

Practice Time Prediction Questions

Fall 2023) A program takes $O(nlgm)$ time to process n data sets, each which have m values. For 100,000 data sets, each with 2^{16} values, the program takes 500 ms (milliseconds) to complete. Given this information, how many milliseconds would we expect the program to take to process 60,000 data sets, each with 2^{20} values?

Spring 2024) A $O(n^3)$ image processing algorithm took 125 milliseconds to index $n = 400$ images. How long would it be expected for this algorithm to take to index **640** images, in milliseconds? **Please show all your work, including algebraic simplification, which is part of what is being tested with this question.**

Summer 2024) An algorithm that processes a list of size n takes $O(\sqrt{n}lgn)$ time. On Shannon's computer, when she runs the algorithm on a list of size $n = 2^{16}$, her computer takes c milliseconds. (Shannon is very secretive, so she hasn't told you the value of c unfortunately!) **In terms of c** , how long, **in milliseconds**, should we expect the algorithm to take on her computer when she is processing a list of size 2^{20} ? (Your answer should be of the form kc , where k is a positive real number.)

Fall 2024) A brute force algorithm which processes all permutations of n routines runs in $O(n \times (n!))$ time. On a particular computer, executing the algorithm for $n = 9$ takes 180 milliseconds. How many seconds is the algorithm expected to take on an input of size $n = 11$, run on the same computer?

Spring 2025) An algorithm that processes a grid of R rows and C columns runs in $O(RlgC)$ time. It turns out that for any R by C grid, we can transpose the grid so that it has C rows and R columns instead and solve the problem on that grid to get the same answer. Fred ran the code with $R = 10^6$ and $C = 10^2$ and it took **3 hours** to run. Shanille transposed the grid and reran the code with $R = 10^2$ and $C = 10^6$ to prove to Fred how inefficient his technique was. How long, **in seconds**, would be expect Shanille's execution of the code to take? **Please answer as a decimal to two places.**

Sum 2025) 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?

Fall 2025) An algorithm to process n entries of data runs in $O(n^3\sqrt{n})$ time. For $n = 40^3$, the algorithm takes 2.5 milliseconds to run. How long will the algorithm take to run for an input size of $n = 80^3$, in milliseconds?

Spr 2026) An algorithm which has a run time of $O(n^2\sqrt{n})$ takes 3 seconds to run on an input with size $n = 10,000$. (Note: the function in the Big-Oh is read out loud as, "n squared times square root n.") If there are 86,400 seconds in a day, how many days would the algorithm take to complete on an input size of $n = 10^6$? **Express your answer as a fraction in lowest terms.** Put a box around your final answer.