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

Greg Miranda, Fall 2020

This lecture is being recorded

Announcements

- Quiz 10 due Monday @ 9am
- Survey 3 due tonight @ 11:59pm
- PA3 due Wednesday @ 11:59pm → practice → submit after
- Exam 1 next Friday
  - Released @ 8am on Friday
  - Closes @ 12pm on Saturday
  - More details to be released on Piazza soon

} 28 hours → 60 minutes

Topics

- Questions on Lecture 10?
- Big O

Questions on Lecture 10?

Let f(n) = 100

- Which of the following is NOT a correct bound?

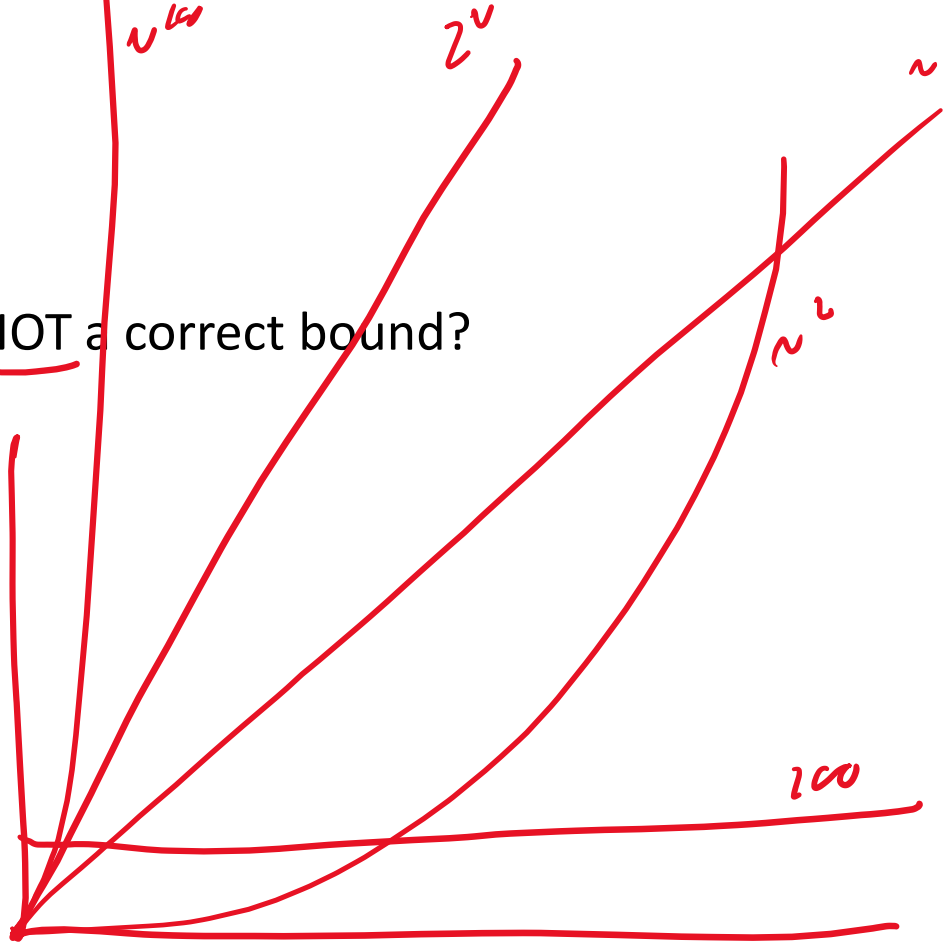
2 A. f(n) is $O(2^n)$

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

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

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

18 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

Big O upper bound

Big Ω lower bound.

Big Θ tight bound.

$f(n) \leq cg(n)$

No

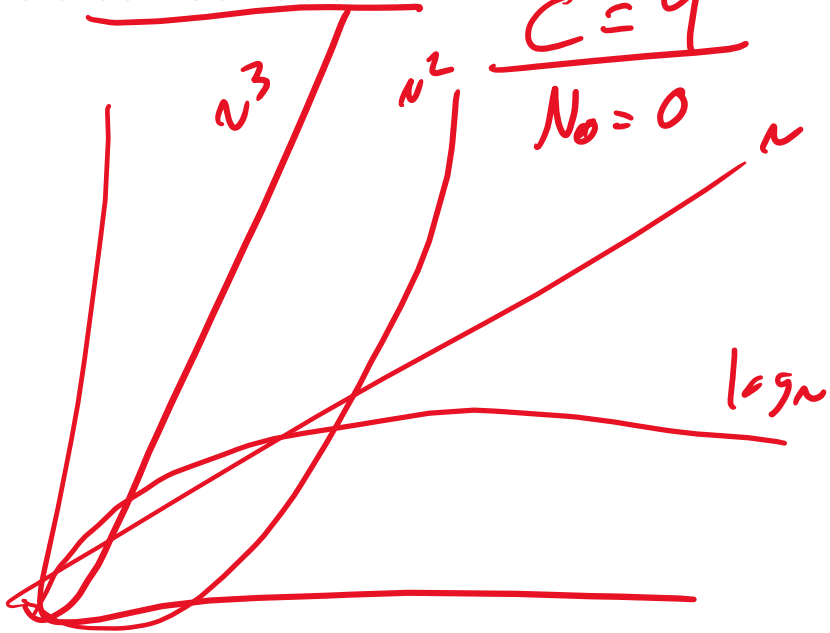
$f(n) = 3n \rightarrow O(n) \rightarrow o(n^n)$ $O(n^2)$

Let $f(n) = 3n^3 + 2n + 7$ $\leq$ $9n^3$

$3n^3 + 3n^3 + 3n^3 = 9n^3$

- 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]);
    }
}
```

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

$3N + 2$

$3N + 3N = 6N$

$\leq 6N$

- 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. 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]);
    }
  }
}
```

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

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

- Which of the following is a correct bound?

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

$2 + 4N + 3N^2$

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. More than one of these

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

- Which of the following is 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 $O(n^3)$

E. More than one of these

$f(n) = 1 + f(n-2) + f(n-1)$

$= 1 + (1 + f(n-4) + f(n-3)) + (1 + f(n-3) + f(n-2))$

$\rightarrow f(n) \rightarrow 2^n$