­­CAB301

Group 96

Queensland University of Technology

Phase 3

Due 11:59 pm, Wednesday, 8th June 2022

# Part B

### Design an algorithm and analyse the time efficiency of the algorithm using the empirical algorithm analysis technique introduced in Topic 2 for the following computational problem:

* Given an array where the elements are randomly stored, find the three largest elements in the array.

**ALGORITHM**

// Given an array , of length , returns the three

// largest values in , in descending order.

// If , is returned for the smallest,

// of the three largest numbers.

**for**  **to** **do**

**if**

**else if**

**else if**

**return**

### Empirical Time Efficiency Analysis

The algorithm was tested with arrays of size 0 to 1,000,000 in increments of 40,000. Each size was tested 10 times and the average number of basic operations executed was recorded. The arrays contained randomly stored integers between -1000 and 1000 inclusive.

The average ratio of and is (refer to Figure 2 in the Appendix). Since this value is almost exactly 2, this suggests that algorithm belongs to .

Chart, scatter chart

Description automatically generated

Figure : Number of basic operations executed vs. array size

As can be seen, the algorithm does indeed belong to as there exists a linear relationship between the number of elements in an array, and the number of basic operations executed.

# Appendix

|  |  |  |
| --- | --- | --- |
| 0 | 2 | **Ratio** |
| 40000 | 120104.8 |  |
| 80000 | 240098.4 | 1.999074 |
| 120000 | 360094 |  |
| 160000 | 480101.6 | 1.999603 |
| 200000 | 600112 |  |
| 240000 | 720102.8 | 1.999763 |
| 280000 | 840095.2 |  |
| 320000 | 960095.6 | 1.999776 |
| 360000 | 1080102 |  |
| 400000 | 1200098 | 1.99979 |
| 440000 | 1320104 |  |
| 480000 | 1440105 | 1.999861 |
| 520000 | 1560098 |  |
| 560000 | 1680102 | 1.999894 |
| 600000 | 1800103 |  |
| 640000 | 1920094 | 1.999898 |
| 680000 | 2040096 |  |
| 720000 | 2160099 | 1.999903 |
| 760000 | 2280105 |  |
| 800000 | 2400101 | 1.999921 |
| 840000 | 2520096 |  |
| 880000 | 2640104 | 1.99992 |
| 920000 | 2760097 |  |
| 960000 | 2880101 | 1.999924 |
| 1000000 | 3000102 |  |
|  |  | **Average Ratio:** 1.9998 |

Figure 2: Ratio between and