CECS 228 Name:  
LAB #1.3 ID: Date:

Objectives:

* Be able to understand and apply nested predicate
* Be able to negate predicate
* Be able to translate from English into logical expressions

Exercise 1: Let P(x) be the statement “x spends more than five hours every weekday in class,” where the domain for x consists of all students. Express each of these quantifications in English.  
a.   
  
  
b.

c.   
  
  
d.   
  
  
Exercise 2: Translate in each of these statements into logical expressions using predicates, quantifiers, and logical connectives. First, let the domain consist of the students

in your class.

a. Everyone in your class has a cellular phone.

b. Somebody in your class has seen a foreign movie.

c. There is a person in your class who cannot swim.

d. All students in your class can solve quadratic equations.  
  
  
Exercise 3: Negate each statement in Exercise 2 and write complete sentence in the space below  
a.  
  
  
  
b.  
  
  
  
c.  
  
  
d.

Exercise 4: Express each of these statements using quantifiers. Then form the negation of the statement so that no negation is to the left of a quantifier. Next, express the negation in simple English. (Do not simply use the phrase “It is not the case that.”). Assume that the domain is all animals.  
**a)** All dogs have fleas.

**b)** There is a horse that can add.

**c)** Every koala can climb.

**d)** No monkey can speak French.

**e)** There exists a pig that can swim and catch fish

Exercise 5: Translate these system specifications into English where the predicate *S(x, y)* is “*x* is in state *y*” and where the domain for *x* and *y* consists of all systems and all possible states, respectively.

**a)** ∃*xS(x,* open)

**b)** ∀*x(S(x,* malfunctioning) ∨ *S(x,* diagnostic))

**c)** ∃*xS(x,* open) ∨ ∃*xS(x,* diagnostic)

**d)** ∀*x*￢*S(x,* working)

Exercise 6: Let *C(x, y)* mean that student *x* is enrolled in class *y*, where the domain for *x* consists of all students in your school and the domain for *y* consists of all classes being given at your school. Express each of these statements by a simple English sentence.

**a)** *C*(Randy Goldberg, CS 252)

**b)** ∃*xC*(*x*, Math 695)

**c)** ∃*x*(*C*(*x*, Math 222) ∧*C*(*x*, CS 252))

**d)** ∃*x*∃*y*∀*z((x* ≠ *y)* ∧ *(C(x, z)* → *C(y, z)))*

Exercise 7: Let *F(x, y)* be the statement “*x* can fool *y*,” where the domain consists of all people in the world.   
i. Use quantifiers to express each of these statements.  
ii. Negate these statements using quantifiers and write them in simple English

**a)** Everybody can fool Fred.

**b)** Evelyn can fool everybody.

**c)** Everybody can fool somebody.

**d)** There is no one who can fool everybody.

**e)** Everyone can be fooled by somebody.

**f )** No one can fool both Fred and Jerry.

**g)** There is exactly one person whom everybody can fool.

**h)** No one can fool himself or herself.