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CS-225: Discrete Structures in CS

Homework 1, Part 1

Exercise Set #2.1, Problem # 5 (b, c, d), #10, #(26, 28, 29, 30, 39), #42, #54

#5.

b. This is not a proposition as the pronoun "she" does not make a reference to anything. We cannot determine whether or not it is true or false – thus it is not a proposition/statement.

c. This is a proposition.

d. This is not a proposition, as the truth value of the variable x is not known.

#10.

a. $p \wedge q \wedge r$
b. $p \wedge \neg q$
c. $p \wedge (\neg q \vee \neg r)$
d. $\neg p \wedge q \wedge \neg r$
e. $\neg p \vee (q \wedge r)$

#26. Sam is **not** an orange belt **or** Kate is **not** a red belt.

#28. The train is **not** late **and** my watch is **not** fast.

#29. 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.

#30. The dollar is **not** at an all-time high **or** the stock market is **not** at a record low.

#39. [(num_orders ≥ 50) or (num_instock ≤ 300)] and [(num_orders < 50) or (num_orders ≥ 75) or (num_instock ≤ 500)]

(cont on page 2)

#42. $((\neg p \wedge q) \wedge (q \wedge r)) \wedge \neg q$

p	q	r	¬p	¬p ∧ q	q ∧ r	(¬p ∧ q) ∧ (q ∧ r)	¬q	((¬p ∧ q) ∧ (q ∧ r)) ∧ ¬q
T	T	T	F	F	T	F	F	F
T	T	F	F	F	F	F	F	F
T	F	T	F	F	F	F	T	F
T	F	F	F	F	F	F	T	F
F	T	T	T	T	T	T	F	F
F	T	F	T	T	F	F	F	F
F	F	T	T	F	F	F	T	F
F	F	F	T	F	F	F	T	F

As shown in the highlighted columns, the statements have differing truth values, so the statement form is a **contradiction**.

#54.

$(p \wedge (\neg (\neg p \vee q))) \vee (p \wedge q) \equiv (p \wedge (\neg(\neg p) \wedge \neg q)) \vee (p \wedge q)$ **De Morgan's laws**

$\equiv (p \wedge (p \wedge \neg q)) \vee (p \wedge q)$ **Double negative law**

$\equiv ((p \wedge p) \wedge \neg q) \vee (p \wedge q)$ **Associative laws**

$\equiv (p \wedge \neg q) \vee (p \wedge q)$ **Idempotent laws**

$\equiv p \wedge (\neg q \vee q)$ **Distributive laws**

$\equiv p \wedge (q \vee \neg q)$ **Commutative laws**

$\equiv p \wedge t$ **Negation laws**

$\equiv p$ **Identity laws**