Homework 4 (due 4/11 at 2pm)
Predicate logic
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1. **[3.5 points]** Find the predicate logic denotations for sentences (a)-(h). You will be using symbols for conjunction (∧), disjunction (∨), existential quantification (∃), universal quantification (∀), implication (→), and negation (¬). You can ignore inflection on the verb.

a. [[Something barks]] = ∃x barks(x)
b. [[Something that is a dog barks]] = barks(dog) or
   ∃x(dog(x) -> barks(x)] or
   ∃x[dog(x) ∧ barks(x)]
c. [[Some dog barks]] = ∃x[dog(x) ∧ barks(x)]
d. [[Some dog barks or growls]] = ∃x[dog(x) ∧ barks(x) v growls(x)]]
e. [[Some dog does not bark]] = ¬∀x[dog(x) ∧ barks(x)]
f. [[No dog barks]] = ¬∃x[dog(x) ∧ barks(x)]
g. [[Every dog barks]] = ∀x[dog(x) ∧ barks(x)]

2. **[3 points]** Derive the meaning of "John or Mary talks" from the meaning of its parts, i.e. provide denotations for (a)-(f) using lambda predicate logic. For each denotation, give its type.

a. [[John]] = John, the indivudal called John
   type: e
b. [[or]] = = λP.λx.λy.[P(x)vP(y)]
   type: <<e,t>,<<e,t>,<e,<e,t>>>>
c. [[Mary]] = Mary, the individual called John
   type: e
d. [[talks]] = λx.[talks(x)]
   type: <e,t>
e. [[John or Mary]] = John v Mary = λP.λx.λy.[P(x)vP(y)][John, Mary]
   type: <e,t>
f. [[John or Mary talks]] = [talks(John) v talks(Mary)]
   type: t

   Predicate logic:
   John or Mary talks = [talks(John) v talks(Mary)]
   talks or talks = λx.[talks(x)] v λy.[talks(y)]
   or = λP.λx.λy.[P(x)vP(y)]

3. **[2 points]** Provide Neo-Davidsonian event semantic denotations for the following sentences. Make sure you use thematic functions *agent* and *theme*.

a. [[Susan ate]] = ∃e.ate(e) ∧ agent(e,Susan)
b. [[Susan ate the apple]] = ∃e.ate(e) ∧ agent(e,Susan) ∧ theme(e,apple)
c. [[The apple was eaten by Susan]] = ∃e.ate(e) ∧ theme(e,apple) ∧ agent(e,Susan)
d. [[The apple was eaten]] = ∃e.ate(e) ∧ theme(e,apple)

4. **[1.5 points]** Consider the sentence "In this neighborhood, every dog loves some cat."
This sentence is ambiguous. Give the predicate logic denotations for each of the two meanings of the sentence (you can ignore "in this neighborhood").

a. $[[\text{Every dog loves some cat}]]_1 = \forall x[dog(x) \rightarrow \exists y[cat(y) \wedge loves(x, y)]]$ or $\forall x[dog(x) \wedge \exists y[cat(y) \wedge loves(x, y)]]$
b. $[[\text{Every dog loves some cat}]]_2 = \exists y[cat(y) \wedge \forall x[dog(x) \wedge loves(x, y)]]$ or $\exists y[cat(y) \wedge \forall x[dog(x) \rightarrow loves(x, y)]]$

Explain in one sentence the difference between these two meanings.
In first case every has wider scope than some, that is for each dog x, there is a cat y, such that x love y. In the second case, some has wider scope, that is there is a particular cat (single cat), such that all dogs love that cat.