Section 1.10: cont'd

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8:38 AM

When would you see De Morgan's in code?

if $(x=5 \text{ or } y=2)$ then do ______
else do ______

under what conditions does the "else" clause occur?

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

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

Distributive:

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

example: rewrite the following using the distributive law

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

② $(A+B)(A+\bar{B}) = A + B\bar{B}$

or $= AA + A\bar{B} + AB + B\bar{B}$

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

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

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

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

2. $AB + ABC = AB$

3. $\overline{AB} + ABC = \overline{AB} + C$

4. $\bar{C}(C+A) = \bar{C}A$

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distrib:

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

simplify:

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

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

$\bar{q} \vee 0$ complement

$\bar{q}$ identity

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simplify:

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

method #1: $AB\bar{A} + AB\bar{B}$ distributive

$B \cdot 0 + A \cdot 0$ complement

$0 + 0$ identity

0 { idempotent / identity / definition of "or" }

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

$AB\,\overline{AB}$ De Morgan's

0 complement

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

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

prove:

$$\overline{B \cdot 0} = \bar{A} + \overline{\bar{A}\bar{B}}$$

$\bar{B} + 1 = \underbrace{\bar{A} + A} + B$ De Morgans

$\bar{B} + 1 = 1 + B$ complement

$1 = 1$ identity

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

$\overline{B \cdot 0} = \bar{B} + \bar{0}$

$= \bar{B} + 1$

$1 = 1$ identity

QED