

5a) Statement

5b) Statement

5c) Statement

5d) Not a Statement

10a) $p \wedge q \wedge r$

10b) $p \wedge \sim q$

10c) $p \wedge (\sim q \vee r)$

10d) $\sim p \wedge q \wedge \sim r$

10e) $\sim p \oplus (q \wedge r)$

25) Hal is not a math major or Hal’s sister is not a computer science major.

26) Sam is not an orange belt or Katie is not a red belt.

27) The computer is not loose and the machine is plugged in.

28) The units digit of 4^{67} is 4 and it is not 6.

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.

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

31) The train is not late and my watch is not fast.

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

$\sim (p \vee \sim q) \vee (\sim p \wedge \sim q)$ **1. De Morgan’s Law**

$(\sim p \wedge \sim (\sim q)) \vee (\sim p \wedge \sim q)$ **2. Double Negation Law**

$(\sim p \wedge q) \vee (\sim p \wedge \sim q)$ **3. Distributive Law**

$(\sim p \wedge (q \vee \sim q))$ **4. Negation Law**

$(\sim p \wedge t)$ **5. Identity Law**

$\equiv \sim p$

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

$(p \wedge (\sim(\sim p \wedge \sim q))) \vee (p \wedge q)$ **1. De Morgan’s Law**

$(p \wedge (p \wedge \sim q)) \vee (p \wedge q)$ **2. Double Negative Law**

$((p \wedge p) \wedge \sim q) \vee (p \wedge q)$ **3. Associative Law**

$(p \wedge \sim q) \vee (p \wedge q)$ **4. Idempotent Law**

$p \wedge (\sim q \vee q)$ **5. Distributive Law**

$p \wedge t$ **6. Negation Law**

$\equiv p$ **7. Universal Bound Law**