

CS665 HW1: Solutions

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1. Given a stream of symbols a_1, a_2, \dots, a_n each an integer in $1, \dots, m$, give an algorithm that will select one symbol uniformly at random from the stream. How much memory does your algorithm require?

Solution:

A random probability to select a given symbol of the stream would be $P = \frac{1}{n}$ where n is the number of symbols in the stream. If we are reading one symbol at a time, the probability of reading the symbol j would be $P = \frac{1}{\sum j}$ where j is the index of the symbol. Therefore the probability of selecting the symbol $j + 1$ is $P_{j+1} = \frac{1}{\sum(j+1)}$.

2. Give an algorithm to select an a_i from a stream of symbols a_1, a_2, \dots, a_n with probability proportional to a_i^2 .

Solution:

In this case the probability of selecting the symbol a_j of the stream would be $P = \frac{1}{S_j}$ where $S_j = \sum a_j^2$.

3. How would one pick a random word from a very large book where the probability of picking a word is proportional to the number of occurrences of the word in the book?

Solution:

Keep track of the appearances of each element and the probability is going to be $P = \frac{1}{\sum}$