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Chandubhai S Patel Institute of Technology

Faculty of Technology and Engineering

Chandubhai S Patel Institute of Technology

Department of Computer Science & Engineering

PRACTICAL – 2

Roll no.: Date: / /

Academic Year	:	2024-25	Semester	:	4
Course code	:	CSE207	Course name	:	Design and Analysis of Algorithms

AIM:

2.1 Implement and analyze the best case, average case and worst case of the algorithms for problems given below.

2.1(a) Given a **sorted array** of integers, find the **first occurrence** of a target element **x**. If the target element is not found, return **-1**. Explore alternatives of searching such elements and analyze.

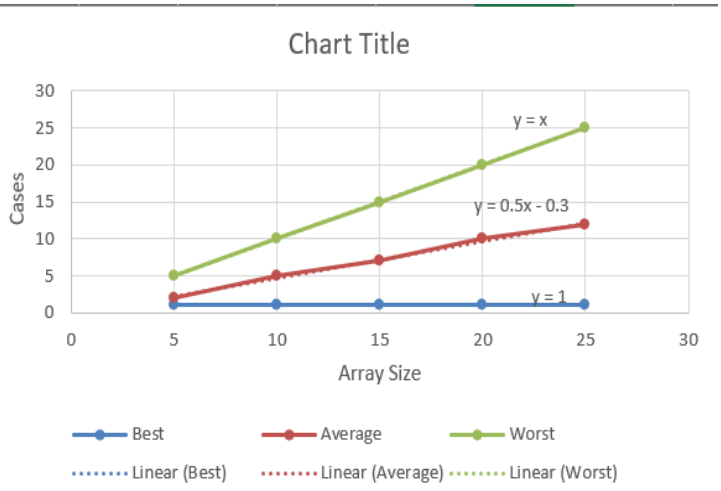
2.1(b) Given an array of integers, use **Insertion Sort** algorithm to sort the array in ascending order.

2.1.1 (a) Data table: linear search algorithm

Input	Best Case	Average Case	Worst Case
5	1	2	5
10	1	5	10
15	1	7	15
20	1	10	20
25	1	12	25

2.1.1 (b) Line Chart: linear search algorithm

Array Size	Best	Average	Worst
5	1	2	5
10	1	5	10
15	1	7	15
20	1	10	20
25	1	12	25
Equation	y=1	y=0.5x-0.3	y=x
Time Complexity	O(n)	O(n)	O(n)

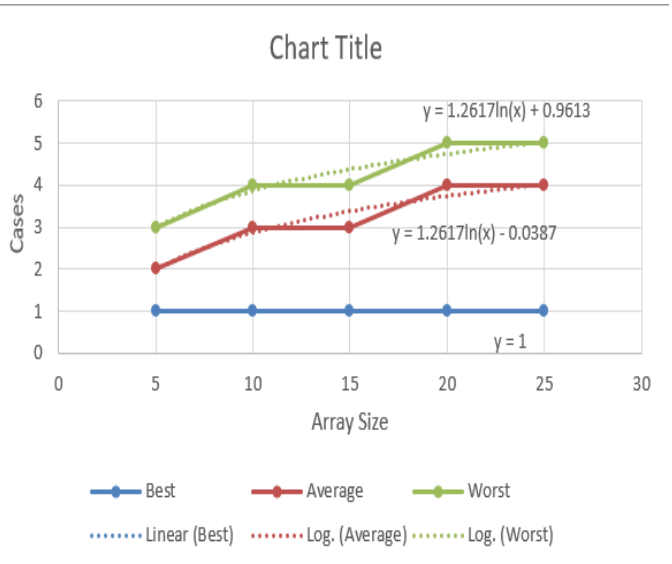


2.1.2 (a) Data table: binary search algorithm

Input	Best Case	Average Case	Worst Case
5	1	2	3
10	1	3	4
15	1	3	4
20	1	4	5
25	1	4	5

2.1.2 (b) Line Chart: binary search algorithm

Array Size	Best	Average	Worst
5	1	2	3
10	1	3	4
15	1	3	4
20	1	4	5
25	1	4	5
Equation	y=1	y=1.2ln(x)-0.03	y=1.2ln(x)+0.96
Time Complexity	O(n)	O(logn)	O(logn)

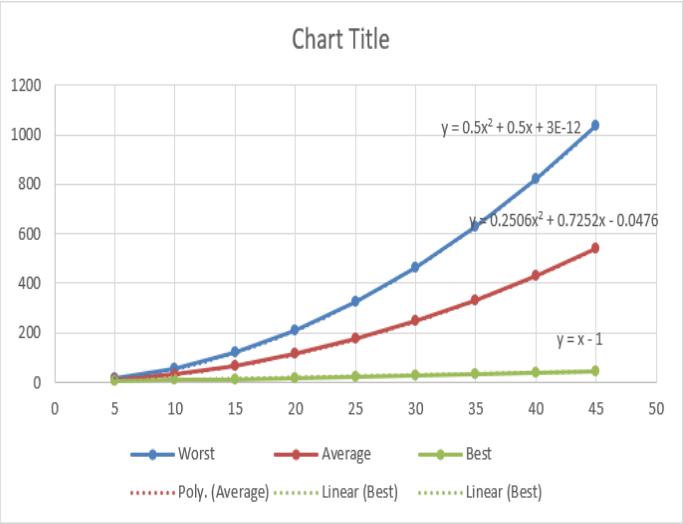


2.2.1 (a) Data table: insertion sort algorithm

Input	Best Case	Average Case	Worst Case
5	4	10	15
10	9	32	55
15	14	67	120
20	19	115	210
25	24	175	325

2.2.2 (b) Line Chart: insertion sort algorithm

Array Size	Worst	Average	Best
5	15	10	4
10	55	32	9
15	120	67	14
20	210	115	19
25	325	175	24
30	465	247	29
35	630	332	34
40	820	430	39
45	1035	540	44
Equation	y=x-1	y=0.2x^2+0.7x-0.04	y=0.5x^2+0.5x +3E-12
Time Complexity	O(n)	O(n^2)	O(n^2)



Conclusion:

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AIM:

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2.1(a) Given a **sorted array** of integers, find the **first occurrence** of a target element **x**. If the target element is not found, return **-1**. Explore alternatives of searching such elements and analyze.

2.1(b) Given an array of integers, use **Insertion Sort** algorithm to sort the array in ascending order.

Answer the following Questions:

1. How does insertion sort outperform selection sort when the elements are already sorted? Justify your answer.

2. Can insertion sort be optimized using binary search in terms of number of comparison, number of shifts and overall time complexity?

Grade / Marks **Sign of Lab Teacher with Date**