1. Introduction and Learning Outcomes

1 / 1 point

The goal of this assignment is to practice with big-O notation.

Recall that we write $f(n) = O(g(n))$ to express the fact that $f(n)$ grows no faster than $g(n)$: there exist constants N and $c > 0$ so that for all $n \geq N$, $f(n) \leq c \cdot g(n)$.

Is it true that $\log_2 n = O(n^2)$?

- (●) Yes
- ( ) No

Correct
A logarithmic function grows slower than a polynomial function.

2. $n \log_2 n = O(n)$

1 / 1 point

- ( ) Yes
- (●) No

Correct
To compare these two functions, one first cancels n. What is left is $\log_2 n$ versus 1. Clearly, $\log_2 n$ grows faster than 1.

3. $n^2 = O(n^3)$

1 / 1 point

- (●) Yes
- ( ) No

Correct
n^a grows slower than n^b for constants $a < b$.

4. $n = O(\sqrt{n})$

1 / 1 point

- ( ) Yes
- (●) No

Correct
$\sqrt{n} = n^{1/2}$ grows slower than $n = n^1$ as $1/2 < 1$.

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

1 / 1 point

- ( ) Yes
- (●) No

Correct
Recall that $a^{\log_b c} = c^{\log_b a}$ so $5^{\log_2 n} = n^{\log_2 5}$. This grows faster than n^2 since $\log_2 5 = 2.321\ldots > 2$.

6. $n^5 = O(2^{3 \log_2 n})$

1 / 1 point

- ( ) Yes
- (●) No

Correct
$2^{3 \log_2 n} = (2^{\log_2 n})^3 = n^3$ and n^3 grows slower than n^5.

7. $2^n = O(2^{n+1})$

1 / 1 point

- (●) Yes
- ( ) No

Correct
$2^{n+1} = 2 \cdot 2^n$, that is, 2^n and 2^{n+1} have the same growth rate and hence $2^n = \Theta(2^{n+1})$.