

2) (5 pts) ANL (Algorithm Analysis)

A $O(\sqrt{n})$ search algorithm took 45 milliseconds to complete a search amongst $n = 4 \times 10^6$ entries. How long would it be expected for this algorithm execute a search amongst a database of 10^8 entries, in milliseconds?

Let $T(n) = c\sqrt{n}$ be the amount of time the algorithm takes to execute on a input of size n . Using the given information we have:

$$T(4 \times 10^6) = c\sqrt{4 \times 10^6} = 45 \text{ ms}$$

$$c\sqrt{4 \times 10^6} = 45 \text{ ms}$$

$$(2 \times 10^3)c = 45 \text{ ms}$$

$$c = \frac{45}{2000} \text{ ms}$$

Now, we solve for $T(10^8)$:

$$T(10^8) = \frac{45}{2000} \text{ ms} \sqrt{10^8} = \frac{45 \times 10^4}{2 \times 10^3} \text{ ms} = 45 \times 5 \text{ ms} = \mathbf{225 \text{ ms}}$$

Grading: 1 pt set up equation for c.

1 pt solve for c.

1 pt plug in $n = 10^8$

2 pts to get to correct final answer simplified as 225 ms. (1 pt for intermediate form)