

2) (5 pts) ANL (Algorithm Analysis)

An algorithm processing an array of size n runs in $O(n^3)$ time. For an array of size 500 the algorithm processes the array in 200 ms. How long would it be expected for the algorithm to take when processing an array of size 1,500? Please express your answer in *seconds*.

Let the algorithm with input size n have a runtime of $T(n) = cn^3$, for some constant c . Using the given information we have:

$$\begin{aligned} T(500) &= c(500)^3 = 200ms \\ c &= \frac{200}{500^3} ms \end{aligned}$$

Now, we must find $T(1500)$:

$$T(1500) = c(1500)^3 = \frac{200}{500^3} ms \times (1500)^3 = \left(\frac{1500}{500}\right)^3 \times 200ms = 3^3 \times 200ms = 5400ms = 5.4s$$

Thus, our final answer is **5.4 seconds**.

Grading: 1 pt to set up the initial equation for c , 1 pt to solve for c , 2 pts to get answer in ms, 1 pt to convert to seconds. Give partial credit for the 2 pts if the setup is correct but some algebra issue occurred. Also, give full credit if the ratio method (which is also valid) is used instead of this method. Map points accordingly if some error is made using that method.