

# 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 that  $f_n = O(n^k)$  for some constant  $k$ .

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  $\phi$  is the golden ratio  $\frac{1+\sqrt{5}}{2}$ .

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

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  $O, o, \Omega, \omega$ , or  $\Theta$  of  $B$ . Assume  $k \geq 1, \epsilon > 0, c > 1$  are constants.

$A$	$B$	$O$	$o$	$\Omega$	$\omega$	$\Theta$
$\lg^k n$	$n^\epsilon$	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  $f_1 = \Omega(f_2), f_2 = \Omega(f_3), \dots, f_{29} = \Omega(f_{30})$ , and partition them into equivalence classes such that each function is big- $\Theta$  of each other.



# **Part III**

## **Software Engineering**



# **Exam 1**



# **Part IV**

## **Operating Systems**





# **Exam 1**

