

FULL SUBTRACTOR

(i) Definition - The full-subtractor is a combinational circuit which is used to perform subtraction of three single bits.

(ii) No. of inputs and outputs

Number of inputs – 3

Number of outputs – 2

(iii) Assigning symbols

Symbols of inputs – X, Y, Z

Symbols of outputs – D (difference) and B (borrow)

(iv) Truth table

INPUT			OUTPUT	
X	Y	Z	D	B
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0

1	1	0	0	0
1	1	1	1	1

(v) Boolean equation

$$D = X'Y'Z + X'YZ' + XY'Z' + XYZ$$

$$= X'(Y'Z + YZ') + X(Y'Z' + YZ)$$

$$= X'(Y \text{ (XOR) } Z) + X(Y \text{ (XNOR) } Z)$$

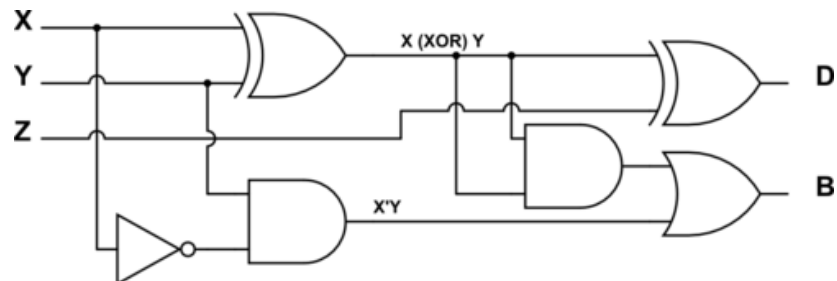
$$= X \text{ (XOR) } Y \text{ (XOR) } Z$$

$$B = X'Y'Z + X'YZ' + X'YZ + XYZ$$

$$= Z(X'Y + XY') + X'Y(Z' + Z)$$

$$= Z(X \text{ (XOR) } Y) + X'Y$$

(vi) Logic Diagram



Source: <http://www.knowelectronics.org/full-subtractor/>