

2) (5 pts) ANL (Algorithm Analysis)

An algorithm to find a particular value takes $O(\log(n))$ time where n is the total number of values. On a data set of $n = 2^{30}$ it took 1.2 seconds to find the desired value. How many **milliseconds** will it take to find a value in a data set with $n = 2^{20}$? (Note: for ease of computation, you may use a logarithm with base 2.)

The runtime in seconds can be expressed as $c \log_2(n)$ where c is some constant. We can find the c by plugging in $n = 2^{30}$ with the answer as 1.2 seconds. We find that

$$\begin{aligned} 1.2s &= c \log_2(2^{30}) \\ 1.2s &= c \log_2(2^{30}) \\ 1.2s &= 30c \\ \frac{1.2s}{30} &= c \end{aligned}$$

To solve for the question we plug 2^{20} for n .

$$\begin{aligned} \text{answer} &= \frac{1.2s}{30} \log_2(2^{20}) \\ &= \frac{1.2s}{30} \times 20 \\ &= \frac{2 (1.2s)}{3} \\ &= .8s \end{aligned}$$

Convert to milliseconds

$$\underline{\text{answer} = 800ms}$$

Grading:

Find c , 2 pts.

Plugging in 2^{20} , 2 pts.

Correct answer by converting, 1 pts.