Ximan Liu

CSC 400 - 802 Loop

Assignment HW #1

Section 1.2

8.b. Is $C \subseteq A$?

Yes, $C \subseteq A$. Both elements of C are in A.

8.c. Is $C \subseteq C$?

Yes, $C \subseteq C$. C is a subset of itself.

9.c. Is $\{2\} \in \{1,2\}$? No.

9d. Is $\{3\} \in \{1,\{2\},\{3\}\}$? YES.

9g. Is $\{1\} \subseteq \{1,2\}$? YES

Section 2.1

17. $\sim(p \wedge q)$ and $\sim p \wedge \sim q$

p	q	$p \wedge q$	$\sim(p \wedge q)$	$\sim p \wedge \sim q$
T	T	T	F	F
T	F	F	T	F
F	T	F	T	F
F	F	F	T	T

$\sim(p \wedge q)$ and $\sim p \wedge \sim q$ don't have the same truth values, so they are not logically equivalent.

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

37. negation of $0 > x \geq -7$

$-7 \leq x < 0$

$\equiv x < -7$ or $x \geq 0$

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

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

Its truth values are all T's, so $(\sim p \vee q) \vee (p \wedge \sim q)$ is a tautology.

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

$\equiv (\sim p \wedge q) \vee (\sim p \wedge \sim q)$ by the De Morgan's Laws

$\equiv \sim p \wedge (q \vee \sim q)$ by the distributive law and the negation law for $\vee$

$\equiv \sim p$

Section 2.2

13b. $\sim(p \to q) \equiv p \wedge \sim q$

p	q	$\sim q$	$p \to q$	$\sim(p \to q)$	$p \wedge \sim q$
T	T	F	T	F	F
T	F	T	F	T	T
F	T	F	T	F	F
F	F	T	T	F	F

$\sim(p \to q)$ and $p \wedge \sim q$ always have the same truth values, so they are logically equivalent.

20b. Today is New Year's Eve and tomorrow is not January.

~~38. If it rains, Ann will go.~~

38. If it doesn't rain, Ann will go.

46c. This statement must be true. It is the contrapositive of the given statement.

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46d. This statement is the inverse of the given statement, and so it is not necessarily true. For example, if the actual boiling point of compound X were 180°C, hence then the given statement would be true but the statement d would be false.

50a. $(p \to (q \to r)) \leftrightarrow ((p \wedge q) \to r)$

$\equiv (p \to (\sim q \vee r)) \leftrightarrow (\sim(p \wedge q) \vee r)$

$\equiv (\sim p \vee (\sim q \vee r)) \leftrightarrow ((\sim p \vee \sim q) \vee r)$

$\equiv ((\sim p \vee \sim q) \vee r) \leftrightarrow ((\sim p \vee \sim q) \vee r)$

$\equiv t$

Section 3.1

1d. True.

4a. $Q(2) = 2^2 = 4 < 30$.

$Q(-2) = (-2)^2 = 4 < 30$

$Q(7) = 7^2 = 49 \not< 30$

$Q(-7) = (-7)^2 = 49 \not< 30$

∴ The statements Q(7) and Q(-7) are false.

The statements Q(2) and Q(-2) are true.

4c. $Q(n) = \{1, 2, 3, 4, 5\}$

8.c. $B(x) = \{-8, -6, -4, -2, 0, 2, 4, 6, 8\}$

10. Counterexample:

Let $a = 1$. Then $(a-1)/a = 0$ is an integer

So this statement is false.

23b. ∀x, if x is a computer science student then x needs to take data structures.

∀ computer science student x, needs to take data structures.