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Program Structures & Algorithms
Spring 2021
Assignment No. 2

- ## Task:
  Benchmark Timer on Insertion Sort

- ## Output:

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 1000 mean time is 0.00958051111111111 for a random array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 1000 mean time is 0.0028416666666666664 for a sorted array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 1000 mean time is 0.0031573555555555557 for a partial array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 1000 mean time is 0.0024064444444444446 for a reversed array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 2000 mean time is 0.004814844444444444 for a random array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 2000 mean time is 0.014369511111111111 for a sorted array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 2000 mean time is 0.005135177777777778 for a partial array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 2000 mean time is 0.004891622222222222 for a reversed array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 4000 mean time is 0.009123022222222223 for a random array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 4000 mean time is 0.0083814 for a sorted array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 4000 mean time is 0.008650044444444444 for a partial array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 4000 mean time is 0.00844991111111111 for a reversed array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 8000 mean time is 0.017434244444444445 for a random array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 8000 mean time is 0.015987044444444445 for a sorted array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 8000 mean time is 0.015949955555555558 for a partial array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 8000 mean time is 0.016445422222222224 for a reversed array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 16000 mean time is 0.03138246666666667 for a random array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 16000 mean time is 0.03225186666666666 for a sorted array

2021-02-04 10:04:19 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 16000 mean time is 0.030305533333333336 for a partial array

2021-02-04 10:04:20 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 16000 mean time is 0.03296568888888889 for a reversed array

2021-02-04 10:04:20 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 32000 mean time is 0.21256657777777777 for a random array

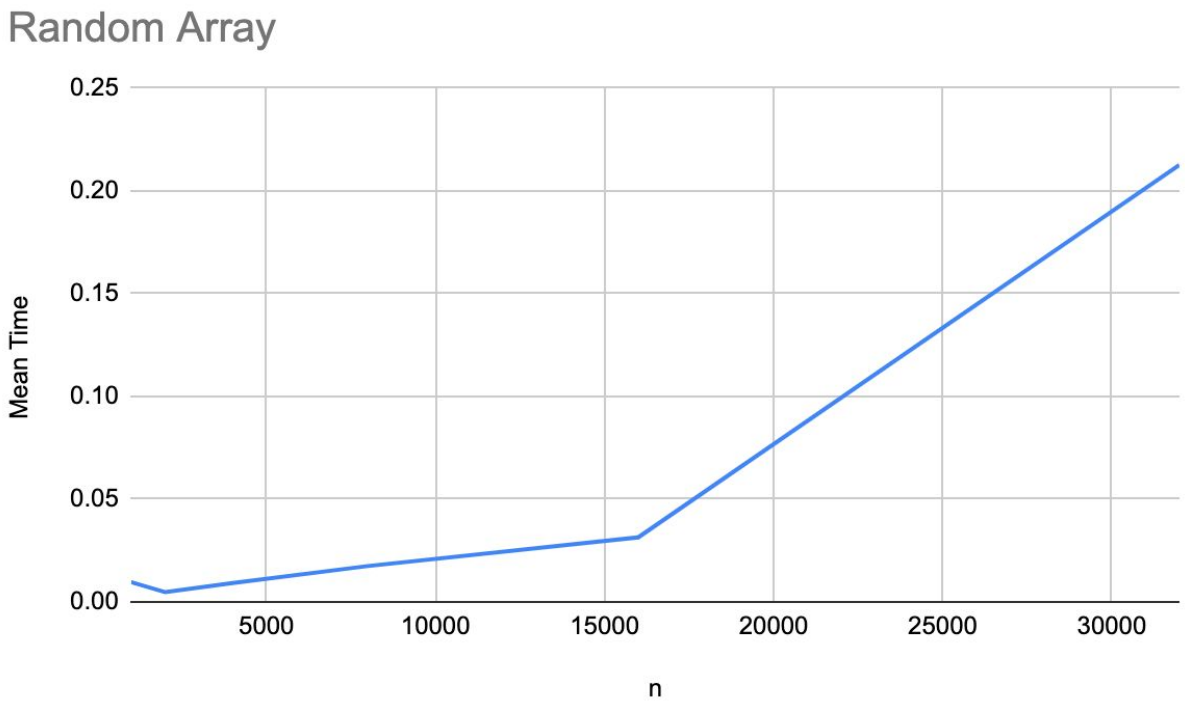
2021-02-04 10:04:21 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 32000 mean time is 0.06371202222222222 for a sorted array

2021-02-04 10:04:23 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 32000 mean time is 0.07166857777777778 for a partial array

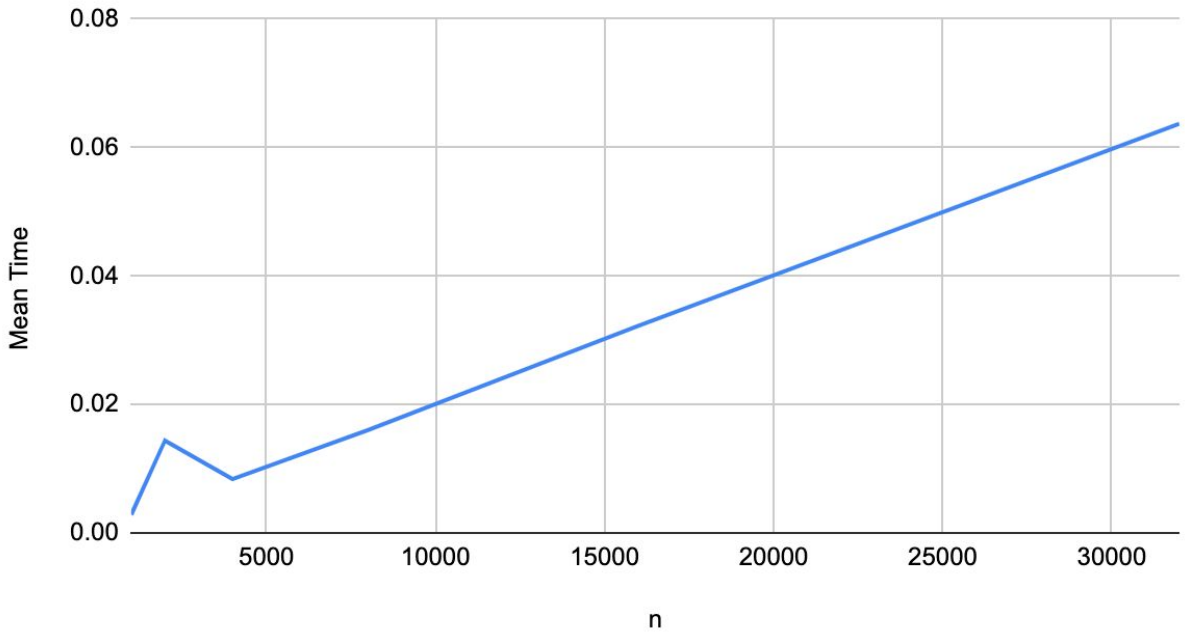
2021-02-04 10:04:24 INFO Benchmark_Timer - Begin run: Benchmarking with 45 runs
When n is 32000 mean time is 0.07252311111111111 for a reversed array

- **Relationship between mean time and n:**
  As the n value increased, the mean time increased for some graphs linearly and for some graphs, in a quadratic manner.

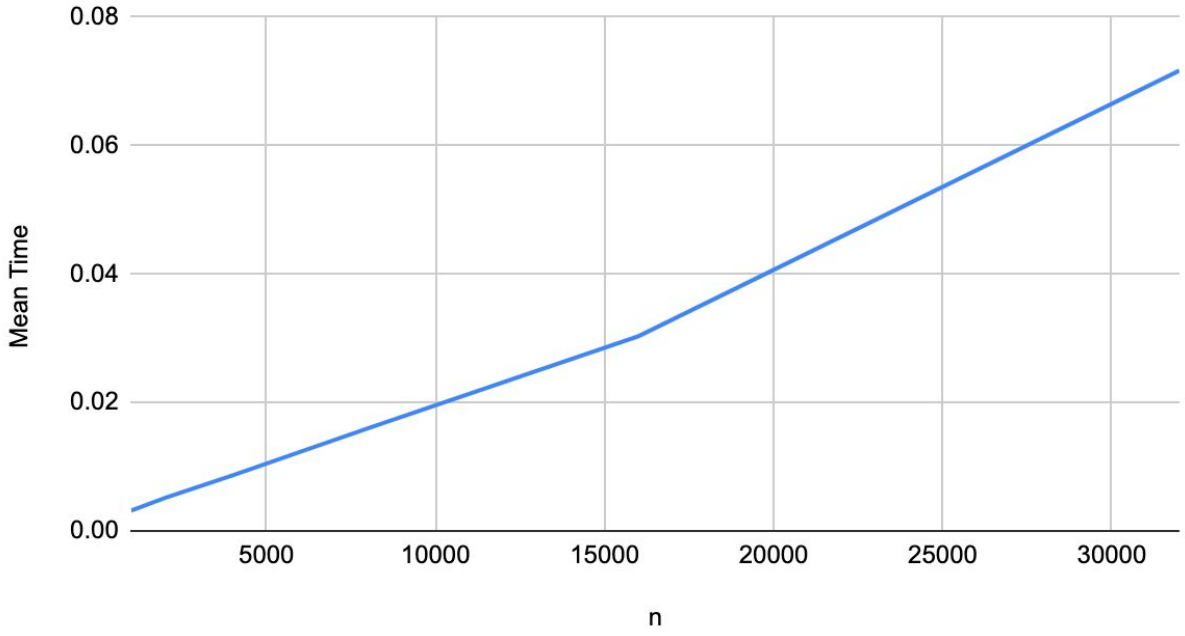
- **Evidence to support the conclusion and graphs:**

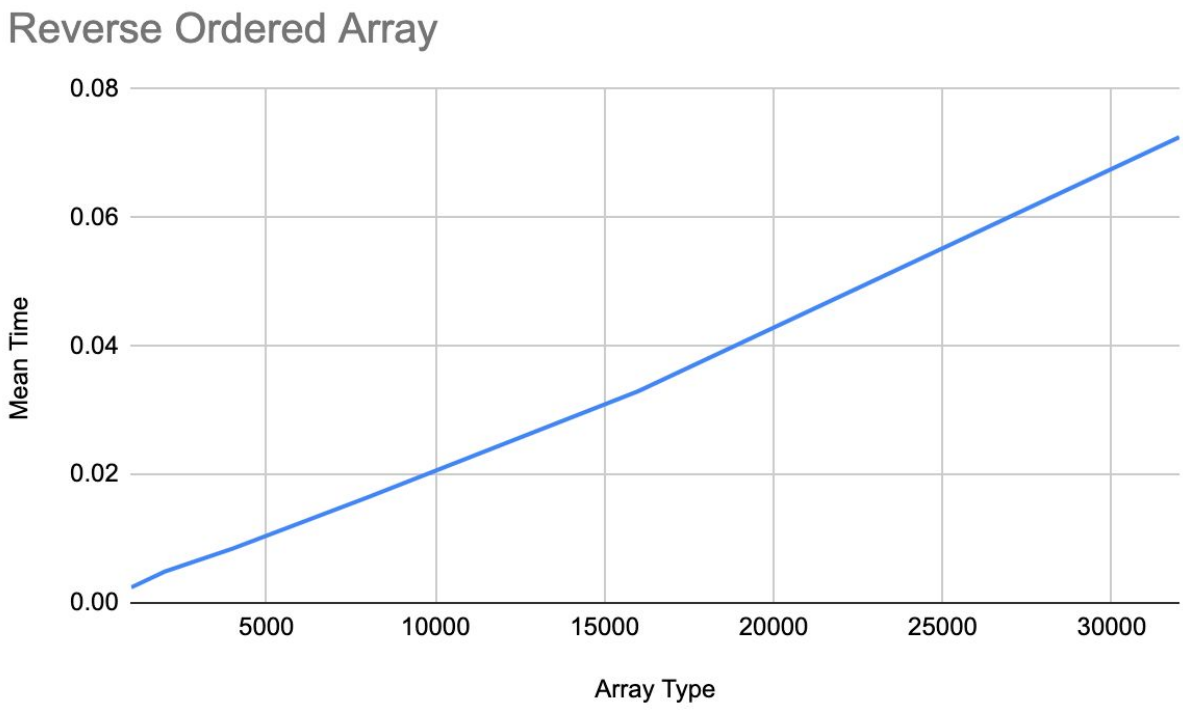


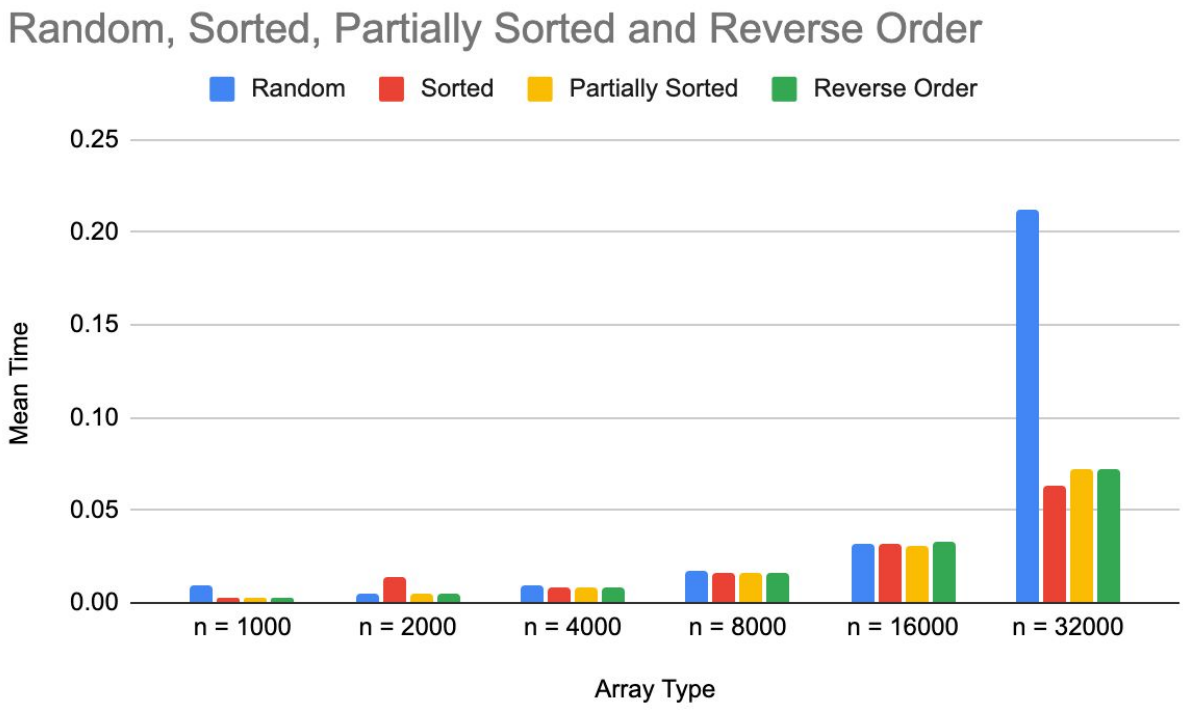
Sorted Array



Partially Sorted Array

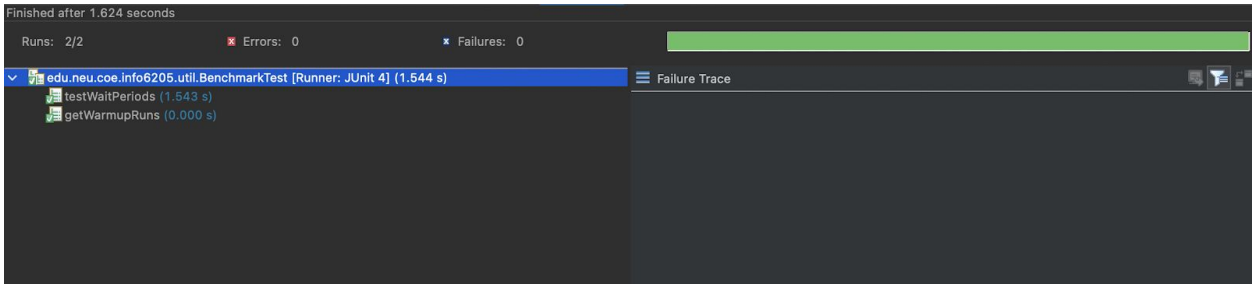



Reverse Ordered Array
0.08
0.06
0.04
0.02
0.00
Mean Time
5000
10000
15000
20000
25000
30000
Array Type

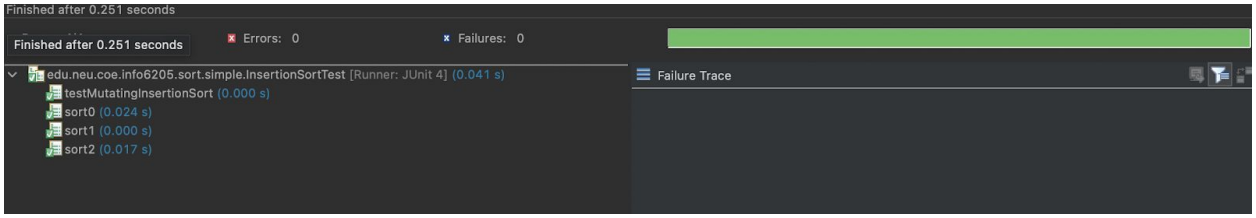

Random, Sorted, Partially Sorted and Reverse Order
Random
Sorted
Partially Sorted
Reverse Order
0.25
0.20
0.15
0.10
0.05
0.00
Mean Time
n = 1000
n = 2000
n = 4000
n = 8000
n = 16000
n = 32000
Array Type

- **Unit test result:**

Benchmark Test



Insertion Sort Test



Timer Test