DISCRETE MATHEMATICS –ASSIGNMENT NO.3

EXERCISE 1.3

3. Use truth tables to verify the commutative laws

a) $p \lor q \equiv q \lor p$.

b) $p \land q \equiv q \land p$.

4. Use truth tables to verify the associative laws

a) $(p \lor q) \lor r \equiv p \lor (q \lor r)$.

b) $(p \land q) \land r \equiv p \land (q \land r)$.

5. Use a truth table to verify the distributive law $p \land (q \lor r) \equiv (p \land q) \lor (p \land r)$.

6. Use a truth table to verify the first De Morgan law $\neg (p \land q) \equiv \neg p \lor \neg q$.

13. Use truth tables to verify the absorption laws.

a) $p \lor (p \land q) \equiv p$

b) $p \land (p \lor q) \equiv p$

EXERCISE 1.4

11. Let $P(x)$ be the statement "$x = x2$." If the domain consists of the integers, what are these truth values?

d) $P(-1)$

e) $\exists x\, P(x)$

f) $\forall x\, P(x)$

17. Suppose that the domain of the propositional function $P(x)$ consists of the integers 0, 1, 2, 3, and 4. Write out each of these propositions using disjunctions, conjunctions, and negations.

d) $\forall x\ \neg P(x)$

e) $\neg\exists x\, P(x)$

f) $\neg\forall x\, P(x)$

19. Suppose that the domain of the propositional function $P(x)$ consists of the integers 1, 2, 3, 4, and 5. Express these statements without using quantifiers, instead using only negations, disjunctions, and conjunctions.

c) $\neg\exists x\, P(x)$

d) $\neg\forall x\, P(x)$

e) $\forall x\, ((x \neq 3) \rightarrow P(x)) \lor \exists x\ \neg P(x)$

52. As mentioned in the text, the notation $\exists!\, x\, P(x)$ denotes
"There exists a unique x such that $P(x)$ is true."
If the domain consists of all integers, what are the truth values of these statements?

b) $\exists! x(x2 = 1)$

c) $\exists! x\ (x + 3 = 2x)$

d) $\exists! x(x = x + 1)$

EXERCISE 1.5

26. Let $Q(x, y)$ be the statement "$x + y = x - y$." If the domain for both variables consists of all integers, what are the truth values?

g) $\exists y\, \forall x\, Q(x, y)$

h) $\forall y\, \exists x\, Q(x, y)$

i) $\forall x\, \forall y\, Q(x, y)$