

Introduction to Informatics

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Revision

- ▶ Which numbers were represented with the IEEE 754 floating point standard?
 - $01000100110111101110100000000000_{(2)} - 44DEE800_{(16)}$
- ▶ Represent the following decimal numbers in 32 bits using the IEEE 754 floating point standard.
 - $-4232.37_{(10)}$
- ▶ Represent $455.6_{(10)}$ number in **octal** system.
 - starting with sign bit
 - the exponent will be 1 digit (in 3 bits), excess-4
 - the fraction part 4 digits
- ▶ Represent $-53214_{(10)}$ number in **hexadecimal** system.
 - starting with sign bit
 - the exponent will be 1 nibble (4 bits), excess-8
 - the fraction part 4 digits

Unicode UTF-8

0xxxxxxx

110xxxxx **10**xxxxxxx

1110xxxx **10**xxxxxxx **10**xxxxxxx

11110xxx **10**xxxxxxx **10**xxxxxxx **10**xxxxxxx

111110xx **10**xxxxxxx **10**xxxxxxx **10**xxxxxxx **10**xxxxxxx

1111110x **10**xxxxxxx **10**xxxxxxx **10**xxxxxxx **10**xxxxxxx **10**xxxxxxx

Exercise

1. Give the Unicode value of the BMP plane's given character and the encoding of UTF-8 in the hexadecimal form.

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	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F
0x3040		あ	あ	い	い	う	う	え	え	お	お	か	が	き	ぎ	く
0x3050	ぐ	け	げ	こ	こ	さ	ざ	し	じ	す	ず	せ	ぜ	そ	ぞ	た
0x3060	だ	ち	ち	っ	っ	づ	て	で	と	ど	な	に	ぬ	ね	の	は
0x3070	ば	ぱ	ひ	び	び	ふ	ぶ	ぷ	へ	べ	ぺ	ほ	ぼ	ぽ	ま	み
0x3080	む	め	も	や	や	ゆ	ゆ	よ	よ	ら	り	る	れ	ろ	わ	わ
0x3090	ゐ	ゑ	を	ん	う					"	°	ゝ	ゞ	ゝ	ゞ	

Solution

- ▶ U+3086
- ▶ 11 0000 1000 0110
- ▶ 1110xxxx 10xxxxxx 10xxxxxx
- ▶ 11100011 10000010 10000110
- ▶ E38286

Exercise

2. Give the Unicode value of the BMP plane's given character and the encoding of UTF-8 in the hexadecimal form.

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	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F
0x3040		あ	あ	い	い	う	う	え	え	お	お	か	が	き	ぎ	く
0x3050	ぐ	け	げ	こ	こ	さ	ざ	し	じ	す	ず	せ	ぜ	そ	ぞ	た
0x3060	だ	ち	ち	っ	っ	づ	て	で	と	ど	な	に	ぬ	ね	の	は
0x3070	ば	ぱ	ひ	び	び	ふ	ぶ	ぷ	へ	べ	ぺ	ほ	ぼ	ぽ	ま	み
0x3080	む	め	も	や	や	ゆ	ゆ	よ	よ	ら	り	る	れ	ろ	わ	わ
0x3090	ゐ	ゑ	を	ん	う					"	°	°	°	ゝ	ゞ	

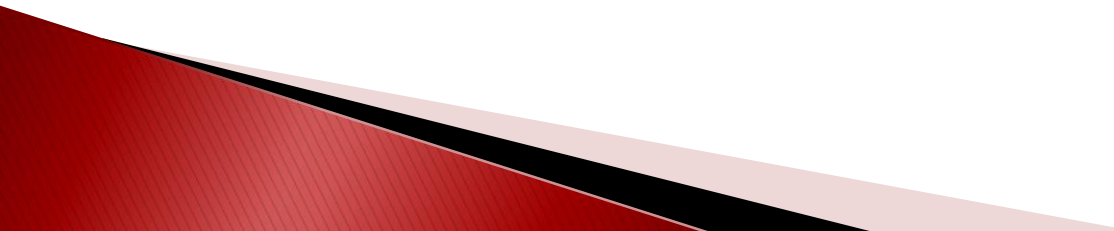
Solution

- ▶ U+307F
- ▶ 11 0000 0111 1111
- ▶ 1110xxxx 10xxxxxx 10xxxxxx
- ▶ 11100011 10000001 10111111
- ▶ E381BF

Exercise

3. Give the Unicode value of the BMP plane's given character and the encoding of UTF-8 in the hexadecimal form.

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[illegible]

Solution

- ▶ U+2D5E
- ▶ 10 1101 0101 1110
- ▶ 1110xxxx 10xxxxxx 10xxxxxx
- ▶ 11100010 10110101 10011110
- ▶ E2B59E

Exercise

4. Give the Unicode value of the BMP plane's given character and the encoding of UTF-8 in the hexadecimal form.

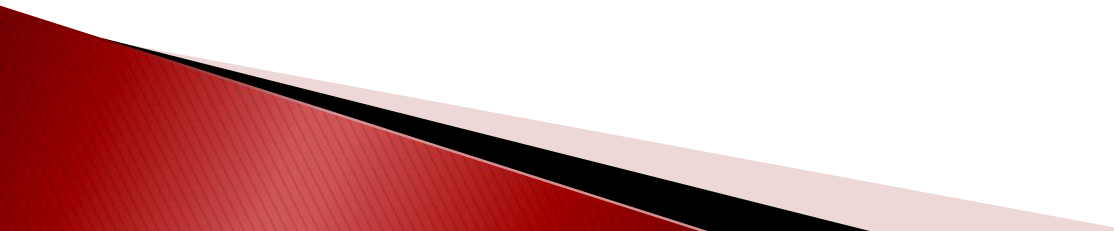
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	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F
0x30a0		ア	ア	イ	イ	ウ	ウ	エ	エ	オ	オ	カ	ガ	キ	ギ	ク
0x30b0	グ	ケ	ゲ	コ	ゴ	サ	ザ	シ	ジ	ス	ズ	セ	ゼ	ソ	ゾ	タ
0x30c0	ダ	チ	ヂ	ツ	ツ	ヅ	テ	デ	ト	ド	ナ	ニ	ヌ	ネ	ノ	ハ
0x30d0	バ	パ	ヒ	ビ	ピ	フ	ブ	プ	ヘ	ベ	ペ	ホ	ボ	ポ	マ	ミ
0x30e0	ム	メ	モ	ヤ	ヤ	ユ	ユ	ヨ	ヨ	ラ	リ	ル	レ	ロ	ワ	ワ
0x30f0	ヰ	ヱ	ヲ	ン	ヴ	カ	ケ	ヅ	ヰ	ヱ	ヲ	・	ー	ヽ	ヾ	

Solution

- ▶ U+30CD
- ▶ 11 0000 1100 1101
- ▶ 1110xxxx 10xxxxxx 10xxxxxx
- ▶ 11100011 10000011 10001011
- ▶ E3838D

Backwards calculation

- ▶ Which characters were encoded in this hexadecimal UTF-8 form?
 - ▶ CE B1
 - ▶ C5 9E
 - ▶ E2 91 B1
 - ▶ EF BC A0
 - ▶ F0 98 86 88
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Backwards – Solution

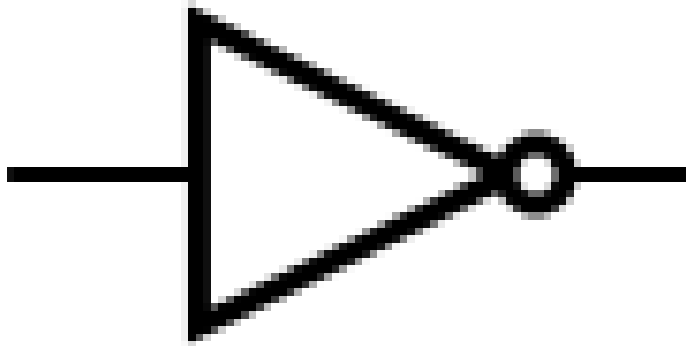
- ▶ Which characters were encoded in this hexadecimal UTF-8 form?
- ▶ CE B1 \rightarrow U+03B1 \rightarrow α
- ▶ C5 9E \rightarrow U+015E \rightarrow Š
- ▶ E2 91 B1 \rightarrow U+2471 \rightarrow ⑱
- ▶ EF BC A0 \rightarrow U+FF20 \rightarrow @
- ▶ F0 98 86 88 \rightarrow U+18188

Unicode table and converter

- ▶ Unicode table:
 - <http://www.tamasoft.co.jp/en/general-info/unicode.html>
- ▶ Unicode converter
 - <http://rishida.net/tools/conversion/>

Logical NOT operation

NOT gate

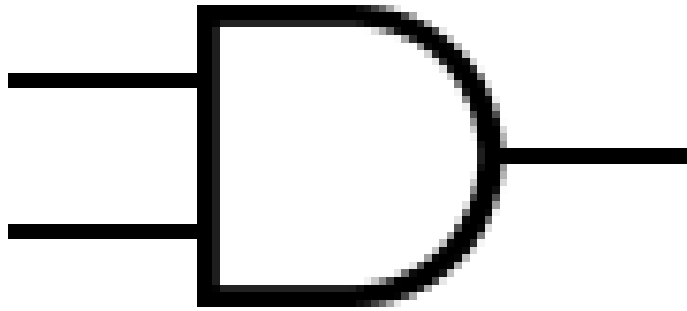


A	Q
0	1
1	0

$$\text{NOT } A = \bar{A}$$

Logical AND operation

AND gate

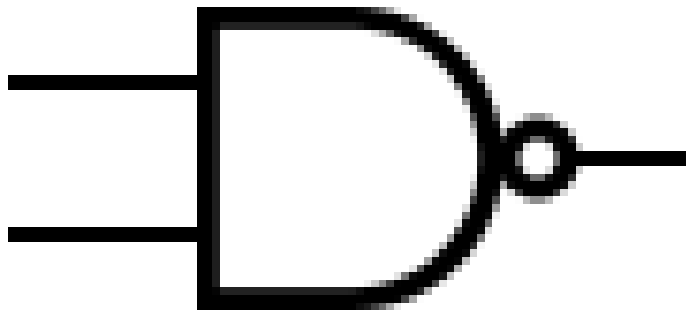


$$A \text{ AND } B = A \cdot B$$

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

Logical NAND operation

NAND gate

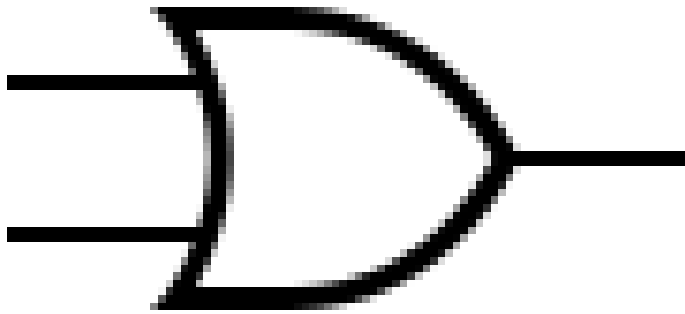


$$A \text{ NAND } B = \overline{A \cdot B}$$

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

Logical OR operation

OR gate

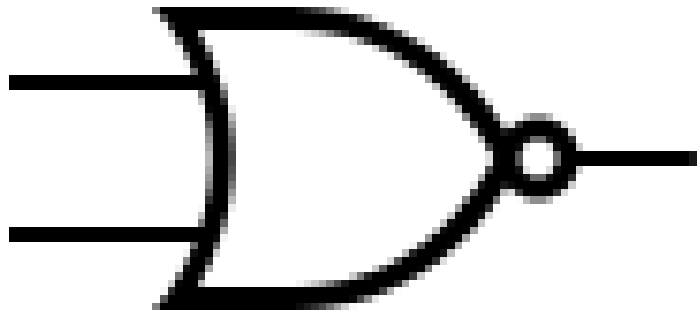


$$A \text{ OR } B = A + B$$

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

Logical NOR operation

NOR gate

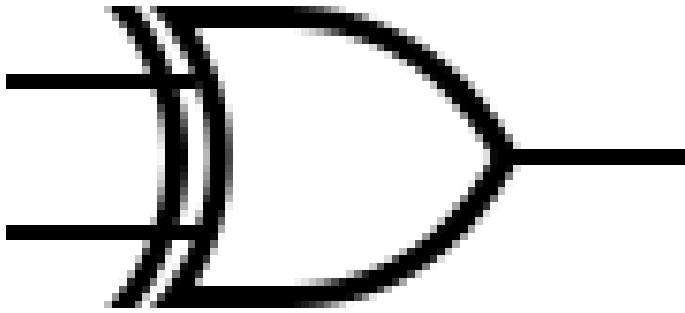


$$A \text{ NOR } B = \overline{A + B}$$

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

Logical XOR operation

XOR gate

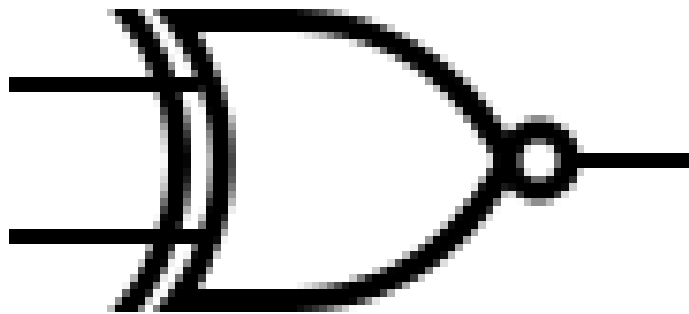


$$A \text{ XOR } B = A \oplus B$$

$$A \cdot \overline{B} + \overline{A} \cdot B$$

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

Logical XNOR operation



$$A \text{ XNOR } B = \overline{A \oplus B}$$

$$A \cdot B + \overline{A} \cdot \overline{B}$$

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

Truth Table

A	B	NOT A	A AND B	A NAND B	A OR B	A NOR B	A XOR B	A XNOR B
0	0	1	0	1	0	1	0	1
0	1	1	0	1	1	0	1	0
1	0	0	0	1	1	0	1	0
1	1	0	1	0	1	0	0	1

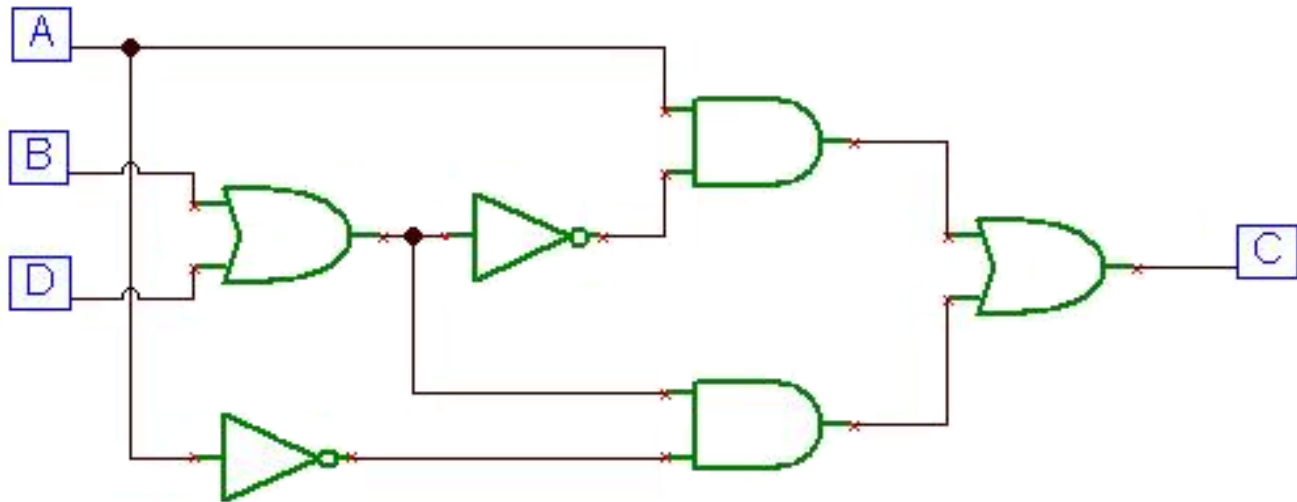
Exercise

Calculate the following logical operations.

1. **NOT** (01110101 **AND** 10010011)=
2. 10110011 **XOR** (11001010 **AND** 10110111)=
3. **NOT**(11001011 **OR** 10111011)=
4. 01011010 **NXOR** 10000011=
5. **NOT**(01001010) **OR** (10110011 **NOR** 10110111)=
6. 11110101 **AND** (11010011 **XOR** 10111101)=
7. (01001010 **OR** 10110011) **AND** (11000001)=
8. 01001010 **XOR** (10110011 **NAND** 11110111)=

Exercise

1. Describe the following circuit with logic expression.
According to this give the mathematical equivalents.
What is the value of expression, if $A=0$, $B=1$, $D=0$?



Solution

(A AND NOT(B OR D)) OR ((B OR D) AND NOT(A))

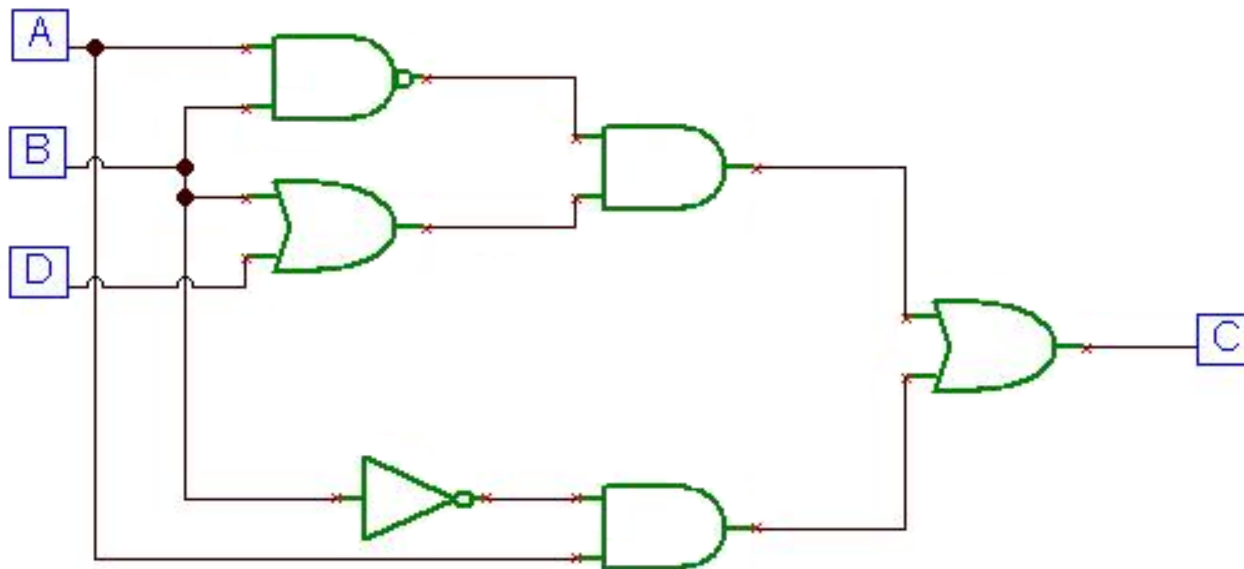
$$\left[A \cdot \overline{(B + D)}\right] + \left[(B + D) \cdot \overline{A}\right]$$

1



Exercise

2. Describe the following circuit with logic expression.
According to this give the mathematical equivalents.
What is the value of expression, if $A=0$, $B=1$, $D=0$?



Solution

(NOT(A AND B) AND (B OR D)) OR (NOT(B) AND A)

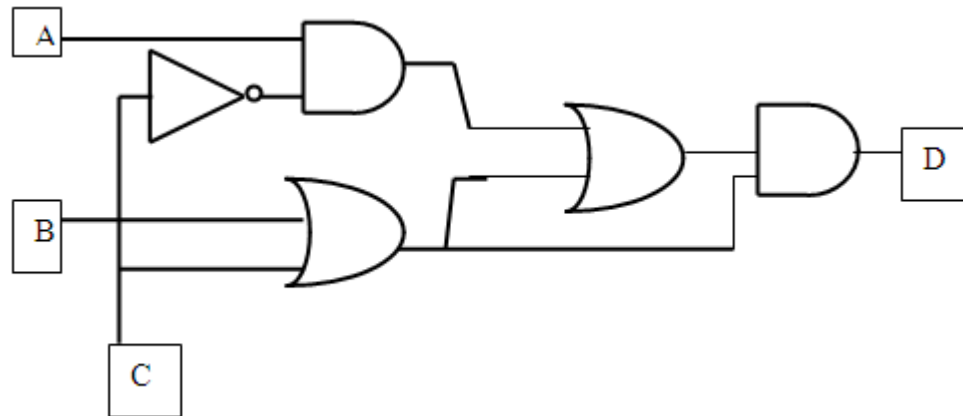
$$\left[\overline{(A \cdot B)} \cdot (B + D) \right] + (\bar{B} \cdot A)$$

1



Exercise

3. Describe the following circuit with logic expression.
According to this give the mathematical equivalents.
What is the value of expression, if $A=1$, $B=1$, $C=1$?



Solution

$$((A \text{ AND } (\text{NOT } C)) \text{ OR } (B \text{ OR } C)) \text{ AND } (B \text{ OR } C) = D$$

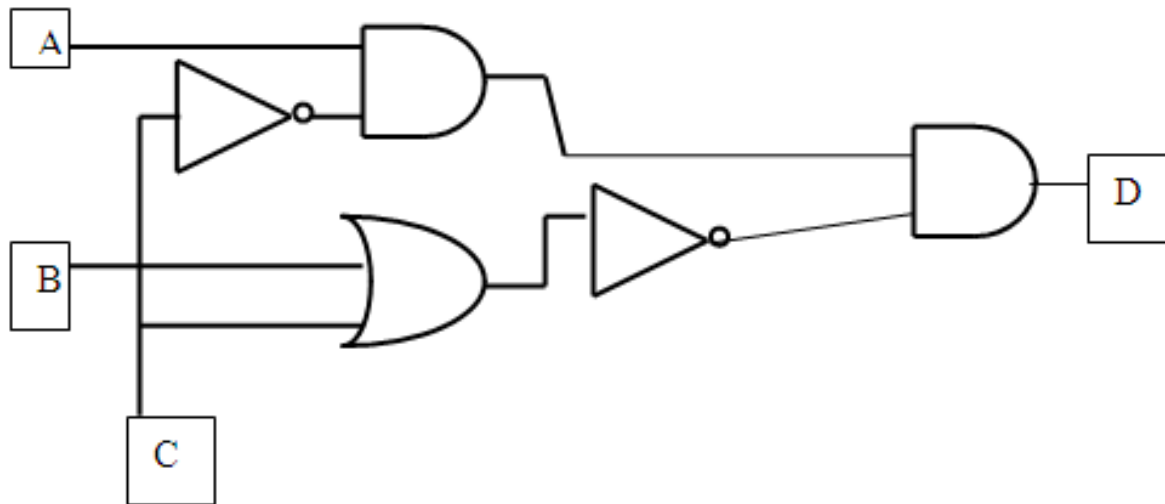
$$(A \cdot \bar{C} + B + C) \cdot (B + C) = D$$

1



Exercise

4. Describe the following circuit with logic expression.
According to this give the mathematical equivalents.
What is the value of expression, if $A=0$, $B=0$, $C=0$?



Solution

(A AND (NOT C)) AND (NOT (B OR C))=D

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

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Logic gate simulator

[http://www.electrosight.com/
logic-gate-simulator](http://www.electrosight.com/logic-gate-simulator)

