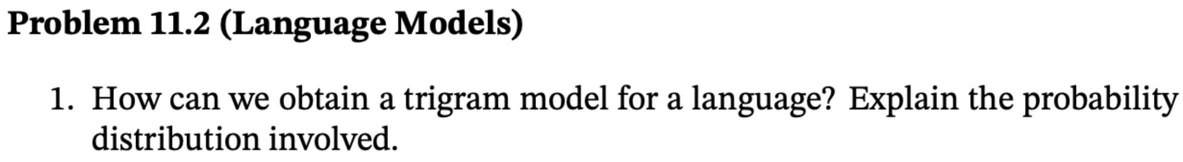
Problem 11.2



Problem 11.2 (Language Models)

1. How can we obtain a trigram model for a language? Explain the probability distribution involved.

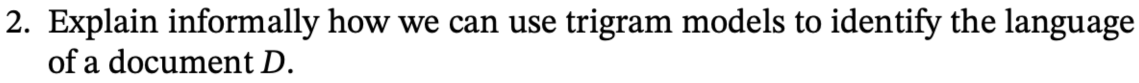
A model of the probability distribution of 3 letter sequences is thus called an tri**gram model**.

An trigram model is defined as a **Markov chain** of order 2. In a Markov chain the probability of character c_i depends only on the immediately pre- ceding characters, not on any other characters. So in a trigram model, we have

$P\ (c_i \mid c_{1:i-1}) = P\ (c_i \mid c_{i-2:i-1})$.

We can define the probability of a sequence of characters $P\ (c_{1:N})$ under the trigram model by first factoring with the chain rule and then using the Markov assumption:

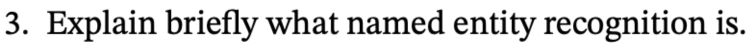
$P\ (c_{1:N}) = \prod_{i = 1 \text{to} N} P(c_i \mid c_{1:i-1}) = \prod_{i = 1 \text{to} N} P(c_i \mid c_{i-2:i-1})$



2. Explain informally how we can use trigram models to identify the language of a document *D*.

For a trigram character model in a language with 100 characters, $\mathbf{P}(C_i \mid C_{i-2:i-1})$ has a million entries, and can be accurately estimated by counting character sequences in a body of text (corpus) of 10 million characters or more.

Language can be identified in a document D by first building a trigram character model of each candidate language and then count these trigrams in a corpus of that language. That gives us a P(text | language), to which further Bayes rule is applied followed by Markov assumption to find most probable language.



3. Explain briefly what named entity recognition is.

Named-entity recognition is the task of finding names of things in a document and deciding what class they belong to. For example, in the text “Mr. Sopersteen was prescribed aciphex,” we should recognize that “Mr. Sopersteen” is the name of a person and “aciphex” is the name of a drug.