# CSE112 Introduction to Artificial Intelligence, Week 12 2019

**Predicate Logic Exercises**

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**Question 1.** Translate the following into symbolic form:

1. Everybody likes him

∀x likes (x, him)

1. Somebody cried out for help and called the police

∃x cried\_out\_for\_help(x)call(x, police)

1. Nobody can ignore her

∃x ignore (x, her)

**Question 2.** What do the following fomulas say about numbers?

1) xy (x < y  z(x < z  z < y))

2) xy (y·y = x)

Give for each formula a set of numbers for which the formula holds and a set of numbers for which

the formula does not hold.

1. For any x and for any y, if x<y, then there exist a z that satisfies x<z and z<y.

2. For any x and for any y, y-y=x.

**Question 3**. State whether each of the following statements is true or false.

1. “Men and women are welcome to apply” is equivalent to

False, x [(M(x) W(x)) pply(x)]

Question (2) – (5): say Attract is a relation from x to y, i.e., A(x,y) says x attracts y.

1. “Everything attracts something”, where “something” means “something or other”, is equivalent to “ x y A(x,y)”.

True, x y A(x,y)

1. “Something is attracted by everything”, where “something” means “something in particular”, is equivalent to “x y A(x,y)”.

False, x y A(x,y)

1. “Everything is attracted by something”, where “something” means “something or other”, is equivalent to “x y A(x,y)”.
2. “Something attract everything”, where “something” means “something in particular”, is equivalent to “x y A(x,y)”.

# Question 4. Some General Questions

Answer briefly. Please use your own words, and cite appropriately.

1. Represent the following sentences in first order logic:
   1. All dogs are mortal.

x dog(x)mortal(x)

* 1. No person buys an expensive policy

 x person(x)  buy(x, expensive\_policy)

1. Translate the following axioms into predicate calculus
2. Mary is a lawyer
3. Ann is a computer scientist
4. Ann is rich
5. Lawyers are rich
6. Computer scientists are smart
7. Lawyers have nice cars
8. Smart, rich people have nice cars
9. A sentence is (valid or satisfiable) if it is true in all models. (4).  entails  if and only if is unsatisfiable.

**Question 5** Questions on First-Order Logic

(a) Translate the following first-order sentences into English:





(i) for all the x, if they are hard-working then they are happy.

(ii) for any person x then there exist a person y who is richer than x.

(iii) there exists a person x that all other person y is richer than x.