Davie Truong

“I have read and agree to the collaboration policy. Davie Truong”

Homework Heavy

Collaborators: Yona Edell

**Homework 1 Question 3 (Induction)**

a) Uniform Shuffling

Uniform Shuffle: the probability for each element’s shuffle is equal throughout the set.

Starting with a set of numbers n, the probability of the first exchange is 1/n chance at being swapped with a particular index. This means there is a (n-1)/n chance at being in the remaining spots. In the next step n is decreased by 1, resulting in 1/(n-1) chance with a particular index and (n-2)/(n-1) everywhere else. Therefore, with induction we can see that for the ith element, the probability is 1/(n-i) to land at specific spot and (n-i-1)/(n-i) everywhere else. Therefore, the shuffle is uniformly random.

The runtime of the algorithm is Theta(n) because it must go through each number once. The other operations generate random number and swapping the values take constant time

b) Error in Induction

The error in this induction proof is that it is reliant on the base case’s logic and applies it incorrectly. Stating that the removal of 1 bus from a set yields that all buses in that set leads to the same destination is incorrect because although the base case is true, it probes that individually 1 bus can only have 1 destination, but it says nothing about the group of buses. The proof also assumes that the set of buses automatically lead to the same destination citing the induction hypothesis that doesn’t correlate with the claim.