

Midterm 2 Standard 14 - Analyzing Code III: Writing down recurrences

Due Date April 17
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1 Instructions

- The solutions **should be typed**, using proper mathematical notation. We cannot accept hand-written solutions. Here's a short intro to \LaTeX .
- You should submit your work through the **class Canvas page** only. Please submit one PDF file, compiled using this \LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You **may not collaborate with other students**. **Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Discord, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.

2 Standard 14 - Analyzing Code III: Writing down recurrences

2.1 Problem 1

Problem 1. Write down a recurrence for the runtime complexity of this algorithm. Clearly justify your answer. You are **not** being asked to solve the recurrence.

```
foo(n) {  
    if (n <= 2) {  
        return 0  
    }  
  
    foo(n/3)  
    foo(n/3)  
    foo(n/3)  
    for (j = 1; j < n; j*3) {  
        bar()  
    }  
}
```

Answer. Since the loop runs until $j \geq n$ and j is multiplied by 3 in each iteration of the loop, the non recursive work done is $\log_3(n)$

$$T(n) = 3T(n/3) + \log_3(n).$$

□