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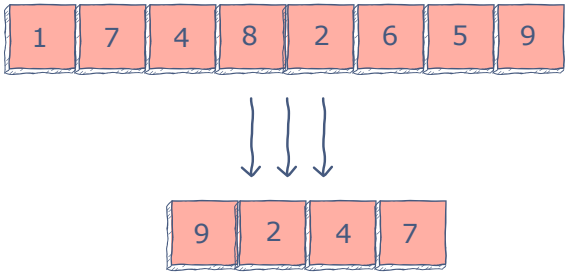
What is reservoir sampling?

sampling algorithms

Reservoir sampling is a randomized algorithm that is used to select k out of n samples; n is usually very large or unknown. For example, reservoir sampling can be used to obtain a sample of size k from a population of people with brown hair. This algorithm takes $O(n)$ to select k elements with uniform probability.



Reservoir sampling is used to randomly take k out n samples. Here k = 4.

Algorithm

1. Copy the first k elements from the input array to the output array.
2. Iterate from k to $n - 1$ (both inclusive). In each iteration j:

   2.1 Generate a random number num from 0 to j.

   2.2 If num is less than k, replace the element at index num in the output array with the item at index j in the input array.

Code

C++ Python3 Java

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```
// Including dependancies
#include <iostream>
#include <stdlib.h>
#include <time.h>
using namespace std;

int main() {
  // Defining the parameters
  int k = 4;
  int n = 8;
  // The array to be sampled
  int input[] = {1, 7, 4, 8, 2, 6, 5, 9};
  int output[k];
  // Getting a random seed everytime
  srand (time(NULL));
  int i;
  // Initializing the output array to the first k elements
  // of the input array.
  for(i = 0; i < k; i++){
    output[i] = input[i];
  }
  int j;
  // Iterating over k to n-1
  for(j = i; j < n; j++){
    // Generating a random number from 0 to j
    int index = rand() % (j + 1);
    // Replacing an element in the  output with an element
    // in the input if the randomly generated number is less
    // than k.
    if(index < k){
      output[index] = input[j];
    }
  }
  cout<<"Input array:"<<endl;
  for( i = 0; i < n; i++){
    cout<<input[i]<<" ";
  }
  cout<<endl;
  cout<<"Output array:"<<endl;
  for(i = 0; i < k; i++){
    cout<<output[i]<<" ";
  }
  cout<<endl;
  return 0;
}
```

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