Khrystian Clark

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. *∼w ∧ (h ∧ s)*

c. John is neither healthy, wealthy, nor wise. *∼h ∧ ∼ w ∧ ∼ s*

e. John is wealthy, but he is not both healthy and wise. *w ∧ ∼(h ∧ 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 ≥ x or x ≥ 2*

35. x≤ -1 or x >1

*-1>x≥ 1 ≡ -1>x ∧ 1≤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∧ q)∨ (~p∧ r)*

*Negation = ~(p ∧ q)∧ ~(~p∧ r)*

43. (∼p ∨ q) ∨ (p ∧ ∼q)

∼ ((∼p ∨ q) ∨ (p ∧ ∼q))

∼(∼p ∨ q) ∧ ∼(p ∧ ∼q)

*(p ∧ ∼q) ∧ (∼p ∨ q)*

52. ∼(p ∨ ∼q) ∨ (∼p ∧ ∼q) ≡ ∼p

De Morgan’s: ∼(p ∨ ∼q) ∨ *∼(p ∨ q)* ≡ ∼p

De Morgan’s: ∼((p ∨ ∼q) ∧ (p ∨ q)) ≡ ∼p

Distributive: p ∨ (∼q ∧ q) ≡ ∼p

Negation: p ∨ **c** ≡ ∼p

Identity: p ≡ ∼p