CSE 12 – Basic Data Structures and Object-Oriented Design
Lecture 10

Greg Miranda & Paul Cao, Winter 2021

This lecture is being recorded

Announcements

- Quiz 10 due Monday @ 8am
- Survey 4 due Friday @ 11:59pm
- PA3 due tonight @ 11:59pm
- Exam 1 on Friday (no class)
  - Released @ 8am on Friday
  - Closes @ 10am on Saturday
  - More details on Piazza

26 hour

60 minutes

No makeups

Lectures → 1-8

Topics

- Questions on Lecture 10?
- Big O

Questions on Lecture 10?

Let f(n) = 100

$f(n) \leq c + g(n)$

N_0

$O(f(n))$

- Which of the following is NOT a correct bound?

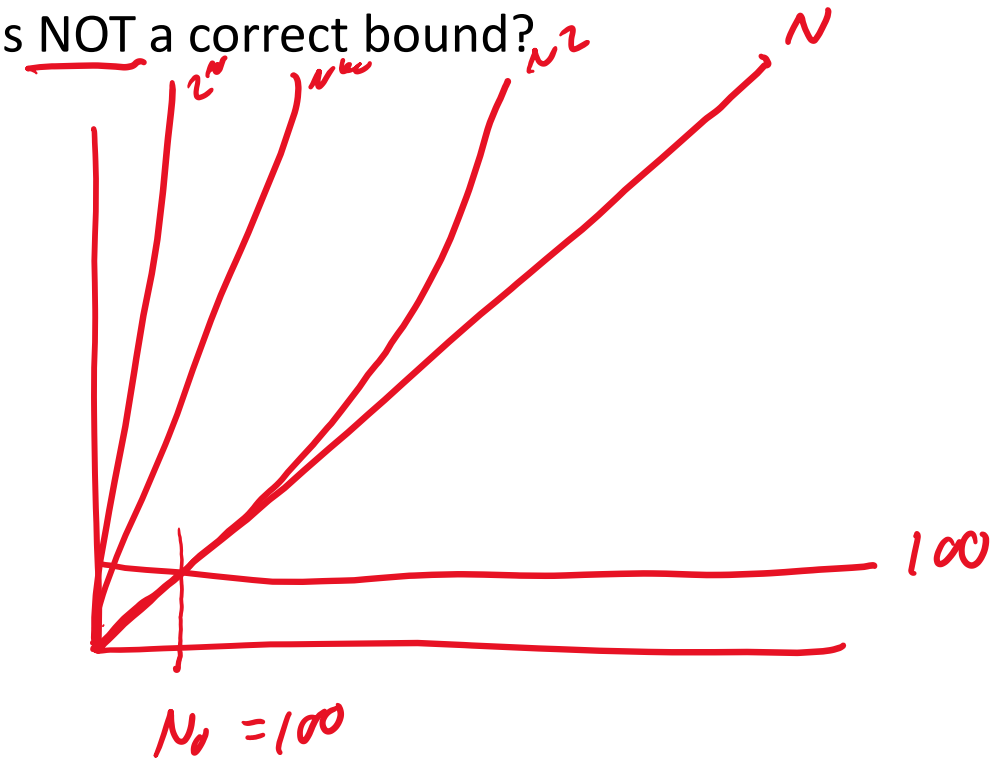
A. f(n) is $O(2^n)$

B. f(n) is $O(n^2)$

C. f(n) is O(n)

D. f(n) is $O(n^{100})$

E. None of these



For each function in the list below, it is related to the function below it by O, and the reverse is **not** true. That is, *n is O(n^2) but n^2 is **not** O(n)*.

- f(n) = 1/(n^2)
- f(n) = 1/n
- f(n) = 1
- f(n) = log(n)
- f(n) = sqrt(n)
- f(n) = n
- f(n) = n^2
- f(n) = n^3
- f(n) = n^4
- … and so on for constant polynomials …
- f(n) = 2^n
- f(n) = n!
- f(n) = n^n

upper bound

$O(f(n))$

$f(n) \leq c * g(n)$

N

n^2

n^3

Let f(n) = 3n3 + 2n + 7

- Which of the following is a correct bound?

A. f(n) is O(log(n))

B. f(n) is O(n^2)

C. f(n) is O(n)

D. f(n) is O(n^3)

E. None of these

```
void printAllElementOfArray(int[] arr) {
    for (int i = 0; i < arr.legnth; i++) {
        printf("%d\n", arr[i]);
    }
}
```

$1 + (N+1) + N + N$

$P(N) = 3N + 2$

- Which of the following is a correct bound?

$3N + 2N = 5N$

$g(N) = N$

$C = 5$

$N_0 = 2$

0 A. f(n) is O(log(n)) ✗

1 B. f(n) is $O(n^2)$ ✓

20 C. f(n) is O(n) ✓

0 D. f(n) is $O(n^3)$ ✓

36 E. More than one of these

```
void printAllPossibleOrderedPairs(int arr[]) {
  for (int i = 0; i < arr.length; i++) {
    for (int j = 0; j < arr.length; j++) {
      printf("%d = %d\n", arr[i], arr[j]);
    }
  }
}
```

N

$1 + (N+1) + N +$

$N(1 + (N+1) + N + N)$

$2 + 2N + N(2 + 3N)$

- Which of the following is a correct bound?

$3N^2 + 2N + 2N + 2$

$f(N)$ $3N^2 + 4N + 2$

1 A. f(n) is O(log(n)) ✗

4 B. f(n) is $O(n^2)$ ✓

0 C. f(n) is O(n) ✗

2 D. f(n) is $O(n^3)$ ✓

4? E. More than one of these

$C = 3$ $g(N) = N^2$

$N_0 = 4$

```
int fibonacci(int num) {
    if (num <= 1) return num;
    return fibonacci(num - 2) + fibonacci(num - 1);
}
```

fibonacci(5)

N N

15 times

- Which of the following is a correct bound?

$2^N \rightarrow 32$

35 A. f(n) is $O(2^n)$

1 B. f(n) is $O(n^2)$ 25

2 C. f(n) is $O(n)$ 5

2 D. f(n) is $O(n^3)$ 125

4 E. More than one of these