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CS-225: Discrete Structures in CS

Homework 1, Part 1

Exercise Set 2.1 of the required textbook: Problem #5(b, c, d), #8(b, c, e), #26, #28, #29, #33, #35, #39, #43, #52

5. Indicate which of the following sentences are statements.

b. *Statement*

c. *Statement*

d. *Not a statement because the validity of the equation is based on the value of x. It can be either true or false base on the value of x.*

8. Let h = "John is healthy," w = "John is wealthy," and s = "John is wise."

b. John is not wealthy but he is healthy and wise. $\sim w \wedge (h \wedge s)$

c. John is neither healthy, wealthy, nor wise. $\sim h \wedge \sim w \wedge \sim s$

e. John is wealthy, but he is not both healthy and wise. $w \wedge \sim(h \wedge s)$

-Use De Morgan's laws to write negations for the statements in 25–30.

26. Sam is an orange belt and Kate is a red belt.

Sam is not an orange belt or Kate is not a red belt.

28. The train is late or my watch is fast.

The train is not late, and my watch is not fast.

29. This computer program has a logical error in the first ten lines or it is being run with an incomplete data set.

This computer program does not have a logical error in the first ten lines, and it is not being run with an incomplete data set.

33. $-10 < x < 2$

$-10 \geq x$ *or* $x \geq 2$

35. $x \leq -1$ or $x > 1$

$-1 > x \geq 1 \equiv -1 > x \wedge 1 \leq x$

-In 38 and 39, imagine that num_orders and num_instock are particular values, such as might occur during execution of a computer program. Write negations for the following statements.

39. (num_orders < 50 and num_instock > 300) or (50 </= num_orders < 75 and num_instock > 500) –

Statement = $(p \wedge q) \vee (\sim p \wedge r)$

Negation = $\sim(p \wedge q) \wedge \sim(\sim p \wedge r)$

43. $(\sim p \vee q) \vee (p \wedge \sim q)$

$\sim ((\sim p \vee q) \vee (p \wedge \sim q))$

$\sim(\sim p \vee q) \wedge \sim(p \wedge \sim q)$

$(p \wedge \sim q) \wedge (\sim p \vee q)$

52. $\sim(p \vee \sim q) \vee (\sim p \wedge \sim q) \equiv \sim p$

De Morgan's: $\sim(p \vee \sim q) \vee$ *$\sim(p \vee q)$* $\equiv \sim p$

De Morgan's: $\sim((p \vee \sim q) \wedge (p \vee q)) \equiv \sim p$

Distributive: $p \vee (\sim q \wedge q) \equiv \sim p$

Negation: $p \vee \mathbf{c} \equiv \sim p$

Identity: $p \equiv \sim p$