Questions on Chapter 1

1. **List examples of real world applications of NLP ?**

   Core applications:
   Email platforms,
   Voice-based assistants,
   Modern search engines,
   Machine translation

2. **Explain the following NLP tasks: language modelling, text classification, information extraction, information retrieval, conversational agent, text summarization, question answering, machine translation, and topic modelling. ?**

   Language modeling This is the task of predicting what the next word in a sentence will be based on the history of previous words. The goal of this task is to learn the probability of a sequence of words appearing in a given language.

   Text classification This is the task of bucketing the text into a known set of categories based on its content

   Information extraction As the name indicates, this is the task of extracting relevant information from text

   Information retrieval This is the task of finding documents relevant to a user query from a large collection

   Conversational agent This is the task of building dialogue systems

   Text summarization This task aims to create short summaries of longer documents

   Question answering This is the task of building a system that can automatically answer questions

   Machine translation This is the task of converting a piece of text from one language to another

   Topic modeling This is the task of uncovering the topical structure of a large collection of documents

3. What are the building blocks of language and their applications?

phonemes (speech to text , text to speech)
morphemes and lexemes (tokenization , word embeddings)
syntax (parsing , entity extraction)
context (summarization , topic modeling)

4. Why is NLP Challenging?

Ambiguity : Ambiguity means uncertainty of meaning.

common knowledge : It is the set of all facts that most humans are aware of.
One of the key challenges in NLP is how to encode all the things that are common knowledge to humans in a computational mode.

Creativity
Diversity across languages

5. How NLP, ML, and DL are related?
ML, DL, and NLP are all subfields within AI

artificial intelligence (AI) is a branch of computer science that aims to build systems that can perform tasks that require human intelligence.

Machine learning (ML) is a branch of AI that deals with the development of algorithms that can learn to perform tasks

Deep learning (DL) refers to the branch of machine learning that is based on artificial neural network architectures

6. Describe the heuristics-based NLP.?

attempts at designing NLP systems were based on building rules for the task at hand.

It uses counts of positive and negative words in the text to deduce the sentiment of the text.

7. Explain briefly Naive Bayes, Support Vector Machine, Hidden Markov Model, And Conditional Random Fields approaches.?

Naive Bayes is a classic algorithm for classification tasks that mainly relies on Bayes' theorem. Using Bayes' theorem, it calculates the probability of observing a class label given the set of features for the input data

The support vector machine (SVM) is another popular classification algorithm. The goal in any classification approach is to learn a decision boundary that acts as a separation between different categories of text

The biggest strength of SVMs are their robustness to variation and noise in the data. A major weakness is the time taken to train and the inability to scale when there are large amounts of training data.

The hidden Markov model (HMM) is a statistical model that assumes there is an underlying, unobservable process with hidden states that generates the data

The conditional random field (CRF) is another algorithm that is used for sequential data. Conceptually, a CRF essentially performs a classification task on each element in the sequence

8. What is the difference between RNN and LSTM NN?

Recurrent neural networks (RNNs) are specially designed to keep such sequential processing and learning in mind. RNNs have neural units that are capable of remembering what they have processed so far.

LSTM they cannot remember longer contexts and therefore do not perform well when the input text is long

9. How CNN can be used for text processing?

Convolutional neural networks (CNNs) are very popular and used heavily in computer vision tasks like image classification, video recognition, etc. CNNs have also seen success in NLP, especially in text-classification tasks. One can replace each word in a sentence with its corresponding word vector, and all vectors are of the same size

10. Describe the concept transfer learning.?

Transfer learning is a technique in AI where the knowledge gained while solving one problem is applied to a different but related problem

11. Give the architecture of autoencoder.?

12. List the key reason that makes DL not suitable for all NLP tasks ?

Overfitting on small datasets

Domain adaptation

Interpretable models **:** Businesses often demand more interpretable results that can be explained to the customer or end user Cost.

Common sense and world knowledge : Since this world knowledge and common sense are inherent in language, understanding them is crucial for any DL model to perform well on various language tasks

On-device deployment : NLP solution needs to be deployed on an embedded device rather than in the cloud

13. Explain the flow of conversation agents ?

Speech recognition and synthesis

Natural language understanding : This can be broken into many small NLP subtasks, such as:
• Sentiment analysis: Here, we analyze the sentiment of the user response.
• Named entity recognition: Here, we identify all the important entities the user mentioned in their response.
• Coreference resolution: Here, we find out the references of the extracted entities.

Dialog management

Response generation