Programming Assignment 2

Subject: CS610 (Tuesdays)

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**Description** : Following Select Algorithms have been implemented using Java programming.

1. Selection using Quick Sort (Select1)

2. QuickSelect (Select2)

3. Select using Medians of Medians (Select3)

For each Algorithm, Same input data has been provided to the programs – Randomly generated data, Sorted data, and reversely sorted data.

The input data is taken from 3 text files:

1. arrayOne.txt
2. arrayTwo.txt
3. arrayThree.txt

Each algorithm calculates total number of key comparisons and returns the kth smallest element.

The kth smallest element can be changes in **CS610ProgAsgn2** class, **main** function, and variable **“kthSmallElem”.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Select1** | | **Select2** | | **Select3** | |
| **n** | Total Comparisons | Clock Time(sec) | Comparisons | Clock Time(sec) | Comparisons | Clock Time(sec) |
| **10000** | 102972 | 0 | 9288 | 1 | 9975 | 6 |
| **100000** | 1324007 | 0 | 142518 | 0 | 99348 | 2 |
| **1000000** | 16045184 | 0 | 1454461 | 0 | 995454 | 26 |

**Select1 :**

Time complexity for Select using Quicksort is O(nlogn), which is average case for the implementation.

n = 10000,

nlogn = 10000 \* log 10000

= 10000 \* 13.28771237954

= 1328771

n = 100000,

nlogn = 100000 \* log 1000000

= 100000 \* 16.609640474436812

= 1660964

n = 1000000,

nlogn = 1000000 \* log 1000000

= 1000000 \* 19.931568569324174

= 19931568

Constant Factor Calculation:

Let us consider C as constant factor.

C \* nlogn >= Θ(nlogn)

Implies, C >= Θ(nlogn) / nlogn

For n = 10000, C >= 102972 / 1328771

= 0.077

For n = 100000, C >= 1324007/ 1660964

= 0.797

For n = 1000000, C >= 16045184/ 19931568

= 0.805

**Select2**

Time complexity for Select using Select2 is O(n), which is average case for the implementation.

n = 10000,

n = 100000,

n = 1000000,

Constant Factor Calculation:

Let us consider C as constant factor.

C \* n >= Θ(n)

Implies, C >= Θ(n) / n

For n = 10000, C >= 9288/ 10000

= 0.92

For n = 100000, C >= 142518/ 100000

= 1.42

For n = 1000000, C >= 1454461/ 1000000

= 1.45

**Select3**

Time complexity for Select using Select3 is O(n), which is average case for the implementation.

n = 10000,

n = 100000,

n = 1000000,

Constant Factor Calculation:

Let us consider C as constant factor.

C \* n >= Θ(n)

Implies, C >= Θ(n) / n

For n = 10000, C >= 9975/ 10000

= 0.99

For n = 100000, C >= 99348/ 100000

= 0.99

For n = 1000000, C >= 995454/ 1000000

= 0.99

**Notes:**

After extracting the folder, the project is under the folder “CS610ProgAsgn2”. You can open the same using an IDE such as Netbeans.

There are the text files, arrayOne.txt, arrayTwo.txt, arrayThree.txt whose path have been set in “CreateArray” class. You will have to change these path according to your environment.

CS610ProgAsgn2.java is the main class.