HOMEWORK 2

CSE 173, Fall 2018

DUE ON NOVEMBER 19, 2018 (BEGINNING OF THE CLASS)

North South University

Problem 1: Use quantifiers to express the below statements, and then derive the negation of the statement. Make sure that the no negation lies in the left of the quantifier. Finally, express the obtained negation in English text.

(a) All cats have parasites. (take it easy! I don't mean it actually.)

(b) There is a cow that can add two numbers.

(c) Every monkey you encounter can climb.

(d) There is a fish that can speak Bengali.

(e) There exists a horse that can fly and catch bird as needed.

Problem 2: Assume $Q(x, y)$ as the statement saying *student x in CSE173 class is a contestant on TV reality show*. Express the below sentences using Q(x, y), and other logical connectives. Consider all students in CSE 173 class as the domain for x and all TV reality shows as the domain for y.

(a) There is a student at CSE 173 who is a contestant on a TV reality show.

(b) No student at CSE 173 has ever been a contestant on a TV reality show.

(c) There is a student at CSE 173 who is a contestant on Close-up and Bangladeshi Idol.

(d) Every TV reality show aired so far had a student from CSE 173 as a contestant.

(e) At least two students from CSE 173 are the contestants on Bangladeshi Idol.

Problem 3: Derive the negation of the below logical expressions; use logical equivalences and move the negation operator onto the smallest element possible. For instance, negation of $\forall x[P(x) \to Q(x)]$ is obtained as per the critera stated as follows: $\neg\forall x[P(x) \to Q(x)]$, convert this to $\exists x[\neg P(x) \to Q(x)]$, and finally to $\exists x[P(x) \wedge \neg Q(x)]$

(a) $\forall x[P(x) \vee Q(x)]$

(b) $\exists y[P(y) \vee (Q(y) \vee R(y))]$

(c) $\exists x[(P(x) \wedge Q(x)) \vee (Q(x) \wedge \neg P(x)]$

Problem 4: Use predicates, quantifiers, logical connectives and mathematical operators to express the below mathematical statements. Consider all integers as the domain.

(a) If m and n are both negative, their product is always positive.

(b) Assume m and n are postive, then average of m and n positive.

(c) If m and n are negative, $m - n$ is not necessarily negative.