Section 1: Big-O Notation (7 Questions)

Recall that we write $f(n) = O(g(n))$ when $f(n)$ grows no faster than $g(n)$.

More formally, $f(n) = O(g(n))$ if there are constants c and n_0 such that for any $n \geq n_0$, $f(n) \leq c \cdot g(n)$.

These are the main rules for working with big-O notation:

- Multiplicative constants can be omitted: $7n^2 = O(n^2)$, $3n = O(n)$.
- Lower order terms can be omitted: $3n + 5 = O(n)$, $7n^2 + 3n + 20 = O(n^2)$.
- n^a grows slower than n^b for constants $0 < a \leq b$: $n^a = O(n^b)$.
- Any logarithm grows slower than any polynomial: $(\log n)^a = O(n^b)$ for constants $a, b > 0$.
- Any polynomial grows slower than any exponential function: $n^b = O(c^n)$ for constants $b > 0, c > 1$.

In the following sequence of questions, your goal is to select correct statements about big-O. Examples of correct statements:

- $n \log n = O(n^2)$
- $n^2 \cdot (\log n)^3 = O(n^5)$
- $n^7 = O(3^n)$

Examples of incorrect statements:

- $\sqrt{n} = O(n^{0.3})$
- $\frac{n^2}{\log n} = O(n \log n)$
- $1.5^n = O(n^{10})$

Recall also the main rules for working with logarithms:

- $\log_a(n^k) = k \log_a n$
- $\log_a(nm) = \log_a n + \log_a m$

- $n^{\log_a b} = b^{\log_a n}$
- $\log_a n \cdot \log_b a = \log_b n$

Correct or not?

1/1 point (graded)

$n \log_2 n = O(n)$

- ○ Correct
- ◉ Incorrect ✔

Submit You have used 1 of 1 attempt

Correct or not?

1/1 point (graded)

$n^{1/2} = O(5^{\log_2 n})$

- ◉ Correct ✔
- ○ Incorrect

Submit

Correct or not?

1/1 point (graded)

$2^n = O(2^{n+1})$

- ◉ Correct ✔
- ○ Incorrect

Submit

Correct or not?

1/1 point (graded)

$(n+3)\cdot(n+7)=O(n\log n)$

- Correct
- Incorrect ✔

Submit You have used 1 of 1 attempt

Correct or not?

1/1 point (graded)

$n^2/\log_3 n=O(n(\log_2 n)^2)$

- Correct
- Incorrect ✔

Submit You have used 1 of 1 attempt

Correct or not?

1/1 point (graded)

$3^n=O(n^5)$

- Correct
- Incorrect ✔

Submit You have used 1 of 1 attempt

Order by growth rate

1/1 point (graded)

You would like to order the given functions by their growth rate (starting from the function with the smallest growth rate: $f_1(n) = n^3$, $f_2(n) = n \log_2 n$, $f_3(n) = 4^n$, $f_4(n) = n^{0.3}$, $f_5(n) = n(\log_2 n)^3$, $f_6(n) = \log_5 n$, $f_7(n) = \sqrt{n}$.

Select the correct ordering.

- $f_4, f_6, f_7, f_2, f_5, f_1, f_3$
- $f_6, f_7, f_4, f_2, f_5, f_1, f_3$
- $f_6, f_4, f_2, f_7, f_5, f_1, f_3$
- $f_6, f_4, f_7, f_5, f_2, f_1, f_3$
- $f_6, f_4, f_7, f_2, f_5, f_1, f_3$ ✔
- $f_6, f_4, f_7, f_2, f_1, f_5, f_3$
- $f_6, f_4, f_7, f_2, f_5, f_3, f_5$

Submit You have used 1 of 1 attempt