Section 2.6: More LOL

Wednesday, September 18, 2019 10:45 AM

De Morgan's:

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

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

examples: use De Morgan's to rewrite

1. $\overline{B+C} = \bar{B}\,\bar{C}$
2. $\overline{\bar{B}+C} = B\,\bar{C}$
3. $\overline{\bar{B}+\bar{C}} = B\,C$
4. $\overline{\text{☺} + \text{☹}} = \overline{\text{☺}}\ \overline{\text{☹}}$
5. $\overline{A\bar{C}} = \bar{A} + C$
6. $\bar{A}\,C = \overline{A + \bar{C}}$

when would you see this in code?

if (x = 5 or y = 2) then do ________
else do ________

under what conditions does the "else" clause occur?

$\Rightarrow$ when $(x = 5$ or $y = 2)$ is FALSE

in other words, when $x \neq 5$ AND $y \neq 2$

Distributive:

$$A(B + C) = AB + AC$$

$$A + BC = (A + B)(A + C)$$

examples: rewrite the following using the distributive law

① $\bar{C}(A + C) = \bar{C}A + \bar{C}C$

② $(A + B)(A + \bar{B}) = A + B\bar{B}$

③ $\bar{B} + \bar{A}\bar{C} = (\bar{B} + \bar{A})(\bar{B} + \bar{C})$

④ $\overline{AB}(B + \bar{C}) = \overline{AB}B + \overline{AB}\bar{C}$

Absorption:

$$A(A + B) = A$$

$$A(\bar{A} + B) = AB$$

$$A + AB = A$$

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

examples: use the absorption laws to rewrite the following:

$A(A+B) = A$

① $\bar{C}(\bar{C} + A) = \bar{C}$

② $\bar{C}(C + A) = \bar{C}A$

③ $AB + ABC = AB$

④ $\overline{AB} + ABC = \overline{AB} + C$

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⑤ $\bar{B} + BA = \bar{B} + A$

⑥ $C(A + C) = C$

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distributive: $(p \vee q) \wedge (p \vee r) \Leftrightarrow p \vee (q \wedge r)$

simplify:

$(\bar{p} \vee \bar{q}) \wedge (p \vee \bar{q})$

$\bar{q} \vee (\bar{p} \wedge p)$ distrib

$\bar{q} \vee 0$ complement

$\bar{q}$ identity

simplify $AB(\bar{A} + \bar{B})$

method #1	$AB\bar{A} + AB\bar{B}$	distrib
	$0 \cdot B + A \cdot 0$	complement
	$0 + 0$	identity
	0	identity idempotent definition of "or"

method #2:

	$AB(\bar{A} + \bar{B})$	
	$AB\,\overline{AB}$	De Morgan's
	0	complement

prove:

	$\overline{B \cdot 0} = \bar{A} + \overline{\bar{A}\bar{B}}$	
	$\bar{0} = \bar{A} + \overline{\bar{A}\bar{B}}$	identity
	$1 = \bar{A} + \overline{\bar{A}\bar{B}}$	definition of "not"
	$1 = \bar{A} + A + B$	De Morgans

$1 = 1 + B$ complement

$1 = 1$ identity

QED

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simplify: $\bar{B}(\bar{A}+B) + \bar{A}(\bar{A}+B)$

method #1 $\bar{B}\bar{A} + \bar{A}$ absorption

$\bar{A}$ absorption

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method #2: $\bar{B}(\bar{A}+B) + \bar{A}(\bar{A}+B)$

$\bar{B}\bar{A} + \bar{B}B + \bar{A}\bar{A} + \bar{A}B$ distributive

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

$\bar{B}\bar{A} + \bar{A}\bar{A} + \bar{A}B$ identity

$\bar{B}\bar{A} + \bar{A} + \bar{A}B$ idempotent

$\bar{A} + \bar{A}(\bar{B}+B)$	distrib	$\bar{B}\bar{A} + \bar{A}$	absorption
$\bar{A} + \bar{A}\cdot 1$	complement	$\bar{A}$	"
$\bar{A} + \bar{A}$	identity		

$\bar{A} + \bar{A}$ identity

$\bar{A}$ idempotent

method # 3 (4?)

$\bar{B}(\bar{A} + B) + \bar{A}(\bar{A} + B)$

$(\bar{A} + B)(\bar{B} + \bar{A})$ distributive

$\bar{A} + B\bar{B}$ "

$\bar{A} + 0$ complement

$\bar{A}$ identity