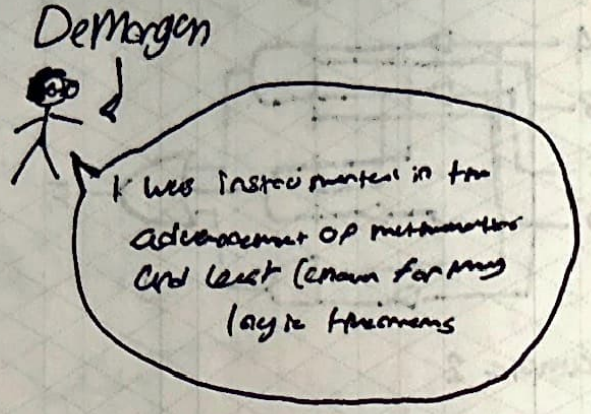
DeMorgan's Theorems

DeMorgan's Theorems are two additional simplification techniques that can be used to simplify Boolean expressions

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

Augustus DeMorgan

English mathematician born in India in 1806



DeMorgan's Theorem #1

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

A	B	$\overline{A\cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

=

A	B	$\bar{A}+\bar{B}$
0	0	1
0	1	1
1	0	1
1	1	0

DeMorgan's Theorem #2

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

A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

=

A	B	$\bar{A}\cdot\bar{B}$
0	0	1
0	1	0
1	0	0
1	1	0

DeMorgan's Shortcut

$\overline{A\,|\,B} = \bar{A}+\bar{B}$ $\qquad$ $\overline{A\cdot B} = \bar{A}\,|\,\bar{B}$

$$F_1 = (X\cdot\bar{Y})\cdot(\bar{Y}+Z)$$
$$= \overline{\overline{(X\cdot\bar{Y})}+\overline{(\bar{Y}+Z)}} = (X\cdot\bar{Y})+(\bar{\bar{Y}}\cdot\bar{Z}) = \boxed{X\bar{Y}+Y\bar{Z}}$$

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Witness:	Date:	

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Title: 2.6 DeMorgan Theorems Circuit Simplification

$$F_2 = \overline{(\overline{x}+2)}\,\overline{(xy)}$$

$$= \overline{(\overline{x}+2)} + \overline{(xy)}$$

$$= (\overline{\overline{x}}\,\overline{2}) + xy$$

$$= x2 + xy$$

$$= x(2+y)$$

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