

# Algoritmalar

Furkan Kapukaya  
Furkan Özer



# Algoritma

Bir problem türündeki tüm durumları  
kısıtlı yer ve zamanda  
efektif bir şekilde çözmek için kullanılan  
formal bir dille tanımlanmış  
hiçbir belirsizlik içermeyen  
sonlu kurallar kümesidir.

# Algoritma

Finiteness

Definiteness

Efectiveness

Correctness

Generality

Input

Output



## Tarihçe

Algorithm = Algorismus + Arithmos

El-Harezmi

Cebir ve Denklem Hesabı Üzerine Özet Kitap

Ada Lovelace

Bernoulli Sayıları

David Hilbert

Entscheidungsproblem



# Algoritmaların Sınıflandırılması

By Implementation

By Design Paradigm

Optimization Problems

By Complexity

## By Implementation

Recursive

Logical

Serial, Parallel or Distributed

Deterministic&Non Deterministic

Exact&Approximate

Quantum



## By Design Paradigm

Divide&Conquer

Search&Enumeration

Brute-Force

Randomized

Reduction of Complexity

# Optimization Problems

Linear Programming

Dynamic Programming

Greedy Method

Heuristic Method



## By Complexity

Constant

Linear

Logarithmic

Polynomial

Exponential



# Algorithm Complexity

Big  $O$

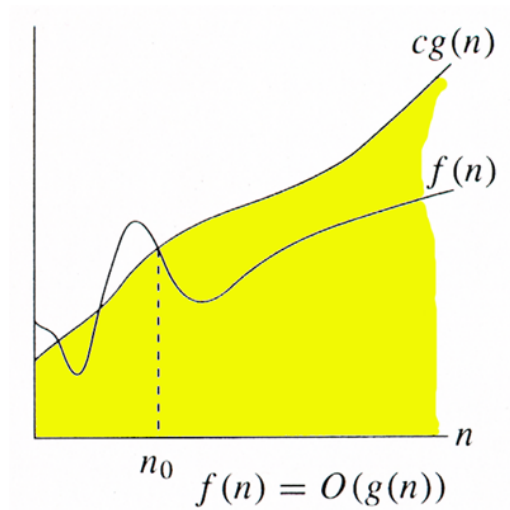
Big  $\Theta$

Big  $\Omega$

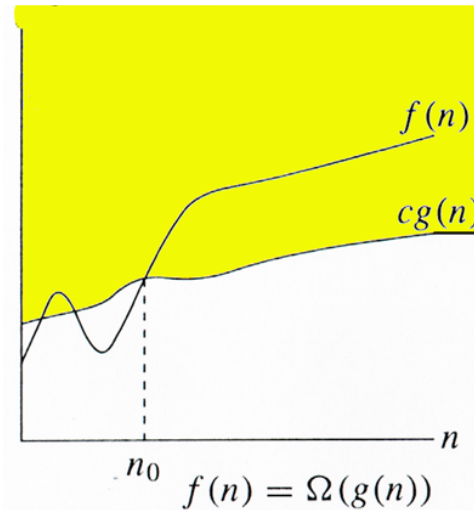
Little  $o$  &  $\Omega$

# Algorithm Complexity

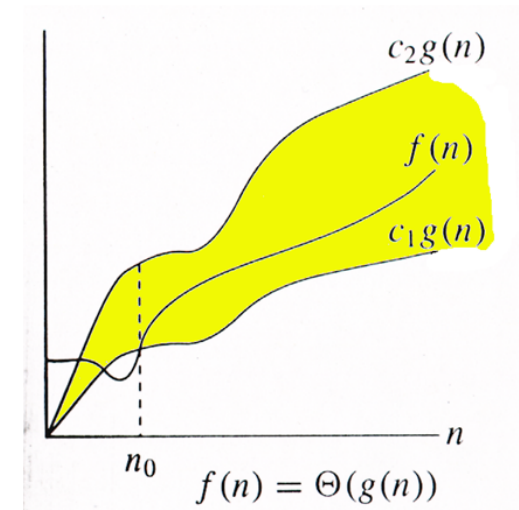
Big O



Big  $\Omega$



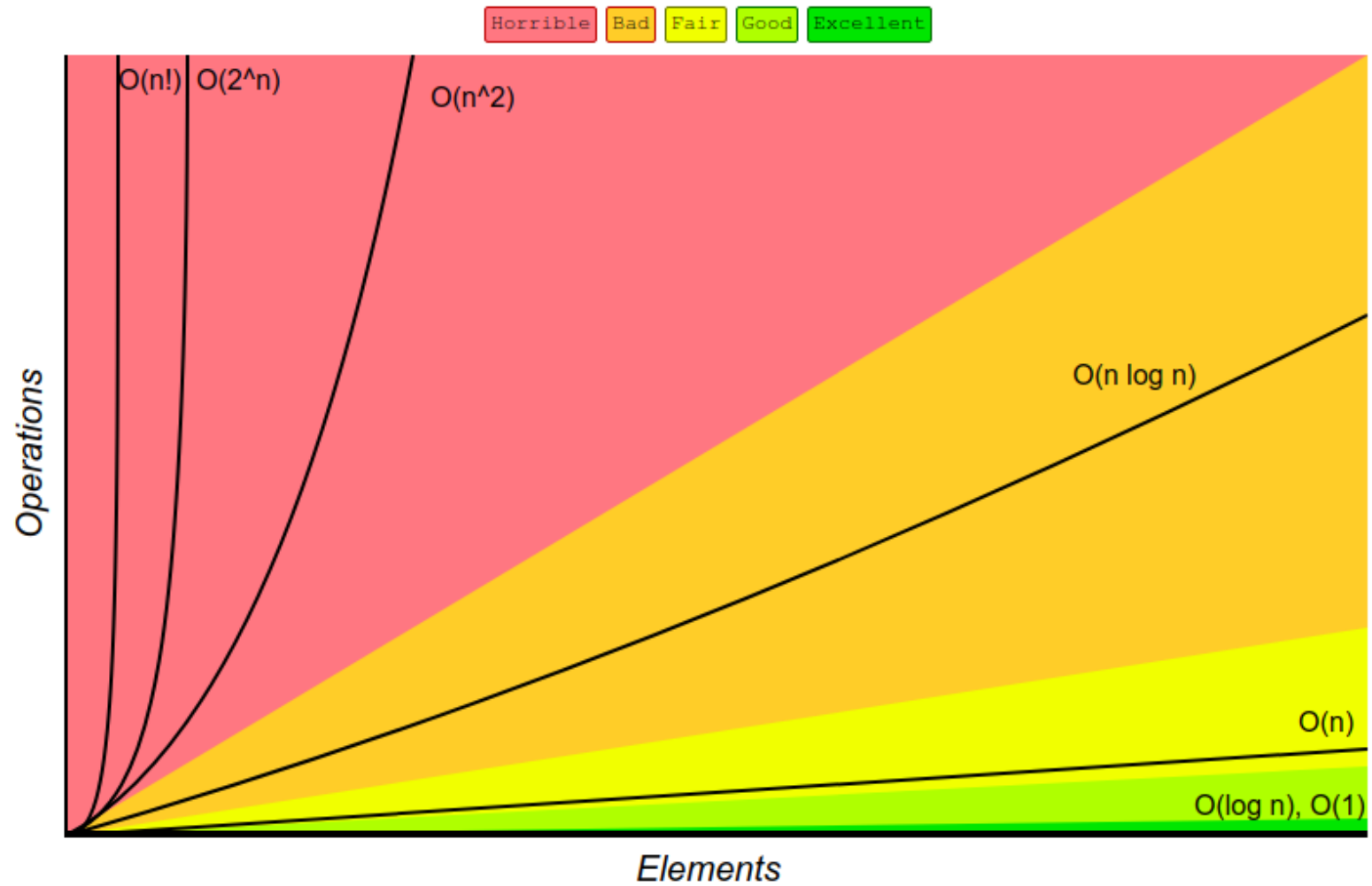
Big  $\Theta$



Little o &  $\Omega$



# Algorithm Complexity



# Algorithm Complexity

Data Structure	Time Complexity								Space Complexity
	Average				Worst				Worst
	Access	Search	Insertion	Deletion	Access	Search	Insertion	Deletion	
<u>Array</u>	$\Theta(1)$	$\Theta(n)$	$\Theta(n)$	$\Theta(n)$	$\Theta(1)$	$O(n)$	$O(n)$	$O(n)$	$O(n)$
<u>Stack</u>	$\Theta(n)$	$\Theta(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$	$O(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$
<u>Queue</u>	$\Theta(n)$	$\Theta(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$	$O(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$
<u>Singly-Linked List</u>	$\Theta(n)$	$\Theta(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$	$O(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$
<u>Doubly-Linked List</u>	$\Theta(n)$	$\Theta(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$	$O(n)$	$\Theta(1)$	$\Theta(1)$	$O(n)$
<u>Skip List</u>	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$O(n)$	$O(n)$	$O(n)$	$O(n)$	$O(n \log(n))$
<u>Hash Table</u>	N/A	$\Theta(1)$	$\Theta(1)$	$\Theta(1)$	N/A	$O(n)$	$O(n)$	$O(n)$	$O(n)$
<u>Binary Search Tree</u>	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$O(n)$	$O(n)$	$O(n)$	$O(n)$	$O(n)$
<u>Cartesian Tree</u>	N/A	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	N/A	$O(n)$	$O(n)$	$O(n)$	$O(n)$
<u>B-Tree</u>	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(n)$
<u>Red-Black Tree</u>	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(n)$
<u>Splay Tree</u>	N/A	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	N/A	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(n)$
<u>AVL Tree</u>	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(\log(n))$	$O(n)$
<u>KD Tree</u>	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$\Theta(\log(n))$	$O(n)$	$O(n)$	$O(n)$	$O(n)$	$O(n)$



# Algorithm Complexity

Algorithm	Time Complexity			Space Complexity
	Best	Average	Worst	Worst
<u>Quicksort</u>	$\Omega(n \log(n))$	$\Theta(n \log(n))$	$O(n^2)$	$O(\log(n))$
<u>Mergesort</u>	$\Omega(n \log(n))$	$\Theta(n \log(n))$	$O(n \log(n))$	$O(n)$
<u>Timsort</u>	$\Omega(n)$	$\Theta(n \log(n))$	$O(n \log(n))$	$O(n)$
<u>Heapsort</u>	$\Omega(n \log(n))$	$\Theta(n \log(n))$	$O(n \log(n))$	$O(1)$
<u>Bubble Sort</u>	$\Omega(n)$	$\Theta(n^2)$	$O(n^2)$	$O(1)$
<u>Insertion Sort</u>	$\Omega(n)$	$\Theta(n^2)$	$O(n^2)$	$O(1)$
<u>Selection Sort</u>	$\Omega(n^2)$	$\Theta(n^2)$	$O(n^2)$	$O(1)$
<u>Tree Sort</u>	$\Omega(n \log(n))$	$\Theta(n \log(n))$	$O(n^2)$	$O(n)$
<u>Shell Sort</u>	$\Omega(n \log(n))$	$\Theta(n (\log(n))^2)$	$O(n (\log(n))^2)$	$O(1)$
<u>Bucket Sort</u>	$\Omega(n+k)$	$\Theta(n+k)$	$O(n^2)$	$O(n)$
<u>Radix Sort</u>	$\Omega(nk)$	$\Theta(nk)$	$O(nk)$	$O(n+k)$
<u>Counting Sort</u>	$\Omega(n+k)$	$\Theta(n+k)$	$O(n+k)$	$O(k)$
<u>Cubesort</u>	$\Omega(n)$	$\Theta(n \log(n))$	$O(n \log(n))$	$O(n)$

