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# Midterm 1

Ch.(1)

1) a) D0 - $t_w = 1$, $T = 1$

$DC = (1ms/1ms)\,100\% = \boxed{100\%}$

D1) - $t_w = 2$, $T = 2$ $\rightarrow$ $DC = (2\mu s/2\mu s)\,100\% = \boxed{100\%}$

D2 - $t_w = 4$, $T = 4$ $\rightarrow$ $DC = (4\mu s/4\mu s)\,100\% = \boxed{100\%}$

D3 - $t_w = 8$, $T = 8$ $\rightarrow$ $DC = (8\mu s/8\mu s)\,100\% = \boxed{100\%}$

, from 0 to 15.

b) The sequence of numbers represents 4 sequences of bits.

2) NAND Gate

| A | B | X | ~X |
|---|---|---|---|
| 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |

X = EN

~X = ~EN


3) $f = 4MHz$ $\Rightarrow$

a) Bit rate (bits/s): $T = 1/f = 1/4MHz = (1/4\mu s)\cdot(16) = \boxed{4\,\mu s}$

(16 = bits length)

b) Bit rate: $T = 1/f = 1/4MHz = (1/4)\cdot(64) = \boxed{16\mu s}$

*serial

Ch. 2

2) a) 1024 (decimal) -

$1024 = 2^{10} = 10000000000$

b) 0xBBBB (hex) -

(hex) (binary) (decimal)

0 - 0000

B - 1011 - 11

B B B B

1011 1011 1011 1011 → 1011 1011 1011 1011

c) -2048 (decimal) -

$-2048 = 2^{11}$ - 1111 1000 0000 0000

2) a) 65535 (decimal) -

65535 / 16 → 16 | 65535 = F

4095 / 16 = 16 | 4095 = 255

255 / 16 = 15, R. F

15 / 16 = 0 R. 15 (F)

FFFF

b) 1000 1000 1000 1000 (binary)

8 8 8 8 → 8888 (hex)

3) base 8 : 1024 (decimal)

1024/8 = 128 → 0

128/8 = 16 → 0

16/8 = 2 → 0

2/8 = 0.25 · 8 → 2

1024 → 2000 (octal)

0.25 · 8 = 2.00

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4) a) $\theta = 180°$, 8 bit changes

b) final Gray code: 1101

c) 16 distinct angles, $360/16 = 22.5°$ angular precision

d) $360/256 = 1.4°$ angular precision

Ch.3

1) $A(AB)\ (AB)B\ A(\overline{AB})\ (\overline{AB})B$

$A(\overline{AB})\ \overline{(AB)}B + A(\overline{AB})\ (\overline{AB})B$

$\overline{A} + (AB)A + (AB) + \overline{B} + \overline{A} + \overline{(AB)} + (AB) + \overline{B}$

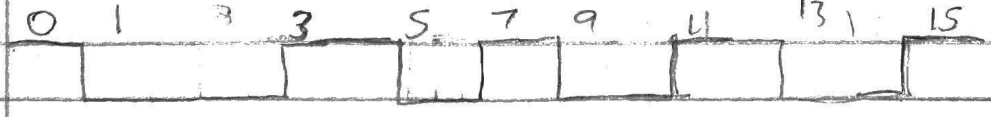
XNOR GATE

| A | B | X |
|---|---|---|
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 1 | 1 |
| 0 | 0 | 1 |

← truth table circuit

2) a = D0, b = D1

| a | b | X |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |



3)

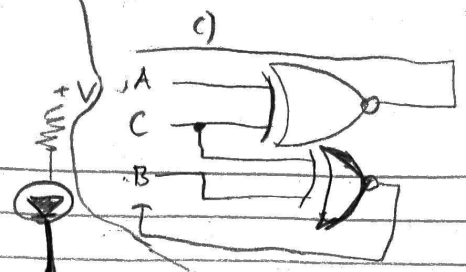
a) A low, B low → high

↑ Table's Low, produces red light

b) A low, B high → low

↑ Table Low/High, produces "Yellow" light

c)




Ch.4-

1) a)

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

b) $F = \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}\bar{C}D + ABC\bar{D} + ABCD$

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

c) **D** seems like the irrelevant statement.

$$ABC\underbrace{(\bar{D}+D)}_{1} + \bar{A}\bar{B}\bar{C}\underbrace{(\bar{D}+D)}_{1} = ABC + \bar{A}\bar{B}\bar{C}$$

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

Ch.4

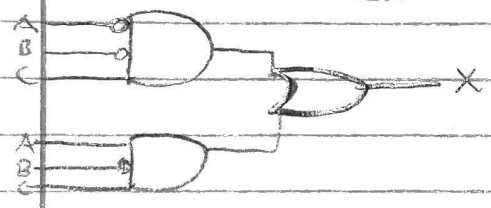
2) a)

| A | B | C | X |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 |

| F | $\bar{C}$ | C |
|---|---|---|
| AB | 0 | 1 |
| 00 | | 1 ← $\bar{A}\bar{B}C$ |
| 01 | | |
| 11 | | |
| 10 | | 1 ← $A\bar{B}C$ |

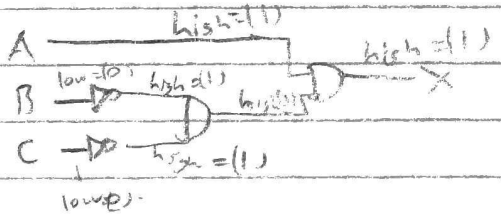
b) $F = \bar{A}\bar{B}C + A\bar{B}C = X$

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




Ch.5 10

1)




2) Yes, the desired output will be generated as the actual output will be 60ns, which is greater than the minimum 25ns.

60ns > 25ns

10ns - delay
1000ns - pulse width