CSCI 4350/5350

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Homework #6

Due: Thu. Nov. 1 by 11:00pm

(10 points) **Translate the following English sentences into First-Order Logic representation**

Use the following predicates:
Barber(t)
Bird(x)
Cat(x)
Failed(s, c)
Fly(x)
GrandParent(g, c)
IsMemberOf(p, c)
IsSideOf(s, t)
Likes (x, y)
Loves (x, y)
Man(p)
MtClimber(x)
Parent(p, c)
Shaves(x, y)
Skier(x)
Triangle(t)

1) A grandparent is a parent of one's parent.

$(\forall x)(\forall z)(Grandparent(x,z) \Rightarrow (\exists y)(Parent(x,y) \wedge Parent(y,z)))$

2) All cats love milk.

$(\forall x)(\forall y)((Cat(x) \wedge Milk(y)) \Rightarrow Love(x,y))$

3) Some birds don't fly.

$(\exists x)(Bird(x) \wedge \neg Fly(x))$

4) Nobody loves everyone.

$\sim(\exists x)(\forall y)(Love(x,y))$

5) Only one student failed both history and biology.

$(\exists x)(Student(x) \wedge Failed(x, History) \wedge Failed(x, Biology) \wedge (\forall y)((Student(y) \wedge Failed(y, History) \wedge Failed(y, Biology)) \Rightarrow x = y))$

6) Every triangle has exactly 3 sides.

$(\forall t)(Triangle(t) \Rightarrow (\exists s_1)(\exists s_2)(\exists s_3)(IsSideOf(s_1,t) \wedge IsSideOf(s_2,t) \wedge IsSideOf(s_3,t) \wedge s_1 \neq s_2 \wedge s_2 \neq s_3 \wedge s_3 \neq s_1 \wedge (\forall x)(IsSideOf(x,t) \Rightarrow x = s_1 \vee x = s_2 \vee x = s_3)))$

7) There is a barber who shaves all men in town who do not shave themselves.

$\exists h(Barber(h) \wedge (\forall m)((Man(m) \wedge \neg Shave(m,m)) \Rightarrow Shave(h,m)))$

8) Every member of the Alpine Club is either a skier or a mountain climber or both.

$(\forall x)(IsMemberOf(x, AlpineClub) \Rightarrow (Skier(x) \vee MtClimber(x)))$

9) No mountain climber likes rain.

$\sim(\exists x)(MtClimber(x) \wedge (\exists y)(Rain(y) \wedge Like(x,y)))$

10) Is there a member of the Alpine Club who is a mountain climber, but not a skier?

$Ask((\exists x)(IsMemberOf(x, AlpineClub) \wedge MtClimber(x) \wedge \sim Skier(x)))$