Solution 4

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1.4

10. a) $\exists x(C(x) \wedge D(x) \wedge F(X))$

b) $\forall x(C(x) \vee D(x) \vee F(X))$

c) $\exists x(C(x) \wedge D(x) \wedge \neg F(X))$

d) $\neg \exists x(C(x) \wedge D(x) \wedge F(X))$

e) $(\exists x C(x)) \wedge (\exists y D(y)) \wedge (\exists z F(z))$

18. Let P(x) be true.

a) $P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2)$

b) $P(-2) \wedge P(-1) \wedge P(0) \wedge P(1) \wedge P(2)$

c) $\neg(P(-2) \wedge P(-1) \wedge P(0) \wedge P(1) \wedge P(2))$

d) $\neg(P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2))$

e) $\neg(P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2))$

f) $\neg(P(-2) \wedge P(-1) \wedge P(0) \wedge P(1) \wedge P(2))$

30. a) $P(1,3) \vee P(2,3) \vee P(3,3)$

b) $P(1,1) \wedge P(1,2) \wedge P(1,3)$

c) $\neg(P(2,1) \wedge P(2,2) \wedge P(2,3))$

d) $\neg(P(1,2) \vee P(2,2) \vee P(3,2))$

42. a) P(x): There is less than x megabytes free on the hard disk.
    Q(x): x is sent a warning message.
    $P(30) \to \forall x Q(x)$

b) P: System errors have been detected.
    Q(x): Directory x can be open.
    R(x): File x can be close.
    $P \to (\forall x \neg Q(x) \wedge (\forall x \neg R(x))$

c) P(x): x currently logged on.
    Q: The file system cannot be backed up.
    $(\exists x P(x)) \to Q$

d) P: Video on demand can be delivered.

Q(x): There are at least x megabytes of memory available.

R(x): The connection speed is at least x kilobits per second.

$(Q(8) \wedge R(56)) \rightarrow P$

56. $(P(1) \wedge \neg P(2) \wedge \neg P(3)) \vee (\neg P(1) \wedge \neg P(2) \wedge P(3)) \vee (\neg P(1) \wedge \neg P(2) \wedge P(3))$

62. a) $\forall x (P(x) \rightarrow Q(x))$

b) $\exists x (R(x) \wedge \neg Q(x))$

c) $\exists x (R(x) \wedge \neg P(x))$

d) Yes.

$(a) \equiv$ Unsatisfactory is not clear explanation.

By (b), Some excuses are not clear explanations.