CS:1010 DISCRETE STRUCTURES

PRACTICE QUESTIONS
LECTURE 2

Instructions

- Try these questions before class. Do not submit!

(1) Determine the truth value of each of these statements if the domain consists of all integers:
   (a) $\forall n(n+1 > n)$
   (b) $\exists n(2n = 3n)$
   (c) $\exists n(n = -n)$
   (d) $\forall n(3n \leq 4n)$

(2) Let $P(x)$ be the statement $x = x^2$. Domain is $\mathbb{Z}$, the set of integers. What are the truth values?
   (a) $P(0)$
   (b) $P(1)$
   (c) $P(2)$
   (d) $\forall x P(x)$

(3) Suppose the domain of $P(x)$ is $\{1, 2, 3, 4\}$ then express $\exists x P(x)$ without a quantifier.

(4) Express each of these statements using logical operators, predicates and qauntifiers.
   (a) Some propositions are tautologies.
   (b) The negation of a contradiction is a tautology.

(5) What are the truth values of these statements?
   (a) $\exists! x P(x) \rightarrow \exists x P(x)$
   (b) $\forall x P(x) \rightarrow \exists! x P(x)$

(6) Let $S(x)$: x is a student, $F(x) : x$ is a faculty member and $A(x, y$: x has asked y a question. Domain: all people associated with our school. Use quantifiers to express each of these statements.
   (a) Divya has asked Prof. Gupta a question.
   (b) Every student has asked Prof. Gupta a question.

(c) Some student has not asked any faculty member a question.

(7) Express each of the statements using predicated, quantifiers, logical connectives and mathematical operators.
   (a) Every positive real number has exactly two square roots.
   (b) A negative real number does not have a square root that is a real number.

(8) Negate the statement such that negation immediately precedes predicates: $\forall x \exists y(P(x, y) \rightarrow Q(x, y))$.

(9) Is this argument correct: " Every computer science student takes discrete mathematics. Natasha is taking discrete mathematics. Therefore, Natasha is a computer science student."

(10) Explain the rules of inference used in each step. "Each of the 93 students in this class own a laptop. Everyone who owns a laptop can use a PDF viewer. Therefore, Arun, a student in this class can use a PDF viewer."