**DATA:**

**Size: 1000003**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Series 1 | Series 2 | Series 3 |
| 0.1 | 105 | 108 | 104 |
| 0.2 | 67 | 55 | 65 |
| 0.3 | 61 | 49 | 68 |
| 0.4 | 54 | 43 | 56 |
| 0.5 | 53 | 47 | 65 |
| 0.6 | 64 | 50 | 60 |
| 0.7 | 75 | 57 | 64 |
| 0.8 | 80 | 60 | 70 |
| 0.9 | 102 | 65 | 74 |

Size: 2000003

|  |  |  |  |
| --- | --- | --- | --- |
|  | Series 1 | Series 2 | Series 3 |
| 0.1 | 183 | 150 | 197 |
| 0.2 | 152 | 130 | 163 |
| 0.3 | 132 | 110 | 158 |
| 0.4 | 115 | 102 | 156 |
| 0.5 | 109 | 111 | 158 |
| 0.6 | 122 | 118 | 186 |
| 0.7 | 144 | 127 | 200 |
| 0.8 | 155 | 136 | 212 |
| 0.9 | 221 | 158 | 236 |

size- 2500017

|  |  |  |  |
| --- | --- | --- | --- |
| 0.1 | 239 | 195 | 242 |
| 0.2 | 221 | 144 | 205 |
| 0.3 | 185 | 133 | 195 |
| 0.4 | 138 | 124 | 186 |
| 0.5 | 139 | 136 | 207 |
| 0.6 | 154 | 147 | 229 |
| 0.7 | 176 | 155 | 242 |
| 0.8 | 200 | 183 | 268 |
| 0.9 | 269 | 201 | 308 |

Linear Probing---

1. It can be seen from the graphs that the break-even point is 0.5
2. The values decrease initially till 0.5 and then gradually increase over time

Quadratic Probing---

1. It can be seen from the graphs that the break-even point is 0.5
2. The values decrease initially till 0.5 and then gradually increase over time

Double Hashing---

1. It can be seen from the graphs that the break-even point is 0.4
2. The values decrease initially till 0.4 and then gradually increase over time

PART 2

Assumptions-

1. I have a bigger array of size triple the size of the initial original array.
2. While inserting in the old array as soon as the load factor reaches the break-even point which is 0.5, then insertion of elements starts into the new bigger array.
3. First the remaining element from the input array is added to the bigger array, then simultaneously first element from the old array is added.
4. The no.of collisions in the bigger array would be less compared to the smaller array.
5. Total time taken to add elements in new bigger array is less than the time taken to add elements in old smaller array which otherwise would have resized.

Hence, creating a bigger array is better than resizing array.

Complexities-

1. For insertion: O(1)
2. For search: O(1)

**Search ---**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Linear | Quadratic | Double Hashing |
| No. of Collision | 2 | 3 | 1 |

Data: 498420

It can be seen from the observation that the best hashing technique is Double hashing.

Series1: Linear Probing

Series2: Quadratic Probing

Series3: Double Hashing

Data Size: 1000003

Series1: Linear Probing

Series2: Quadratic Probing

Series3: Double Hashing

Data Size: 2000003

Series1: Linear Probing

Series2: Quadratic Probing

Series3: Double Hashing

Data Size: 2500017