**CS 201**

**Homework 2**

Name:Osman Burak İNTİŞAH

Student ID:21602430

Section: 2

Date: 16.04.2018

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary Search** |  |  |  |  |
| **Input Size (N)** | **Beginning** | **Middle** | **End** | **Not Exist** |
| 100 | 0,0004 | 0,0004 | 0,0004 | 0,0004 |
| 250 | 0,0004 | 0,0003 | 0,0004 | 0,0004 |
| 500 | 0,0008 | 0,0004 | 0,0004 | 0,0004 |
| 1000 | 0,0008 | 0,0008 | 0,0004 | 0,0008 |
| 2500 | 0,0004 | 0,0004 | 0,0008 | 0,0008 |
| 5000 | 0,0004 | 0,0004 | 0,0004 | 0,0008 |
| 10000 | 0,0004 | 0,0005 | 0,0004 | 0,0008 |
| 25000 | 0,0004 | 0,0008 | 0,0004 | 0,0008 |
| 50000 | 0,0004 | 0,0008 | 0,0004 | 0,0008 |
| 100000 | 0,0008 | 0,0008 | 0,0008 | 0,0008 |
| 250000 | 0,0008 | 0,0008 | 0,0008 | 0,0008 |
| 500000 | 0,0008 | 0,0004 | 0,0008 | 0,0012 |
| 1000000 | 0,0008 | 0,0008 | 0,0004 | 0,0011 |
| 2500000 | 0,0012 | 0,0004 | 0,0008 | 0,0012 |
| 5000000 | 0,0012 | 0,0008 | 0,0008 | 0,0013 |
| 10000000 | 0,0012 | 0,0004 | 0,0004 | 0,0013 |
| 25000000 | 0,0012 | 0,0005 | 0,0008 | 0,0017 |
| 50000000 | 0,0016 | 0,0004 | 0,0008 | 0,0017 |
| 100000000 | 0,0016 | 0,0004 | 0,0016 | 0,0016 |
| 250000000 | 0,0016 | 0,0005 | 0,0012 | 0,0023 |
| 400000000 | 0,0036 | 0,0004 | 0,0012 | 0,0027 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Linear Search** |  |  |  |  |
| **Input Size (N)** | **Beginning** | **Middle** | **End** | **Not Exist** |
| 100 | 0,0004 | 0,0004 | 0,0004 | 0,0004 |
| 250 | 0,0009 | 0,0007 | 0,0012 | 0,0012 |
| 500 | 0,0004 | 0,0008 | 0,0012 | 0,0174 |
| 1000 | 0,0004 | 0,0016 | 0,0028 | 0,0028 |
| 2500 | 0,0008 | 0,0036 | 0,0071 | 0,0071 |
| 5000 | 0,0004 | 0,0067 | 0,0138 | 0,0135 |
| 10000 | 0,0004 | 0,0122 | 0,0273 | 0,274 |
| 25000 | 0,0004 | 0,0344 | 0,0672 | 0,0833 |
| 50000 | 0,0004 | 0,0699 | 0,1367 | 0,1355 |
| 100000 | 0,0004 | 0,1691 | 0,3049 | 0,311 |
| 250000 | 0,0004 | 0,3386 | 0,7565 | 0,7941 |
| 500000 | 0,0004 | 0,7305 | 1,4072 | 1,4491 |
| 1000000 | 0,0004 | 1,4937 | 2,8373 | 2,8883 |
| 2500000 | 0,0004 | 3,5521 | 7,0594 | 7,3467 |
| 5000000 | 0,0004 | 6,7588 | 14,1068 | 14,7274 |
| 10000000 | 0,0004 | 14,0421 | 28,5467 | 33,7703 |
| 25000000 | 0,0004 | 34,9688 | 69,7454 | 72,3296 |
| 50000000 | 0,0004 | 69,6376 | 144,888 | 142,609 |
| 100000000 | 0,0008 | 143,02 | 281,535 | 286,767 |
| 250000000 | 0,0004 | 357,469 | 711,42 | 720,546 |
| 400000000 | 0,0004 | 593,611 | 1159,18 | 1147,27 |

Best case is having the value at the middle , average case is at the beginning and end, worst case is not existance of the value.

Best case is having the value at the beginning , average case is at the middle, worst case is non existance of the value.

**Computer Specification**

**Processor –** Intel (R) Core(TM) i7 – 6700 HQ CPU @ 2.60 Ghz

**Ram –** 16 Gb

**Operating System –** 64 bit Window 10

When we analyze these plots, it can be seen that for binary search, there are some deviations. It’s because we are dealing with so small numbers. But in general for binary search, not having the value in the array is the longest one. So the worst case is not having the value. Thus, computer checks mid values ,as we have in the code block, until there will not be any value in the array. However, it only takes ,even for the worst case, logN times. And for the linear search, the worst case is relatively same as having the value at the end or not having the value in the array. Because both times computer checks the all memory locations to find the value until the end of the array. Therefore, it takes N times which means growth rate of linear search is N. Lastly, when we compare the results and theoritical graphs, it can be observed that binary search is more efficient than linear search. Because as the input size grows, the execution time grows with it for linear search. However, for the binary search execution time grows very very slowly compared to linear search.