

Computer Science Notes

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Preface

These are my exam review notes taken throughout the Spring semester.

February 5, 2024

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Part I

Computer Networks

Exam 1

Part II

Advanced Algorithms

Exam 1

Assignment 1

Assignment 2

3.1 Are either $\lceil \lg n \rceil!$ or $\lceil \lg \lg n \rceil!$ polynomially bounded?

Polynomially bounded means $f_n = O(n^k)$ for some constant k . Therefore, to demonstrate whether f_n is polynomially bounded, prove or disprove the inequality $f_n \leq c \cdot n^k$.

3.2 Use induction to prove $F_i = \frac{\phi^i - \hat{\phi}^i}{\sqrt{5}}$; where $F_i = F_{i-2} + F_{i-1}$, and ϕ is the golden ratio $\frac{1+\sqrt{5}}{2}$.

3.3 Show that $k \lg k = \Theta(n)$ implies $k = \Theta\left(\frac{n}{\lg n}\right)$.

3.4 Are either 2^{n+1} or 2^{2n} big- O of 2^n ?

3.5 For each pair of functions (A, B) , indicate whether A is O, o, Ω, ω , or Θ of B . Assume $k \geq 1$, $\epsilon > 0$, $c > 1$ are constants.

| A | B | O | o | Ω | ω | Θ |
|-------------|--------------|-----|-----|----------|----------|----------|
| $\lg^k n$ | n^ϵ | yes | yes | yes | yes | yes |
| n^k | c^n | yes | yes | yes | yes | yes |
| \sqrt{n} | $n^{\sin n}$ | yes | yes | yes | yes | yes |
| 2^n | $2^{n/2}$ | yes | yes | yes | yes | yes |
| $n^{\lg c}$ | $c^{\lg n}$ | yes | yes | yes | yes | yes |
| $\lg(n!)$ | $\lg(n^n)$ | yes | yes | yes | yes | yes |
| A | B | yes | yes | yes | yes | yes |

3.6 Order the following functions such that $f_1 = \Omega(f_2)$, $f_2 = \Omega(f_3)$, ..., $f_{29} = \Omega(f_{30})$, and partition them into equivalence classes such that each function is big- Θ of each other.

Part III

Software Engineering

Exam 1

Part IV

Operating Systems

Exam 1

