A) Define NLP in your own words.

Natural Language Processing is a study that is the combination of computer science, machine learning, and linguistics. This field looks at the way that humans can interact with computers. Artificial Intelligence is used to take in the human input, understand, and use it in a way that the computer would interpret it. The input is essentially converted from human language to code that the computer could process and is compared to natural language data to provide an output to whatever was asked in the input.

B) Define the relationship between AI and NLP

Natural Language Processing is the bridge between computer science and linguistics. The field is the study of computers being able to interpret human linguistics. Artificial Intelligence is essentially the field of attempting to recreate human capabilities within computers. Using this information, it can be said that Natural Language Processing is a subfield of AI as in it is specifically applied to the domain of computers and human linguistics.

C) Write a sentence or two comparing and contrasting natural language understanding and natural language generation.

Natural Language Understanding focuses on the computer being able to comprehend what is being communicated by the input. Natural Language Generation enables the computer to produce a response based on the user input.

D) List some examples of modern NLP applications.

ChatGPT – Chatbot developed by OpenAI which interacts with the user in a conversation.
Siri/Alexa – These Speech Recognition technologies utilize NLP to transform the spoken language into a format that can be interpreted by the computer.
Amazon Comprehend – This application uses NLP to get insights on the content of the document that is being read.

E) Write 3 paragraphs describing each of the 3 main approaches to NLP, and list examples of each approach.

Rule-Based NLP – This is the oldest approach to Natural Language Processing. Rule-Based NLP tends to focus on concepts such as pattern-matching or parsing and is often thought as a "fill in the blanks" methods. There are benefits and cons to using the Rule-Based NLP approach. The benefit is that this approach is low precision and high recall which means that it has high performance in certain use cases but has worse performance when it is generalized. A chatbot could be an example of this NLP approach since it uses keywords and patterns to understand and respond based on the user input.

Machine learning-based NLP – This approach focuses on machine learning techniques such as linear classifiers and likelihood maximization. These models are trained on large datasets of examples and use techniques such as supervised and unsupervised learning to make predictions.

Deep learning-based NLP – This approach is similar to the machine learning based approach except that it makes use of neural networks. There are different neural networks such as Recurrent Neural Networks (RNNs) and Convolutional Neural Networks (CNNs). Steps such as

feature engineering is typically skipped in this approach as it is a unsupervised learning approach. Words that are typically spoken in naturalistic scenarios would be used in this NLP approach instead of the feature engineered dataset. Deep learning-based NLP is being researched heavily at the moment and there are complex use cases such as dialogue systems and speech recognition software with natural language processing.

F) **Write a paragraph describing your personal interest in NLP and whether/how you would like to learn more about NLP for personal projects and/or professional application.**

I am currently pursuing research in Automatic Speaker Recognition. This field focuses on translating actual speech into something that is readable in the computer. While focusing on the Automatic Speaker Recognition part, I am learning that machine learning and deep learning based approaches are creating breakthroughs in the subject. This class would allow me to learn Natural Language Processing which is another subdomain of speech and linguistics which would allow me to learn more. I am also applying to graduate school in computer science with a focus in speech/linguistics and it would allow me to build a professional portfolio which would give me a more solid foundation for my study of future.