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MATRICULA 20151015020169

VS de Eletrônica Digital

1. Efetue as seguintes conversões de base: (1,5pts)

a. $4673_8 \rightarrow (15311)_6$

b. $CAFE_{16} \rightarrow (145376)_8$

c. $221012_3 \rightarrow (835)_9$

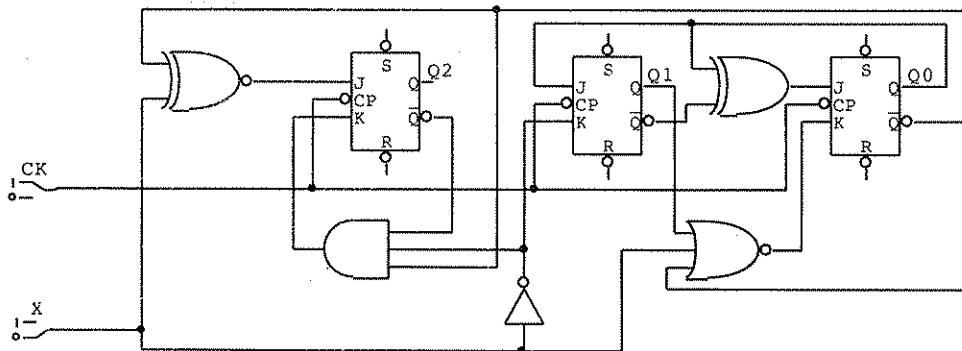
2. Dada a expressão, simplifique utilizando algebra de boole. (2,0pts)

$$S = \overline{(A \cdot B \cdot C + (\overline{B} \oplus D))} \cdot \overline{(B \cdot A + C + A + D)}$$

3. O código gray (código binário refletido) foi originalmente desenvolvido para prevenir ruídos de chaveamento (bounces) de chaves eletro-mecânicas. Hoje, é utilizado em correção de erros em sistemas de comunicação digital, encoders de posição, algoritmos genéticos, etc. Projete um decodificador que converta um número de 4 bits do código gray para o BCD. (3,0 pts)

| Código Gray | | | | Código BCD | | | |
|-------------|----|----|----|------------|---|---|---|
| GD | GC | GB | GA | D | C | B | A |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |

Dado os circuitos, encontre a sequência:



③

$$D = GD$$

$$C = GC \cdot \overline{GD}$$

$$B = \overline{GB} \cdot GC \cdot \overline{GD} + GB \cdot \overline{GC}$$

$$A = GA \cdot GD + GA \cdot \overline{GB} \cdot \overline{GC} + GA \cdot GB \cdot GC + \overline{GA} \cdot \overline{GB} \cdot GC \cdot \overline{GD} + \overline{GA} \cdot GB \cdot \overline{GC}$$

1. a)

$$\begin{aligned} & 4673_8 \\ & 3 \cdot 8^0 + 7 \cdot 8^1 + 6 \cdot 8^2 + 4 \cdot 8^3 \\ & 3 \cdot 1 + 7 \cdot 8 + 6 \cdot 64 + 4 \cdot 512 \\ & 3 + 56 + 384 + 2048 \\ & 2491_{10} \end{aligned}$$

$$\begin{array}{r} 249116 \quad 41516 \quad 6916 \quad 1116 \\ (1) \quad 415 \quad (1) 69 \quad (3) 11 \quad (5) 1 \end{array}$$

$$15311_6$$

b) $CAFE_{16}$

$$16 \cdot 2^4$$

$$1100 \ 1010 \ 1111 \ 1110$$

$$\begin{array}{r} 001 \ 100 \ 101 \ 011 \ 111 \ 110 \\ 1 \quad 4 \quad 5 \quad 3 \quad 7 \quad 6 \end{array}$$

$$145376_8$$

c) 221012_3

$$2 \cdot 3^0 + 1 \cdot 3^1 + 0 \cdot 3^2 + 1 \cdot 3^3 + 2 \cdot 3^4 + 2 \cdot 3^5$$

$$2 + 3 + 27 + 162 + 486$$

$$680_{10}$$

$$\begin{array}{r} 68019 \quad 7519 \\ 5 \quad 75 \quad 3 \quad 8 \end{array}$$

$$\boxed{835_9}$$

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

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

$$S = \bar{A} + B + \bar{C} + \bar{B} \bar{D} + BD + \cancel{B \cdot A} + \bar{C} \bar{A} \bar{D}$$

$$BA + B = B$$

$$S = \bar{A} + \bar{C} + \bar{B} \bar{D} + \cancel{BD} + \bar{C} \bar{A} \bar{D} + B$$

$$S = \bar{A} + B + \bar{C} + \bar{B} \bar{D} + \cancel{\bar{C} \bar{A} \bar{D}}$$

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

$$\boxed{S = \bar{A} + B + \bar{C} + \bar{B} \bar{D}} = \bar{A} + B + \bar{C} + \bar{D}$$

D

| | GA | \overline{GA} | | |
|-----------------|-----------------|-----------------|-----------------|---|
| GB | 0 | 0 | 0 | 0 |
| \overline{GB} | X | X | X | X |
| | X | 1 | 1 | X |
| | 0 | 0 | 0 | 0 |
| | \overline{GC} | GC | \overline{GC} | |

C

| | GA | \overline{GA} | | |
|-----------------|-----------------|-----------------|-----------------|---|
| GB | 0 | 1 | 1 | 0 |
| \overline{GB} | X | X | X | X |
| | X | 0 | 0 | X |
| | 0 | 1 | 1 | 0 |
| | \overline{GC} | GC | \overline{GC} | |

$D = GD$

~~$C = GC + \overline{GD}$~~

$C = GC \cdot \overline{GD}$

B

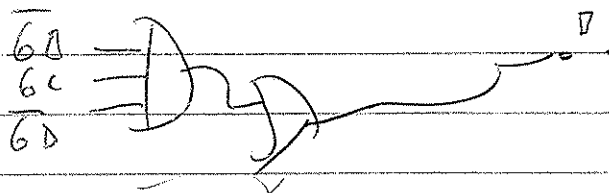
| | GA | \overline{GA} | | |
|-----------------|-----------------|-----------------|-----------------|---|
| GB | 1 | 0 | 0 | 1 |
| \overline{GB} | X | X | X | X |
| | X | 0 | 0 | X |
| | 0 | 1 | 1 | 0 |
| | \overline{GC} | GC | \overline{GC} | |

A

| | GA | \overline{GA} | | |
|-----------------|-----------------|-----------------|-----------------|---|
| GB | 0 | 1 | 0 | 1 |
| \overline{GB} | X | X | X | X |
| | X | 1 | 0 | X |
| | 1 | 0 | 1 | 0 |
| | \overline{GC} | GC | \overline{GC} | |

$B = \overline{GB} \cdot GC \cdot \overline{GD} + GB \cdot \overline{GC}$

$A = GA \cdot GD + GA \cdot \overline{GB} \cdot \overline{GC} + GA \cdot GB \cdot GC + \overline{GA} \cdot \overline{GB} \cdot GC \cdot \overline{GD} + \overline{GA} \cdot GB \cdot \overline{GC}$



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| X | Q ₂ | Q ₁ | Q ₀ | J ₂ | K ₂ | J ₁ | K ₁ | J ₀ | K ₀ | Q ₂ | Q ₁ | Q ₀ |
|---|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |

$$J_2 = \overline{Q_0} \odot X$$

$$K_2 = \overline{Q_2} \cdot \overline{X} \cdot \overline{Q_0}$$

$$J_1 = Q_0$$

$$K_1 = \overline{X}$$

$$J_0 = Q_0 \oplus \overline{Q_1}$$

$$K_0 = Q_1 + X + \overline{Q_0}$$

