112-1 Discrete Mathematics Charpter 1-4

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4.

a) $P(x)$ *is False, and* $x = 0$ (x *has no change*)

b) $P(x)$ *is False, and* $x = 1$ (x *has no change*)

c) $P(x)$ *is True, and* $x = 1$ (x *changes*)

6.

b) "*Every students in school have visited North Dakota.*"

d) "*Some students in school have not visited North Dakota.*"

f) "*Every students in school have not visited North Dakota.*"

10.

a) $\exists x\,(C(x) \wedge D(x) \wedge F(x))$

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

e) $\exists x\,C(x) \wedge \exists x\,D(x) \wedge \exists x\,F(x)$

14.

a) T

b) T

c) T

d) $F,$ *because if* $x < 0,$ *then* $2x < x$

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

36.

a) $\exists x\,((x \leqslant -2) \vee (x \geqslant 3))$

b) $\exists x\,((x < 0) \vee (x \geqslant 5))$

c) $\forall x\,((x < -4) \vee (x > 1))$

d) $\forall x\,((x \leqslant -5) \vee (x \geqslant -1))$

62.

a) $\forall x \left(P(x) \rightarrow Q(x)\right)$

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

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

d) *Yes, (c) follow from (a) and (b), and the following steps can be used to establish the conclusion.*

Step		Reason
1.	$\exists x \left(R(x) \wedge \neg Q(x)\right)$	*Premise*
2.	$R(a) \wedge \neg Q(a)$	*Existential instantiation from* (1)
3.	$R(a)$	*Simplification from* (2)
4.	$\neg Q(a)$	*Simplification from* (2)
5.	$\forall x \left(P(x) \rightarrow Q(x)\right)$	*Premise*
6.	$P(a) \rightarrow Q(a)$	*Universal instantiation from* (5)
7.	$\neg P(a)$	*Modus tollens from* (4) *and* (6)
8.	$R(a) \wedge \neg P(a)$	*Conjunction from* (3) *and* (7)
9.	$\exists x \left(R(x) \wedge \neg P(x)\right)$	*Existential generalization from* (8)