1.4.

1. a) $P(0)$ true value.
b). $P(4)$. true value.
c). $P(6)$ false value.

5. a). there exist student who spends more than. 5 hours every weekday in class.

b). All students spends more than 5 hours every weekday in class.

c). not all students spend more than 5 hours every weekday in class.

d). Every students do not spend more than 5 hours every weekday in class.

7. a) $\forall x(C(x) \to F(x))$.
all ~~tion~~ comedian is funny.

b). $\forall x(C(x) \land F(x))$
Some co

c) $\exists x(C(x) \to F(x))$
Some comedian is funny.

11. a) $P(0)$. $0^2 = 0$. true.
b). $P(1)$ $1 = 1^2$ true.
c) $P(2)$ $2 \neq 2^2 = 4$ false
d) $P(-1)$ $-1 \neq (-1)^2 = 1$ false.
e) $\exists x P(x)$. true.
f) $\forall x P(x)$ false.

17.

a). $\exists x P(x)$.

$P(0) \vee P(1) \vee P(2) \vee P(3) \vee P(4)$.

b). $\forall x P(x)$.

$P(0) \wedge P(1) \wedge P(2) \wedge P(3) \wedge P(4)$.

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

$\neg P(0) \vee \neg P(1) \vee \neg P(2) \vee \neg P(3) \vee \neg P(4)$.

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

$\cancel{\neg P(0) \vee \neg P(1) \vee \neg P(2)}$

$\neg P(0) \wedge \neg P(1) \wedge \neg P(2) \wedge \neg P(3) \wedge \neg P(4)$.

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

$\neg (P(0) \vee P(1) \vee P(2) \vee P(3) \vee P(4))$

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

$\neg (P(0) \wedge P(1) \wedge P(2) \wedge P(3) \wedge P(4))$.

27. a). D: a students in my school who live in Vietnam.

V: a student x.

$Ex P(x)$.

D. a students live in school, students live in Vietnam.

V. a student x.

$Ex (P(x) \wedge C(x))$.

$\exists x (A(x) \wedge P(x, Vietnam))$.

b). $Ex P(x)$.

D: students in my school who cant speak Hindi.

$Ex (P(x) \wedge C(x))$.

D. students in my school.

People ~~students~~ can speak Hindi.

$Ex (P(x) \wedge C(x, Hinda))$.

D. students in my school.

students who ~~sped~~ speak Hindi.

C. $Ex P(x)$.

D: people who know java, Prolog, and C++.

$Ex (Px \wedge C(x))$

D. students who know java, Prolog and C++ who also live in school

30. a). $P(1,3)$, $\cancel{P(2,3)}$, $P(3,3)$
$P(2,3)$.

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

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

d) $\neg P(1,2) \wedge \neg P(2,2) \wedge \neg P(3,2)$.

50. ① suppose. $\forall x P(x) \vee \forall x Q(x)$ is true.

② $[P(x_1) \wedge P(x_2) \wedge P(x_3) \cdots P(x_n)]$ or
$[Q(x_1) \wedge Q(x_2) \wedge Q(x_3) \cdots Q(x_n)]$ is true.

③ $\neg \forall x P(x) \wedge \neg \forall Q(x) \rightarrow$ false.

④ $\exists x \neg P(x) \wedge \exists x \neg Q(x) \rightarrow$ false.

⑤ $[\neg P(x_1) \vee \neg P(x_2) \vee \neg P(x_3) \cdots \neg P(x_n)]$ and
$[\neg Q(x_1) \vee \neg Q(x_2) \vee \neg Q(x_3) \cdots \neg Q(x_n)] \rightarrow$ false.

⑥ $\neg (\exists x \neg P(x)) \vee \neg (\exists x \neg Q(x)) \rightarrow$ true.

$\neg (\exists x \neg P(x) \vee \exists x \neg Q(x)) \rightarrow$ true.

$(\exists x \neg P(x) \vee \exists x \neg Q(x)) \rightarrow$ false.

1.5

1. a). for all x there exist at ~~least~~ a number y such that $y > x$.

b). For every number x and y ~~there~~ who is greater than 0, their product is greater or equal to 0.

c). There exist a number z, ~~th~~ for all x and y, x times y equal to z.

30. a). a) $\forall x \forall y \neg P(x, y)$.

b). $\cancel{E}$ $\exists x \forall y \neg P(x, y)$

★ c). $\forall y \neg (Q(y) \wedge \forall x \neg P(x, y))$

$\exists x \forall y \neg P(x, y)$.

d). $\forall y \neg (\exists x P(x, y) \vee \forall x S(x, y))$

$= \forall y (\forall y \neg P(x, y) \wedge \neg \exists x S(x, y))$

e). $\forall y \neg (\forall x \exists z T(x, y, z) \vee \exists x \forall z U(x, y, z))$.

$= \forall y (\exists x \forall z \neg T(x, y, z) \wedge \forall x \exists z \neg U(x, y, z))$.

21. $\forall x \exists a \exists b \exists c \exists d\, ((x > 0) \rightarrow a^2 + b^2 + c^2 + d^2))$

27. a). true.

b). true.

c) true.

d) true.

e). true.

f). false

g). false.

h). ~~fa~~ true.

i). false.

45 a) true.

b) false.

c true.

~~48. ∀xP(x)∨∀yQ~~

48. $\forall x P(x) \vee \forall x Q(x)$

$\equiv [P(x_1) \wedge P(x_2) \wedge P(x_3) \wedge \cdots P(x_n)] \vee [Q(x_1) \wedge Q(x_2) \wedge Q(x_3) \cdots Q(x_n)]$

$\equiv \{P(x_1) \vee [Q(x_1) \wedge Q(x_2) \wedge Q(x_3) \cdots]\} \wedge \{P(x_2) \vee [Q_{x_1} \cdots]\} \wedge \{P(x_3 \cdots$

$\equiv [P(x_1) \vee Q(x_1)] \wedge [P(x_2) \vee Q(x_2)] \wedge \cdots [P(x_n) \vee Q(x_n)]$

$\equiv \forall x (P(x_1) \vee Q(x_1))$ $\equiv \forall x (P(x) \vee \forall y Q(y))$.

$\equiv \forall x \forall y (P(x) \vee Q(y))$.