

Codeforces

Sphere Online Judge (SPOJ)

CodeChef

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Competitive Programming

How do I know if an algorithm will pass the time limit in competitive programming questions?

usually the questions have a variable (let's say n) and the range of the variable is given. Sometimes n is $\leq 10^6$ and some times $n \leq 10^9$. And sometimes $n \leq 10^5$. Now I have seen than the the cases of 10^6 and 10^9 , linear solutions are passed where as in 10^9 only $\log n$ solution is passed. Can you please give a list of common restrictions (range of n) and the running time of algorithm (eg- $n \log n$ etc) that are usually passed.

1 Answer

Bhavya Ghai, Data Science Enthusiast & Aspiring Data Scientist

Written 144w ago

Time complexity (eg.- $O(n)$, $O(n \log n)$, etc) of the chosen algorithm will directly affect the time to solve the problem for a particular n . We always consider worst case condition.

In the question if range of n is from 1 to 1million. Then we will design our algorithm considering $n=1$ million (worst case). In programming problems time limit is given in seconds. Now the question is how to map time complexity ($O(n)$, $O(n \log n)$, etc) to seconds.

The exact time taken by the problem depends on the speed of server, architecture of server, OS and certainly on the complexity of the algorithm.

For example spoj uses two kinds of servers mentioned in this link [Sphere Online Judge \(SPOJ\)](#) ↗.

Most of the online judges don't use latest machines for judging so that minor differences can be judged accurately.

To give a very rough idea consider that 1million instructions will be executed per second. Considering time limit to be 1sec.

max value of n	time complexity
10^6	$O(n)$

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10^5	$O(n \log n)$
10^3	$O(n^2)$
10^2	$O(n^3)$
10^9	$O(\log n)$

In case time limit is x seconds then the algo's worst case acceptable complexity will be multiplied by a factor of x.

I strongly suggest anyone with same problem to go through 'Art of Programming Contest' by Ahmed Shamsul Arefin Page no:-22 to get a more elaborate answer to this problem.

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