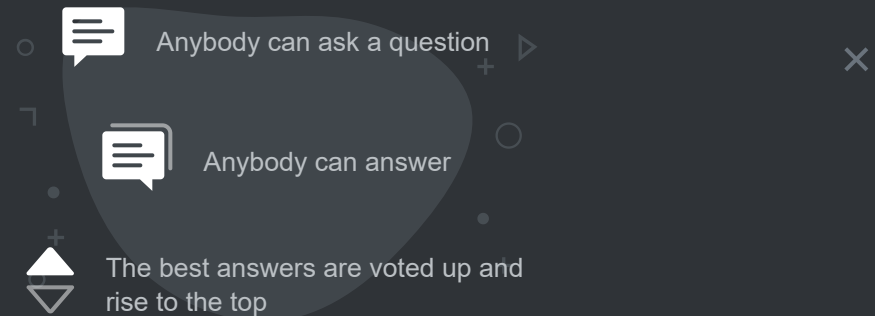


Mathematics Stack Exchange is a question and answer site for people studying math at any level and professionals in related fields. It only takes a minute to sign up.

Sign up to join this community



Big-O Notation (How to calculate C and k)

Asked 5 years, 8 months ago Active 5 years, 8 months ago Viewed 10k times



I have a fair idea of what Big-O Notation is, but I'd like to know if there's a sure fire way to calculate the values of C and k for which

1



Let f and g be functions from the set of integers or the set of real numbers to the set of real numbers. We say that $f(x)$ is $O(g(x))$ if there are constants C and k such that



$$|f(x)| \leq C|g(x)|$$



whenever $x > k$. [This is read as “ $f(x)$ is big-oh of $g(x)$.”]

Example question:

3. Use the definition of “ $f(x)$ is $O(g(x))$ ” to show that $x^4 + 9x^3 + 4x + 7$ is $O(x^4)$.

Via trial and error, I have found them out to be $C = 4$, $k = 9$. Is there a specific method to calculate these values?

algorithms

asked Dec 31 '14 at 18:05



Rafay

125 1 5

2 Answers

Active

Oldest

Votes



Is there a specific method to calculate these values?

3

No.

In the case you explain though, for every $x \geq 1$, $x^4 + 9x^3 + 4x + 7 \leq x^4 + 9x^4 + 4x^4 + 7x^4$ hence $k = 1$ and $C = 21$ fit.



Likewise (*exercise*), $k = 2$ and $C = 7$ would fit. Or $k = 5$ and $C = 4$. Or many others.



edited Dec 31 '14 at 18:26

answered Dec 31 '14 at 18:09



Did

261k 26 247 506

So we can have multiple values of C and k for which the equality holds true? – Rafay Dec 31 '14 at 18:12

- 1 @Rafay Yes! This is a vitally useful insight. Notice that in Did's answer $k = 1$ was not calculated, but chosen specifically to ensure that $x^4 \geq x^3 \geq x^2 \geq x \geq 1$ as long as $x \geq k$. You'll find it takes much less effort to find a working C if you allow yourself the freedom of increasing k when it's advantageous. – Erick Wong Dec 31 '14 at 18:19



There is no specific general method to calculate these values. In this case you could fix any C greater than 1 and then determine a k via solving the resulting (in)equality.

1



However, please note that the point here is not at all to find *optimal* values; basically you can take whatever works conveniently. Normally, one uses this asymptotic notation precisely when one does not care about the fine details but just wants a rough idea.





answered Dec 31 '14 at 18:12



quid ♦

39.1k

● 9

■ 56

▲ 96