

ECE 2400 Computer Systems Programming

Topic 8: Complexity Analysis

<http://www.csl.cornell.edu/courses/ece2400>
School of Electrical and Computer Engineering
Cornell University

revision: 2025-03-03-19-30

Please do not ask for solutions. Students should compare their solutions to solutions from their fellow students, discuss their solutions with the instructors during lab/office hours, and/or post their solutions on Ed for discussion.

List of Problems

1	Short Answer	2
2	K-ary and Hybrid Search	3
2.A	K-ary Search Algorithm	3
2.B	Hybrid Search Algorithm	4
2.C	Comparing Search Algorithms	5

Note that there are also problems related to complexity analysis in earlier topics!

Problem 1. Short Answer

Carefully plan your solution before starting to write your response. Please be brief and to the point; if at all possible, limit your answers to the space provided.

Part 2.C Comparing Search Algorithms

In this problem, you will be qualitatively comparing various search algorithms. **Begin by filling in the following table.** Your analysis for K-ary search should be generalized for any value of K . Your analysis for hybrid search should be generalized for any value of M . *Hint: For K-ary search carefully consider what computation increases and decreases with K !* Your analysis should be for the worst case. *Note that this does not mean the worst case values of K or M .* This means the worst case array data and/or search value which produce the worst case function of N .

	Worst Case Execution Time ($T(N)$)	Worst Case Time Complexity (big-O)
Linear Search		
Binary Search		
Ternary Search		
K-ary Search		
Hybrid Search		

Use these results along with deeper insights to perform a comparative analysis of these search algorithms, with the ultimate goal of **making a compelling argument for which algorithm will perform better across a large number of usage scenarios.** While you are free to use whatever approach you like, we recommend you structure your response in several paragraphs. The **first paragraph** might discuss the performance of linear and binary search using time complexity analysis summarizing what we learned in lecture. Justify the entries in the table. The **second paragraph** might start by discussing the performance of 3-ary search using time complexity analysis before generalizing this analysis for an arbitrary value of K . Justify the entries in the table. Remember that asymptotic big-O time complexity analysis is not the entire story; it is just the starting point for understanding execution time. *Consider how the execution time varies as a function of K . Think critically about what might be an optimum value of K .* The **third paragraph** might discuss the performance of the hybrid search algorithm using time complexity analysis. Justify the entries in the table. Remember that asymptotic big-O time complexity analysis is not the entire story; it is just the starting point for understanding execution time. *Consider how the execution time varies as a function of M . Think critically about what kind of overheads a hybrid search algorithm is trying to optimize.* The **fourth paragraph** might discuss other qualitative metrics such as generality, maintainability, and design complexity. The **final paragraph** can conclude with a compelling argument for which search algorithm will perform better in the general case, or if you cannot strongly argue for any algorithm explain why. Your answer will be assessed on how well you argue your position.