

Lab W1D4

Question 1.

An array S of size 10 is filled with four different letters A, B, C and D. Assume that all four letters are equally likely to appear in the array S . However, there is no guarantee that all four letters are in the array.

- (a) What is the average number of array locations to inspect to find a D? Give your answer using a formula or result mentioned in the class note. Please give the Slide number as a reference.
- (b) Let Z be the random variable such that $Z = 1$ means the first D in the array is found in the first location. $Z = 2$ means the first D in the array is found in second location and so on. Compute $E(Z)$. (Note $Z = 0$ if D is not in the array)

Question 2.

An **array** of size 100 is filled with four different letters A, B, C and D. Assume that all four letters are equally likely to appear in the array S . However, there is no guarantee that all four letters are in the array.

- (a) What is the average number of array locations to inspect to find 10 D's? Give your answer using a formula or result mentioned in the class note. Please give the Slide number as a reference.
- (b) What is the average number of array locations to inspect to find k D's? Give your answer using a formula or result mentioned in the class note. Please give the Slide number as a reference.
- (c) What is the "average time complexity" to find k D's in an array?

Question 3.

Prove: $1 + 1/2 + 1/3 + \dots + 1/n = O(\log n)$.

Hint:

Let $n = 7$

$$1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6 + 1/7 \leq 1 + 1/2 + 1/2 + 1/4 + 1/4 + 1/4 + 1/4 = 3 = \log(7 + 1)$$

Question 4.

Find the sum: $1/2 + 2/4 + 3/8 + 4/16 + 5/32 + \dots$

Hint:

$$S = 1/2 + 2/4 + 3/8 + 4/16 + 5/32 + \dots$$

$$S/2 = 1/4 + 2/8 + 3/16 + 4/32 + \dots$$

$$S - S/2 = 1/2 + 1/4 + 1/8 + 1/16 + 1/32 + \dots$$