1. Create a FOPC meaning representation for the sentence "Draco tormented a wizard." Use FrameNet to motivate your representation (and explain how you have done so). Give another sentence that has a different syntactic parse, but that would yield the same meaning representation.

a. \( \exists w, x \text{ ISA}(w, \text{wizard}) \land \text{ISA}(x, \text{tormenting}) \land \text{agent}(x, \text{Draco}) \land \text{experiencer}(x, w) \)

b. The FrameNet frame for \( \text{torment.v} \) is "cause_to_experience". The cores of this frame are "Agent" and "Experiencer". So for my FOPC representation I create a tormenting experience and a particular wizard. Then I specify that Draco is the "agent" of the experience and the wizard is the "experiencer" of the experience.

c. "A wizard was tormented by Draco" has a difference syntactic parse, but the same meaning representation as "Draco tormented a wizard".

2. Write a CFG grammar with semantic attachments to handle "Draco tormented a wizard", and show how it can be used to derive the target meaning representation.

a. \[ S \rightarrow \text{NP VP} \{\text{VP.sem(NP.sem)}\} \]
\[ \text{NP} \rightarrow \text{ProperNoun} \{\text{ProperNoun.sem}\} \]
\[ \text{NP} \rightarrow \text{Det Nominal} \{< \text{Det.sem} x \text{Nominal.sem}(x) >\} \]
\[ \text{VP} \rightarrow \text{Verb NP} \{\text{Verb.sem(NP.sem)}\} \]
\[ \text{Verb} \rightarrow \text{tormented} \{\lambda x \lambda y \exists e \text{ ISA}(e, \text{tormenting}) \land \text{agent}(e, y) \land \text{experiencer}(e, x) \}\]
\[ \text{ProperNoun} \rightarrow \text{Draco} \{\text{Draco}\} \]
\[ \text{Det} \rightarrow \text{a} \{\exists\} \]
\[ \text{Nominal} \rightarrow \text{Noun} \{\lambda x \text{ ISA}(x, \text{Noun.sem})\} \]
\[ \text{Noun} \rightarrow \text{wizard} \{\text{Wizard}\} \]

b. \[ S \rightarrow \text{NP VP} \{\text{VP.sem(NP.sem)}\} \]
\[ S \rightarrow \text{ProperNoun VP} \{\text{VP.sem(ProperNoun.sem)}\} \]
\[ S \rightarrow \text{Draco VP} \{\text{VP.sem(Draco)}\} \]
\[ S \rightarrow \text{Draco V NP} \{\text{Verb.sem(NP.sem)(Draco)}\} \]
\[ S \rightarrow \text{Draco tormented NP} \{\lambda x \lambda y \exists e \text{ ISA}(e, \text{tormenting}) \land \text{agent}(e, y) \land \text{experiencer}(e, x)(\text{NP.sem})(\text{Draco})\} \]
\[ S \rightarrow \text{Draco tormented Det Noun}\{\lambda x \lambda y \exists e \text{ ISA}(e, \text{tormenting}) \land \text{agent}(e, y) \land \text{experiencer}(e, x)(< \text{Det.sem} x \text{Nominal.sem}(x) >)(\text{Draco})\} \]
S → Draco tormented a Nominal{λxλy∃e ISA(e, tormenting) ∧ agent(e, y) ∧ experiencer(e, x)(< ∃ x Nominal.sem(x) >)(Draco)}
S → Draco tormented a Noun{λxλy∃e ISA(e, tormenting) ∧ agent(e, y) ∧ experiencer(e, x)(< ∃ x (x) λx ISA(x, Noun.sem) >)(Draco)}
S → Draco tormented a wizard{λxλy∃e ISA(e, tormenting) ∧ agent(e, y) ∧ experiencer(e, x)(< ∃ x (x) λx ISA(x, wizard) >)(Draco)}
S → Draco tormented a wizard{∃e∃x ISA(e, tormenting) ∧ ISA(x, wizard) ∧ agent(e, Draco) ∧ experiencer(e, x)}

3. Exercise 16.2, Jurafsky and Martin (p. 628), done by examining the entries for these lexemes in WordNet, and considering only ADJECTIVE senses.

Each of the following words has at least one sense that can be used to describe something that is not real. Imitation, fake, and simulated are the most similar of the three words each having one sense that is defined by WordNet to be "fake, false, faux, or imitation, simulated". However, each of these words also has other sense that slightly change the connotations associated with each word. Simulated is the most positive of the three. It's second sense is "reproduce or made to resemble". This does not have any negative connotations and is used to describe something that tries to adhere as closely to reality as possible but does not try to conceal the fact that it is not real. Imitation is the second least negative of the three words. It does not have any other senses and it usually used to describe something that does not try to resemble something as closely as a simulation would. Fake has the most negative connotations of the three words because of it’s first sense. Unlike simulated and imitation fake is usually used to describe something that intentionally tries to deceive someone, and appear as close to the original as possible.

Synthetic and artificial are also similar in meaning. Synthetic has senses related to science. These senses usually give the word a positive meaning, somethings even saying that the synthetic material is better in someway than the original. Synthetic fibers are usually more sturdy than natural and synthetic food can be made to have more nutritional value. Artificial has senses that give it artistic connotations. It is usually used when trying to trick someone and appear as the original.

4. Exercise 16.6, Jurafsky and Martin (p. 629), but just for the VERB "embrace".

**Sense 1** - include in scope

**Actor Restrictions** - Actor must be something

**Theme Restrictions** - Theme must be something

∃e, x, y Embracing(e) ∧ Embraicer(e, x) ∧ Theme(e, y) ∧ ISA(y, entity) ∧ ISA(x, entity)

**Sense 2** - hug

**Actor Restrictions** - Actor must be a person or animate entity with arms.

**Theme Restrictions** - Theme must be a a physical entity

∃e, x, y Embracing(e) ∧ Embraicer(e, x) ∧ Theme(e, y) ∧ ISA(y, entity) ∧ hasArms(x)
∧ ISA(y, PhysicalEntity)

**Sense 3** - take up the cause
**Actor Restrictions** - Actor must be a person.

**Theme Restrictions** - Theme must be an abstract idea or practice.

\[
\exists e, x, y \\text{Embracing}(e) \land \text{Embracer}(e, x) \land \text{Theme}(e, y) \land \text{ISA}(y, \text{entity}) \land \\
\text{ISA}(x, \text{Person}) \land \text{ISA}(y, \text{Thought})
\]

5. Exercise 16.7, Jurafsky and Martin (p. 629), again just for the VERB ”embrace”. Use as your corpus the 7 examples of ”embrace” in the three corpora from Homework 2. Use the constraint satisfaction viewpoint discussed in class.

- and it came to pass, when laban heard the tidings of jacob his sister’s son, that he ran to meet him, and **embraced** him, and kissed him, and brought him to his house. and he told laban all these things.

  The actor in this sentence is ”Laban”, who is a person. The theme in this sentence is someone referred to as ”him”, probably a person. This fits the selectional restrictions of sense 2. A person has arms and a person is a physical entity.

- and esau ran to meet him, and **embraced** him, and fell on his neck, and kissed him: and they wept.

  The actor in the sentence is ”Esau”, a person. The theme in this sentence is someone referred to as ”him”, probably a person. This fits the selectional restrictions of sense 2. A person has arms and a person is a physical entity.

- now the eyes of israel were dim for age, so that he could not see. and he brought them near unto him; and he kissed them, and **embraced** them.

  The actor in this sentence is Joseph, a person. The theme in this sentence is Joseph’s sons, a group of people. This fits the selectional restrictions of sense 2. A person has arms and a group of people is a physical entity.

- on one occasion he actually seized her in his arms and **embraced** her – an outrage which caused his own secretary to reproach him for his unmanly conduct.

  The actor in this sentence is someone referred to as ”his”, probably a person. The theme in this sentence is someone referred to as ”her”, also probably a person. This fits the selectional restrictions of sense 2. A person has arms and a person is a physical entity.

- at first this vague and terrible power was exercised only upon the recalcitrants who, having **embraced** the mormon faith, wished afterwards to pervert or to abandon it.

  The actor in this sentence is ”the recalcitrants”, a group of people. The theme in this sentence is ”the mormon faith”, an abstract idea. The mormon faith fits the theme restriction for sense 3 but a group of people is not a person so constraint satisfaction fails for sense 3 and sense 1 would be chosen.

- in return for all this we asked but one condition: that was, that you should **embrace** the true faith, and conform in every way to its usages. this you promised to do, and this, if common report says truly, you have neglected.

  The actor in this sentence is someone referred to as ”you”, probably a person. The theme in this sentence is ”the true faith”, a thought. This fits the selectional restrictions for sense 3. A person is a person and ”the true faith” is a thought.

- a disaster which had **embraced** them all, and yet had left no traces behind it.
The actor in this sentence is "a disaster". The theme in this sentence is a group referred to as "them all". A disaster is not a person so the constraint satisfaction fails for sense 2 and 3 so sense 1 would be chosen.