

```

import time
import random
import matplotlib.pyplot as plt

def quick_sort(arr):
    if len(arr) <= 1:
        return arr

    first = arr[0]
    mid = arr[len(arr) // 2]
    last = arr[-1]
    pivot = sorted([first, mid, last])[1] # ---> Median pivot

    left = [x for x in arr if x < pivot]
    middle = [x for x in arr if x == pivot]
    right = [x for x in arr if x > pivot]

    return quick_sort(left) + middle + quick_sort(right)

def measure_time(arr):
    start = time.time()
    quick_sort(arr)
    end = time.time()
    return (end - start) * 1000 # --> Time in milliseconds

```

[+ Code](#)
[+ Text](#)

```

sizes = list(range(3000000, 30000001, 3000000))
unsorted_times = []
sorted_times = []

for size in sizes:
    print(f"Array size: {size}")

    unsorted_array = [random.randint(1, size) for _ in range(size)]
    unsorted_time = measure_time(unsorted_array)
    unsorted_times.append(unsorted_time)
    print(f"Unsorted array time: {unsorted_time:.2f} ms")

    sorted_array = sorted(unsorted_array)
    sorted_time = measure_time(sorted_array)
    sorted_times.append(sorted_time)
    print(f"Sorted array time: {sorted_time:.2f} ms")

```

```

➞ Array size: 3000000
Unsorted array time: 17992.59 ms
Sorted array time: 16382.92 ms
Array size: 6000000
Unsorted array time: 38489.61 ms
Sorted array time: 42255.60 ms
Array size: 9000000
Unsorted array time: 65779.35 ms
Sorted array time: 65620.41 ms
Array size: 12000000
Unsorted array time: 89925.71 ms
Sorted array time: 86882.72 ms
Array size: 15000000
Unsorted array time: 117722.14 ms
Sorted array time: 115369.13 ms
Array size: 18000000

```

```

plt.figure(figsize=(12, 6))
plt.plot(sizes,sorted_times, marker='o', linestyle='-', color='red', label='Sorted Array')
plt.plot(sizes,unsorted_times,marker='o', linestyle='-', color='royalblue', label='Unsorted Array')
plt.ylabel('Array Size')
plt.xlabel('Time (ms)')
plt.title('Quick Sort Time: Sorted vs Unsorted Arrays')
plt.grid(True)
plt.legend()
plt.show()

```

