**Report of Assignment 5**

**Linear Probing:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Size  Load Factor | 10^3 | 10^4 | 10^5 | 10^6 | !0^7 |
| 0.1 | 1 | 1 | 5 | 108 | 2039 |
| 0.2 | 1 | 1 | 8 | 148 | 2847 |
| 0.3 | 1 | 2 | 11 | 210 | 3953 |
| 0.4 | 1 | 3 | 15 | 301 | 8499 |
| 0.5 | 1 | 4 | 64 | 409 | 9089 |
| 0.6 | 2 | 5 | 76 | 508 | 10630 |
| 0.7 | 2 | 5 | 118 | 585 | 12394 |
| 0.8 | 2 | 5 | 130 | 780 | 20579 |
| 0.9 | 3 | 8 | 153 | 989 | 23662 |

In the chart, we can see that:

* For any load factor less than 1, linear probing will find an empty slot. For the small size, **f(i)=i.**
* the breakeven point of linear probing is around size of 10^6. For each load factor, the time of creating hashing table increases with a much larger slope when the size arrives 10^6.

**Quadratic Probing:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Size  Load Factor | 10^3 | 10^4 | 10^5 | 10^6 | !0^7 |
| 0.1 | 1 | 1 | 11 | 133 | 3189 |
| 0.2 | 1 | 1 | 14 | 237 | 3809 |
| 0.3 | 2 | 2 | 17 | 388 | 5129 |
| 0.4 | 2 | 4 | 25 | 436 | 12827 |
| 0.5 | 3 | 5 | 56 | 535 | 16411 |
| 0.6 | 4 | 6 | 97 | 657 | 17859 |
| 0.7 | 4 | 7 | 128 | 773 | 20199 |
| 0.8 | 5 | 8 | 130 | 998 | 28983 |
| 0.9 | 5 | 9 | 160 | 1372 | 35715 |

In the chart, we can see that:

* For any load factor more than 0.5, quadratic probing use time to create hash table more than linear table. And the bigger of the size, the more time would be used.
* the breakeven point of quadratic probing is around size of 10^6. For each load factor, the time of creating hashing table increases with a much larger slope when the size arrives 10^6. The slope is larger than linear probing.

**Double hashing:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Size  Load Factor | 10^3 | 10^4 | 10^5 | 10^6 | !0^7 |
| 0.1 | 1 | 3 | 11 | 201 | 3873 |
| 0.2 | 1 | 4 | 18 | 269 | 4530 |
| 0.3 | 2 | 4 | 20 | 296 | 6046 |
| 0.4 | 2 | 6 | 22 | 444 | 11690 |
| 0.45 | 3 | 7 | 52 | 496 | 14946 |

In the chart, we can see that:

* For any double hashing, load factor should be less than 0.5. Double hashing use time to create hash table more than linear table. And the bigger of the size, the more time would be used.
* the breakeven point of double hashing is around size of 10^6. For each load factor, the time of creating hashing table increases with a much larger slope when the size arrives 10^6. The slope is larger than linear probing.