Probability

July 30, 2024

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1. week 1

Experiment Shuffle a deck of cards, go through in order. How many times do 2 consecutive cards have the same suit?

1.1. Linearity of expectation

...The sum of each little thing

$$\mathbb{E}[X+Y] = \mathbb{E}[X] + \mathbb{E}[Y]$$

No assumption of independence or anything. Surprisingly useful.

Prove Expectation of selecting a card of type 1 1/13

sum of all expecations Xi depends on 2 cards. What's Pr

Probability of 52 C 13 E[Xi] = Pr[Xi = 1]

Note: difference between Expectation and Probability. Probability = the likelihood of the event e.g. selecting 2 consecutive suit cards from a deck of 52 Expectation = the average outcome. Multiply each outcome by it's probability.

need to do

discuss diffe

Monte Carlo, Las Vegas Running time Output quality

Question I have an array with n = 100 index of an even number what is time complexity of getting even numbers Theta n

- why isn't this constant? because you can create an algorithm that only selects "on expectation", the las Vegas

exepcted time For all expectation [Ta] = sum from infiintiy i = 1, i Pr [takes i attempts to find an even number]

$$\mathbb{E}[T_a] = \sum_{i=1}^{\infty} i \cdot \Pr[\text{takes } i \text{ attempts to find an even number}]$$

$$= \sum_{i=1}^{\infty} \frac{i}{2^i} = O(1)$$

Why Randomization?

Faster, Simpler Algo'S - miller rabin, it's a monte carlo algo. Runs in $Otilden^2$

Algos Quicksort Expected running time Is it Las Vegas or Monte Carlo? It's always going to return the sorted array, so it's Las Vegas. Proof: T(n) = Expectations[runtime on array size n] T(n) = E[T(|A1|)] + E[T(|A2|)] + O(n) We know |A1| + |A2| = n-1 |Why n-1?

2. Tutorial 1

Problem 1 Consider a deck of $4n$ cards with 'S', 'H', 'D', 'C', after shuffled randomly, what's the expected number of consecutive pairs of the same suit.

3. Quiz 0

4. week 2

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\begin{math}
    \sqrt{x+y}
\end{math}
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If you want the math to appear in its own line, the standard way is to use:

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\[
    \sqrt{x+y}
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Acknowledgments

Thank everyone.