Discrete Mathematics

1.3

$P(x)$ $\quad x = x^2$

(i) $P(0) = 0 = (0)^2 = T$
$P(1) = 1 = (1)^2 = T$
$\exists x\, P(x) = \text{for } x = 0 = T$
$\forall x\, P(x) = \text{for } x = 2 = F$
DoM = All Real No's.

(a) $\exists x\,(x^3 = -1) = \text{for } x = -1 = T$

(b) $\exists x\,(x^4 < x^2) = \text{for } x = .1 = T$

(c) $\forall x\,((-x)^2 = x^2) = T$

(d) $\forall x\,(2x > x) = \text{for } x = \cancel{2} = F$

Q

(a) Some dogs can learn new tricks.

$\exists x\ P(x)$

$P(x)$ = x can learn new things

Domain = dog's

(b) ~~Every~~ bird can fly

Every

$P(x)$ x can fly Domain bird's

$\forall x\ P(x)$

(c) There is no dog which can talk.

$P(x)$ x can talk

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

$\neg \exists x\ (Q(x) \rightarrow P(x))$

Q

F(P) = Printers P is out of service

A (P) = Printer P is busy

L (j) = Print Job j is lost

Q (j) = Print Job j is Queued

(a) $\exists P\,(F(P) \land A(P)) \longrightarrow \exists j\, L(j)$

(b) $\forall P\; A(P) \longrightarrow \exists j\; Q(j)$

(c) $\exists j\,((Q(j) \land L(j)) \longrightarrow \exists P\, F(P)$

Nested Quantifiers

Sum of two +ve integers is +ve

$\forall x\, \forall y\, ((x>0) \land (y>0) \land (x+y>0))$

(a) $\forall x\, \exists y\, (x < y)$ Dom is Real No's

(b) $\forall x\, \forall y\, ((x \geq 0) \land (y \geq 0)) \rightarrow (xy \geq 0)$

(c) $\forall x\, \forall y\, \exists z\, (x \cdot y = z)$

Q. $C(x, y)$ x is enrolled in course y.

Dom of x = studen[illegible]
// y = course

(a) $C(\text{Ali}, \text{CS252})$

(b) $\exists_x C(x, \text{Math})$

(c) $\exists_x C(\text{Asad}, x)$

(d) $\exists_x \exists_y \forall_z ((x \neq y) \wedge (C(x, z) \rightarrow$ [illegible]

(e) $\exists_x \exists_y \forall_z ((x \neq y) \wedge C(x, z) \leftrightarrow C(y, z))$

Ex: 1.1, 1.2, 1.3, 1.4

[illegible] [illegible] [illegible] [illegible]

Dom = integer

$\exists_n \exists_m (n^2 + m^2 = 5)$

For $n = 1, m = 2$ $= T$

$\exists_n \exists_m (n^2 + m^2 = 6)$ $= F$

$\exists_n \exists_m (n + m = 4 \wedge n - m = 1)$

For $n = 3, m = 1$ $= T$

$\forall_n \forall_m \exists_p (p = \frac{m+n}{2})$ F