

4511W, Fall-2017

ASSIGNMENT 5:

**Assigned: 11/26/17 Due: Sunday 12/03/17 at 11:55 PM** Submit on moodle (in a zip if you have multiple files)

**Written/drawn:**

**Problem 1.** (20 points)

Consider the sentences below. You may assume the objects are: {Lion, Elk, Eagle}

$$\forall x \text{ Carnivore}(x) \vee \text{Herbivore}(x)$$

$$\exists x \text{ Herbivore}(x)$$

$$\forall x, y \text{ Carnivore}(x) \wedge \text{Herbivore}(y) \Rightarrow \text{CanEat}(x, y) \wedge \text{Happy}(x)$$

(1) Convert these sentences to equivalent propositional logic sentences.

(2) Then convert ~~these sentences~~ **your answers for part (1)** to CNF form.

**Problem 2.** (30 points)

Consider the following sentences:

$$\forall x \text{ Large}(x) \iff \text{GasGiant}(x) \vee \text{Star}(x)$$

$$\forall x \neg \text{Large}(x) \wedge \text{Water}(x) \Rightarrow \text{Habitable}(x)$$

$$\forall x \text{ Water}(x) \vee \neg \text{Habitable}(x)$$

$$\forall x \text{ System}(x) \Rightarrow \exists y \text{ Star}(y)$$

$$\text{System}(\text{Sol})$$

$$\exists x \text{ Habitable}(x)$$

(1) Convert these sentences into CNF while remaining in first-order logic.

(2) Use resolution to determine if the following sentence is entailed: “Exists  $x, y$   $\text{Star}(x) \wedge \neg \text{Water}(x) \wedge \text{Water}(y)$ ”.

**Problem 3.** (20 points)

Convert the paragraph below into first-order logic.

Youtube has free videos about cats and dogs. Youtube has good educational videos as well. Some cat videos (on youtube) are good, but not any dog videos. All bad youtube videos have ads, but some good videos have ads as well. I put a dog video onto youtube.

**Problem 4.** (20 points)

Use backward chaining on the following sentences to determine whether: Exists  $x$   $\text{Traps}(\text{Felicidad}, x)$

$\exists x \text{ Troll}(x)$

$\forall x \text{ Troll}(x) \Rightarrow \text{Large}(x)$

$\exists x \text{ Troll}(x) \wedge \text{Aggressive}(x)$

$\forall x \text{ Large}(x) \wedge \text{Aggressive}(x) \Rightarrow \text{Dangerous}(x)$

$\forall x, y \text{ Hunter}(x) \wedge \text{Dangerous}(y) \wedge \text{Bounty}(y) \Rightarrow \text{Traps}(x, y)$   
 $\text{Hunter}(\text{Felicidad})$

$\exists x \text{ Troll}(x) \wedge \text{Bounty}(x)$

**Problem 5.** (10 points)

Use forward-search to solve the following planning problem. Use a breadth-first-search to approach for searching the space until a goal is found. Show all possible states at the depth the goal was found as well.

Objects =  $\{CSci4511\}$

Initial =  $\neg \text{Study}(CSci4511) \wedge \neg \text{Passed}(CSci4511)$

Goal =  $\text{Study}(CSci4511) \wedge \text{Passed}(CSci4511)$

Action =  $\text{Cram}(x)$ ,

Precondition:

Effect:  $\text{Study}(x)$

Action =  $\text{PassTest}(x)$ ,

Precondition:  $\text{Study}(x)$

Effect:  $\neg \text{Study}(x) \wedge \text{Passed}(x)$