PRACTICAL 2A: NAND GATE REPRESENTATION

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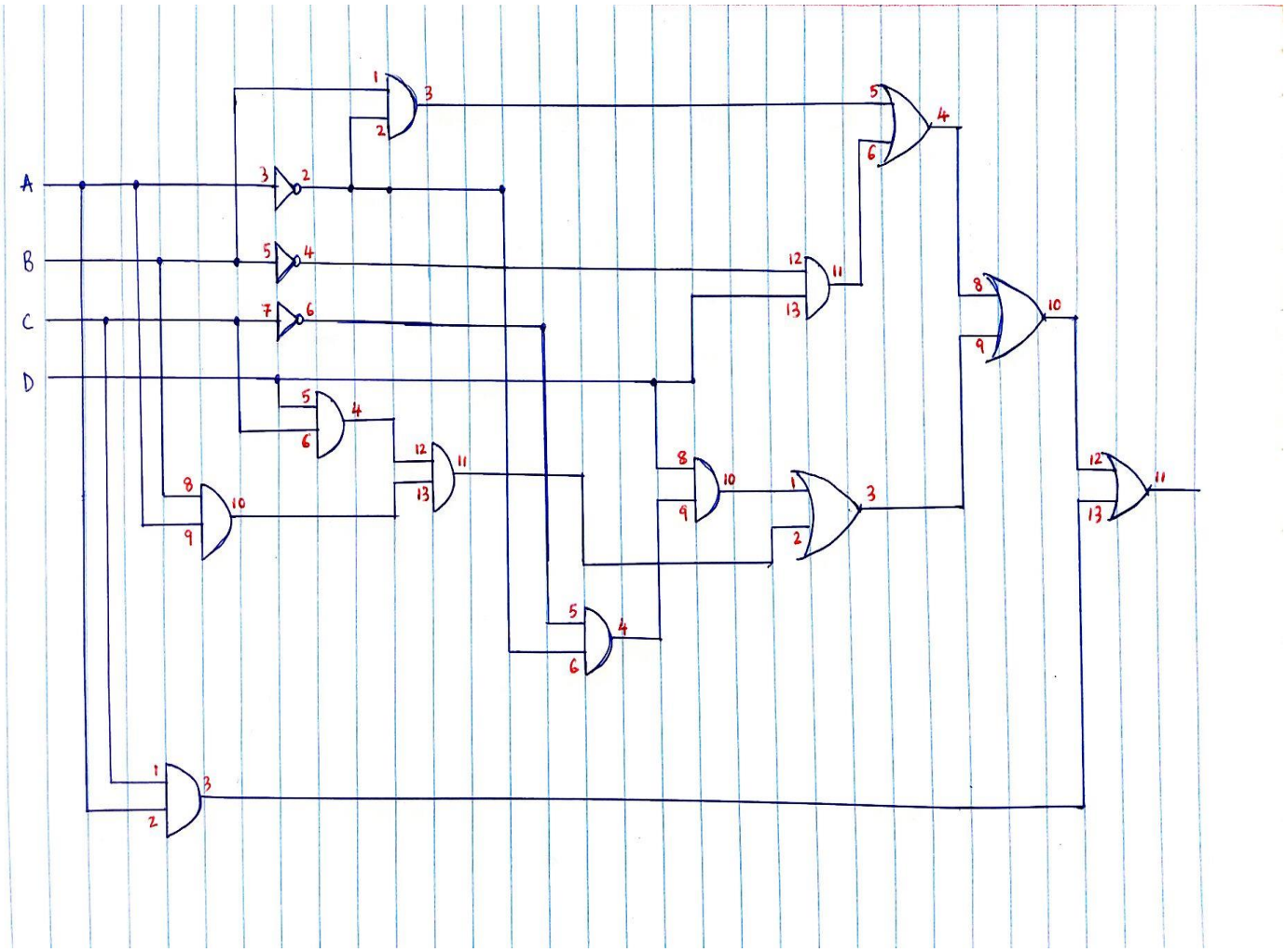
Signature

18-04-2018

Date

Solutions

a) Y = (A . B . C . D) + ($\bar{A}$. B) + (A . C) + (!B . D) + ($\bar{A}$. !C . D)



b) It will need Four 4000 series logic chips.

- 1 Quad 2-input OR-gate (4071)
- 2 Quad 2-input AND-gate (4081)
- 1 Hex Buffer Inverter (4049)

c)

A	B	C	D	(A.B.C.D)	(Ā.B)	(A.C)	(!B.D)	(Ā.!C.D)	Y
0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1	1	1
0	0	1	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1	0	1
0	1	0	0	0	1	0	0	0	1
0	1	0	1	0	1	0	0	1	1
0	1	1	0	0	1	0	0	0	1
0	1	1	1	0	1	0	0	0	1
1	0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	1	0	1
1	0	1	0	0	0	1	0	0	1
1	0	1	1	0	0	1	1	0	1
1	1	0	0	0	0	0	0	0	0
1	1	0	1	0	0	0	0	0	0
1	1	1	0	0	0	1	0	0	1
1	1	1	1	1	0	1	0	0	1

d) **Sum of minterms = Sum of Products**

Y = (!A . !B . !C . D) **+** (!A . !B . C. D) **+** (!A . B . !C . !D) **+** (!A . B . !C . D) **+** (!A . B . C . !D) **+** (!A . B . C . D) **+**

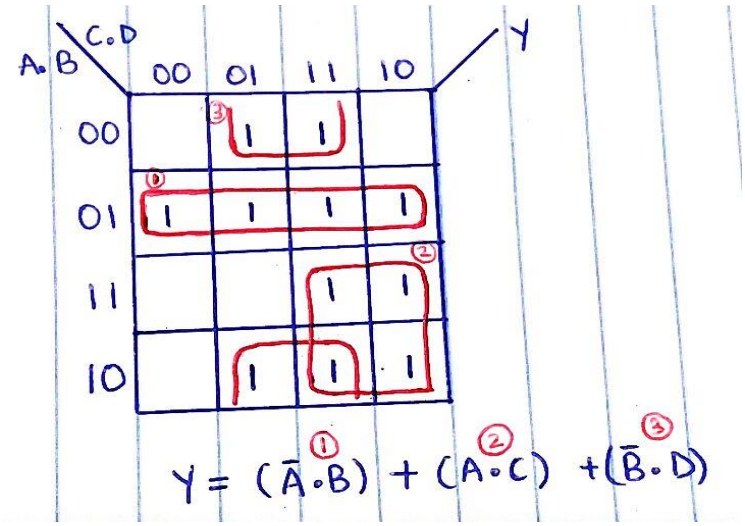
(A . !B . !C . D) **+** (A . !B . C . !D) **+** (A . !B . C . D) **+** (A . B . C . !D) **+** (A . B . C . D)

e) **Product of maxterms = Product of Sum**

Y = (A + B + C + D) **.** (A + B + !C + D) **.** (!A + B + C +D) **.** (!A + !B + C + D) **.** (!A + !B + C + !D)

f)

KARNAUGH MAP



g) **Y = (!A . B) + (A . C) + (!B . D)**

Y = !(!((!A . B) + (A . C) + (!B . D)))

Y = !(!((!A . B)) . !((A . C)) . !((!B . D)))

Y = !(!(!(!A.A) . B) . !(A . C) . !(!(B.B) . D)) //Simplified Version

For more complex but detailed circuit; join two of the expressions with a NAND gate and then NAND the output with itself

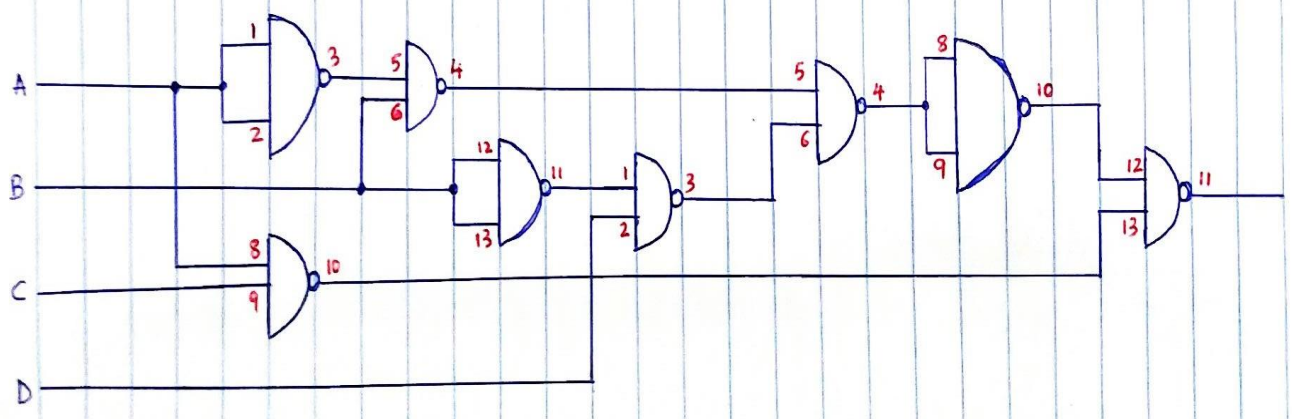
Y = !(!(!(!A.A) . B) . !(!(B.B) . D) . !(A . C))

Y = !(!(!(!(A.A).B) . !(!(B.B).D)) . !(A . C))

Y = !(!(!(!(!(A.A).B) . !(!(B.B).D)) . !(!(!(A.A).B) . !(!(B.B).D))) . !(A . C))

h)

$$Y = \overline{\overline{[(\overline{A \cdot A}) \cdot B]} \cdot (\overline{A \cdot C}) \cdot \overline{[(\overline{B \cdot B}) \cdot D]}}$$



j)

Y = !(!(!(A.A) . B) . !(A . C) . !(!(B.B) . D))

A	B	C	D	!(A.A)	!(!(A.A) .B)	!(A.C)	!(B.B)	!(!(B.B) .D)	Y	VERIFIED
0	0	0	0	1	1	1	1	1	0	0
0	0	0	1	1	1	1	1	0	1	1
0	0	1	0	1	1	1	1	1	0	0
0	0	1	1	1	1	1	1	0	1	1
0	1	0	0	1	0	1	0	1	1	1
0	1	0	1	1	0	1	0	1	1	1
0	1	1	0	1	0	1	0	1	1	1
0	1	1	1	1	0	1	0	1	1	1
1	0	0	0	0	1	1	1	1	0	0
1	0	0	1	0	1	1	1	0	1	1
1	0	1	0	0	1	0	1	1	1	1
1	0	1	1	0	1	0	1	0	1	1
1	1	0	0	0	1	1	0	1	0	0
1	1	0	1	0	1	1	0	1	0	0
1	1	1	0	0	1	0	0	1	1	1
1	1	1	1	0	1	0	0	1	1	1