课后作业（Assignments）

一、 阅读教材 2.5 节，求解如下问题（Problems）

1. 总结谓词公式推理过程.

2. 教材第二章习题：题 14，题 15（5，6）.

3. Consider the following problem. We know that horses are faster than dogs and that there is a greyhound that is faster than every rabbit. We know that Harry is a horse and that Ralph is a rabbit. Our job is to derive the fact that Harry is faster than Ralph.

Problem translated in FOPL:

$\forall x \forall y ((Horse(x) \wedge Dog(y)) \rightarrow Faster(x,y))$

$\exists y (Greyhound(y) \wedge (\forall z\ Rabbit(z) \rightarrow Faster(y,z)))$

$Horse(Harry)$

$Rabbit(Ralph)$

Added axioms to represent commonsense knowledge:

$\forall y (Greyhound(y) \rightarrow Dog(y))$

$\forall x \forall y \forall z ((Faster(x,y) \wedge Faster(y,z)) \rightarrow Faster(x,z))$

Derive the following fact:

$Faster(Harry, Ralph)$

Proving using Proof Theory and a set of inference rules

1. $\forall x \forall y\ Horse(x) \wedge Dog(y) \rightarrow Faster(x,y)$ Premise
2. $\exists y\ Greyhound(y) \wedge (\forall z\ Rabbit(z) \rightarrow Faster(y,z))$ Premise

3.	$\forall$y Greyhound(y) $\rightarrow$Dog(y)	Premise
4.	$\forall$x$\forall$y$\forall$z Faster(x,y) $\wedge$ Faster(y,z) $\rightarrow$Faster(x,z)	Premise
5.	Horse(Harry)	Premise
6.	Rabbit(Ralph)	Premise
7.	Greyhound(Greg) $\wedge$ ($\forall$z Rabbit(z) $\rightarrow$Faster(Greg,z))	ES (2)
8.	Greyhound(Greg)	T,I (7)
9.	$\forall$z Rabbit(z) $\rightarrow$Faster(Greg,z))	T,I (7)
10.	Rabbit(Ralph) $\rightarrow$Faster(Greg,Ralph)	US (9)
11.	Faster(Greg,Ralph)	T,I (6),(10)
12.	Greyhound(Greg) $\rightarrow$Dog(Greg)	US (3)
13.	Dog(Greg)	T,I (12), (8)
14.	Horse(Harry) $\wedge$ Dog(Greg) $\rightarrow$Faster(Harry, Greg)	US (1)
15.	Horse(Harry) $\wedge$ Dog(Greg)	T,I (5), (13)
16.	Faster(Harry, Greg)	T,I (14), (15)
17.	Faster(Harry, Greg) $\wedge$ Faster(Greg, Ralph) $\rightarrow$Faster(Harry,Ralph)	US (4)
18.	Faster(Harry, Greg) $\wedge$ Faster(Greg, Ralph)	T,I (11), (16)
19.	Faster(Harry,Ralph)	T,I (17), (19)

Using Resolution to determine logical entailment

1.	{¬Horse(x),¬Dog(y),Faster(x,y)}	Premise
2.	{Greyhound(gary)}	Premise
3.	{¬Rabbit(z),Faster(gary,z)}	Premise
4.	{¬Greyhound(y),Dog(y)}	Premise
5.	{¬Faster(x,y), ¬Faster(y,z),Faster(x,z)}	Premise
6.	{Horse(harry)}	Premise
7.	{Rabbit(ralph)}	Premise
8.	{¬Faster(harry, ralph)}	Negated Goal
9.	{Dog(gary)}	2, 4
10.	{¬Dog(y), Faster(harry, y)}	6, 1
11.	{Faster(harry, gary)}	9, 10
12.	{Faster(gary, ralph)}	7, 3
13.	{¬Faster(gary, z), Faster(harry, z)}	11, 5
14.	{Faster(harry, ralph)}	12, 13
15.	{}	14, 8