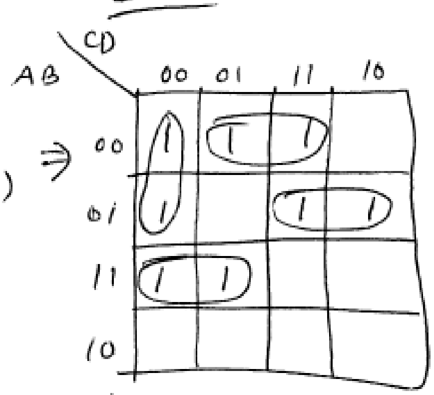
50 (b) $F = (\bar{A}+B)\cdot(\bar{A}+\bar{B}+\bar{C})\cdot(B+\bar{C}+D)\cdot(A+\bar{B}+C+\bar{D})$

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

<u>K-map for $\bar{F}$</u>



<u>K-map of F</u>



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

<u>For the POS expression</u>, remove $(\bar{A}+\bar{B}+\bar{C}) = \overline{(A\cdot B\cdot C)}$

+ add $\overline{(A\cdot C)} = (\bar{A}+\bar{C})$ to avoid static-0 hazard.

Thus, $\bar{F} = (A\cdot\bar{B}) + (\cancel{A\cdot B}\cdot C) + (\bar{B}\cdot C\cdot\bar{D}) + (\bar{A}\cdot B\cdot\bar{C}\cdot D) + (A\cdot C)$

$\therefore\ F = (\bar{A}+B)\cdot(B+\bar{C}+D)\cdot(A+\bar{B}+C+\bar{D})\cdot(\bar{A}+\bar{C})$

For the SOP expression add 4 more prime implicants to the expression derived earlier

$(\bar{A}\cdot\bar{B}\cdot\bar{C}) + (\bar{A}\cdot C\cdot D) + (B\cdot\bar{C}\cdot\bar{D}) + (\bar{A}\cdot B\cdot\bar{D})$