W1D4 Lab

Group members:

*\* 15. Nguyen, Ha Vu Duy  
\* 20. Pham, Van ty*

Question 1:

a/

Slide 17, 18

A math problem with red text

Description automatically generated with medium confidence

1. What is the average number of array locations to inspect to find the first D?

E(firstD) = 1/p = 1/1/4 = 4

For p = ¼

b/

Slide 20

A close-up of a number

Description automatically generated

Inspect to find 10 D:

E(10D) = k/p = 10/1/4 = 40

For p=1/4, k=10

c/

Above array has limit of size,

An *array*of size **1000000000000000** 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.

So the complexity is Big-Oh(1)

If the array comes to infinite, the complexity is **Big-Oh(k)**

Question 2:

Prove: 1+1/2+1/3+…+1/n = Θ(log n).

Algebra:

LHS = 1 + ½ + 1/3 + ¼ + 1/5 + 1/6 + … + 1/n <= 1 + ½ + ½ + ¼ + ¼ + ¼ + ¼ + 1/8 + 1/8 + 1/8 + 1/8 + …

LHS = 1 + ½ + 1/3 + ¼ + 1/5 + 1/6 + … + 1/n <= 1 + 1 + 1 + 1 + …

LHS = 1 + ½ + 1/3 + ¼ + 1/5 + 1/6 + … + 1/ <= log n

* LHS is as Ο(log n) (\*)

LHS = 1 + ½ + 1/3 + ¼ + 1/5 + 1/6 + 1/7 + 1/8 + … + 1/n >= 1 + ½ + 1/4 + ¼ + 1/8 + 1/8 + 1/8 + 1/8 + …

LHS = 1 + ½ + 1/3 + ¼ + 1/5 + 1/6 + 1/7 + 1/8 + … + 1/n >= 1 + ½ + ½ + ½ + …

LHS = 1 + ½ + 1/3 + ¼ + 1/5 + 1/6 + 1/7 + 1/8 + … + 1/n >= 1 + logn

* LHS is as Ω(1 + log n) => LHS is as Ω(log n) (\*\*)

By (\*) & (\*\*),

* LHS = Θ(log n). Prove!

Question 3:

