

Lab 9 Report

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Pledge	I pledge my honor that I have abided by the Stevens Honor System

1 Task 1: Profiling a Linked List and an Array

Please present your experiment record below: either a graph or a chart.

Linked List	Length	Time
10^2	100	0.000002s
10^3	1000	0.000005s
10^4	10000	0.000061s
10^5	100000	0.000319s
10^6	1000000	0.008129s

Array	Length	Time
10^2	100	0.000001s
10^3	1000	0.000004s
10^4	10000	0.000033s
10^5	100000	0.000107s
10^6	1000000	0.003431s

Please explain: why does the two algorithms with both $\mathcal{O}(n)$ complexity, have very different performance when n increases? You need to explain in detail from the perspective of locality.

- The two algorithms with both $\mathcal{O}(n)$ have very different performances when n increases because of their locality. Arrays offer better locality of reference leading to faster access times. Linked lists, with scattered memory locations, can result in higher access times. As the dataset increases, these differences become more pronounced.

2 Task 2: Locality Improved Linked List

Please present your experiment record below: either a graph or a chart

Linked List	Length	Time
10^2	100	0.000005s
10^3	1000	0.0000010s
10^4	10000	0.000066s
10^5	100000	0.000948s
10^6	1000000	0.008846s

Array	Length	Time
10^2	100	0.000002s
10^3	1000	0.000005s
10^4	10000	0.000039s
10^5	100000	0.000459s
10^6	1000000	0.003887s

Unlinked List	Length	Time
10^2	100	0.000001s
10^3	1000	0.000005s
10^4	10000	0.000045s

10^5	100000	0.000491s
10^6	1000000	0.004823s

Please explain: what is the time complexity of unrolled linked list? How does an unrolled linked list improve the efficiency of traversal in terms of locality?

- The time complexity of unrolled linked list is $O(n)$ when traversing through the unrolled linked list. An unrolled list improves the efficiency of traversal in terms of locality due to improved cache locality, reducing scattered pointer chasers, and it can efficiently access elements within a block. Unrolled linked list has a balance of efficient local access and linear traversal complexity.