# Brief Analysis of Linear Probe & Quadratic Probe Hash Tables

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In summary, the Linear Probe generated fewer collisions. This was due to the fact that updating the index itself guaranteed a different bucket every time a collision did occur. By jumping linearly with less of a gap between jumps, the probability of hitting a used slot actually seemed to decrease until one reaches closer to the end of the array. As for the Quadratic Probe, this generated a lot more collisions because of it does not update the index at i. In fact, it seems index i initially tried position at h(k). However, it was actually unnecessary to begin the probe with j=0 since it would equate to the same thing. Therefore, we are guaranteed 2 collisions instead of 1. Furthermore, the j=1 would not produce a big enough jump, making it more likely to hit an occupied bucket. The higher the number of probes, the bigger the jump as well. This will result in more empty slots being skipped than slots filled and it is highly likely that one will end up in the same place as before, with multiple slots that are already filled. We would be traveling circularly until we finally reach an empty slot or determine there are none incorrectly if i=start again. However, the number of collisions would remain. This is why there exists a significantly greater amount of collisions. As for each bucket array capacity, it makes sense that collisions increased due to the fact that there are more slots to be filled with a greater number of entries. This is an exponential increase in entries, resulting in an increase in collision count.

<u>Quadratic Probe</u>

N=101

| n | LF | Avg Collisions (out of 3 experiments) |
|---|---|---|
| 51 | 0.50 | 286 |
| 56 | 0.55 | 535 |
| 61 | 0.60 | 627 |
| 66 | 0.65 | 734 |
| 71 | 0.70 | 1215 |
| 76 | 0.75 | 1294 |
| 81 | 0.80 | 1872 |
| 86 | 0.85 | 2364 |
| 91 | 0.90 | 3208 |
| 96 | 0.95 | 3723 |
| 97 | 0.96 | 4517 |
| 98 | 0.97 | 4853 |
| 99 | 0.98 | 4484 |
| 100 | 0.99 | 66948 |

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N=499

| n | LF | Avg Collisions (out of 3 experiments) |
|---|---|---|
| 250 | 0.50 | 7588 |
| 274 | 0.55 | 9905 |
| 299 | 0.60 | 15909 |
| 324 | 0.65 | 19553 |
| 349 | 0.70 | 24457 |
| 374 | 0.75 | 29412 |
| 399 | 0.80 | 39683 |
| 424 | 0.85 | 49781 |
| 449 | 0.90 | 61950 |
| 474 | 0.95 | 83722 |
| 479 | 0.96 | 89749 |
| 484 | 0.97 | 99788 |
| 489 | 0.98 | 107009 |
| 494 | 0.99 | 117552 |

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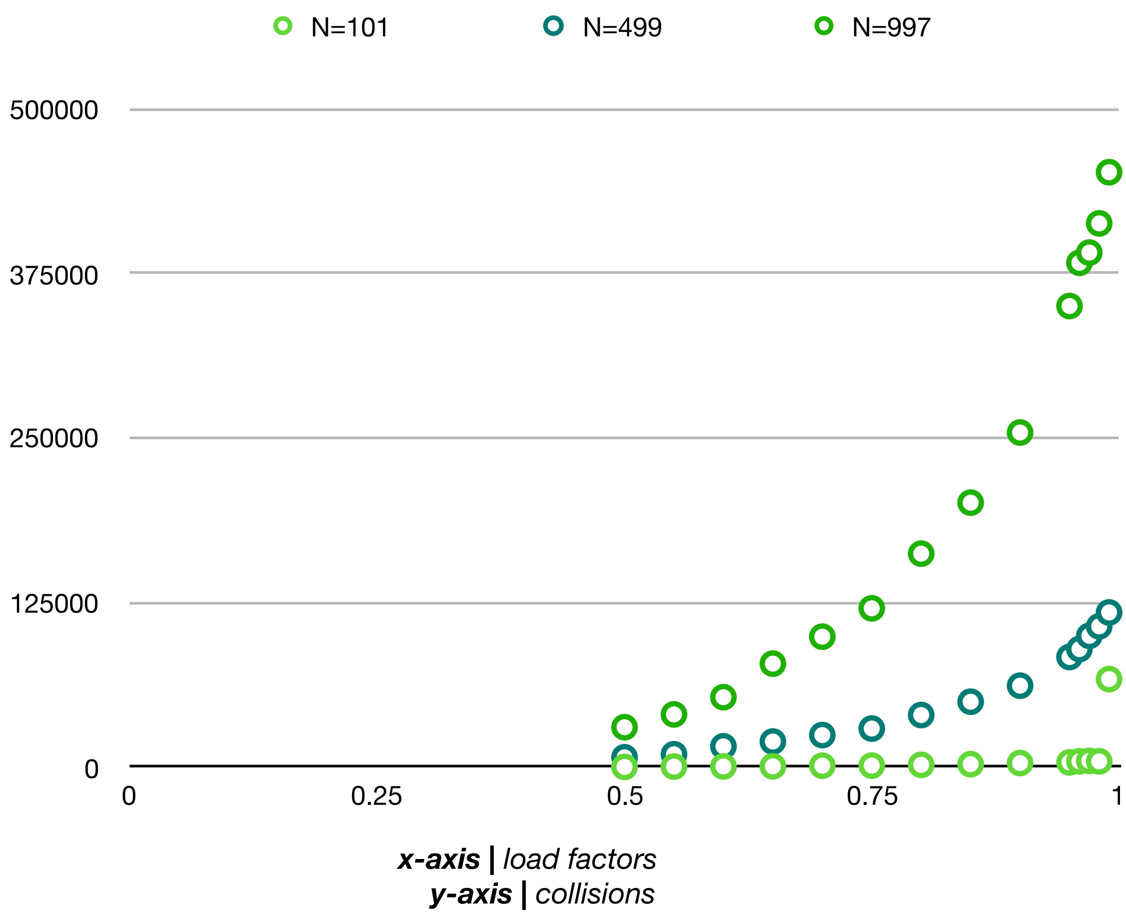
N=997

| n | LF | Avg Collisions (out of 3 experiments) |
|---|---|---|
| 499 | 0.50 | 30433 |
| 548 | 0.55 | 40161 |
| 598 | 0.60 | 53219 |
| 648 | 0.65 | 78681 |
| 698 | 0.70 | 99163 |
| 748 | 0.75 | 120684 |
| 798 | 0.80 | 162208 |
| 847 | 0.85 | 200911 |
| 897 | 0.90 | 254161 |
| 947 | 0.95 | 350162 |
| 957 | 0.96 | 383015 |
| 967 | 0.97 | 390742 |
| 977 | 0.98 | 412922 |
| 987 | 0.99 | 451752 |


N=101
N=499
N=997
500000
375000
250000
125000
0
0
0.25
0.5
0.75
1
**x-axis** | *load factors*
**y-axis** | *collisions*

## Linear Probe

N=101

| n | LF | Avg. Collisions (out of 3 experiments) |
|---|---|---|
| 51 | 0.50 | 24 |
| 56 | 0.55 | 33 |
| 61 | 0.60 | 47 |
| 66 | 0.65 | 43 |
| 71 | 0.70 | 84 |
| 76 | 0.75 | 112 |
| 81 | 0.80 | 139 |
| 86 | 0.85 | 162 |
| 91 | 0.90 | 211 |
| 96 | 0.95 | 393 |
| 97 | 0.96 | 399 |
| 98 | 0.97 | 562 |
| 99 | 0.98 | 625 |
| 100 | 0.99 | 689 |

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N=499

| n | LF | Avg. Collisions (out of 3 experiments) |
|---|---|---|
| 250 | 0.50 | 126 |
| 274 | 0.55 | 157 |
| 299 | 0.60 | 253 |
| 324 | 0.65 | 236 |
| 349 | 0.70 | 401 |
| 374 | 0.75 | 478 |
| 399 | 0.80 | 685 |
| 424 | 0.85 | 989 |
| 449 | 0.90 | 1352 |
| 474 | 0.95 | 4164 |
| 479 | 0.96 | 5027 |
| 484 | 0.97 | 6011 |
| 489 | 0.98 | 5141 |
| 494 | 0.99 | 7670 |

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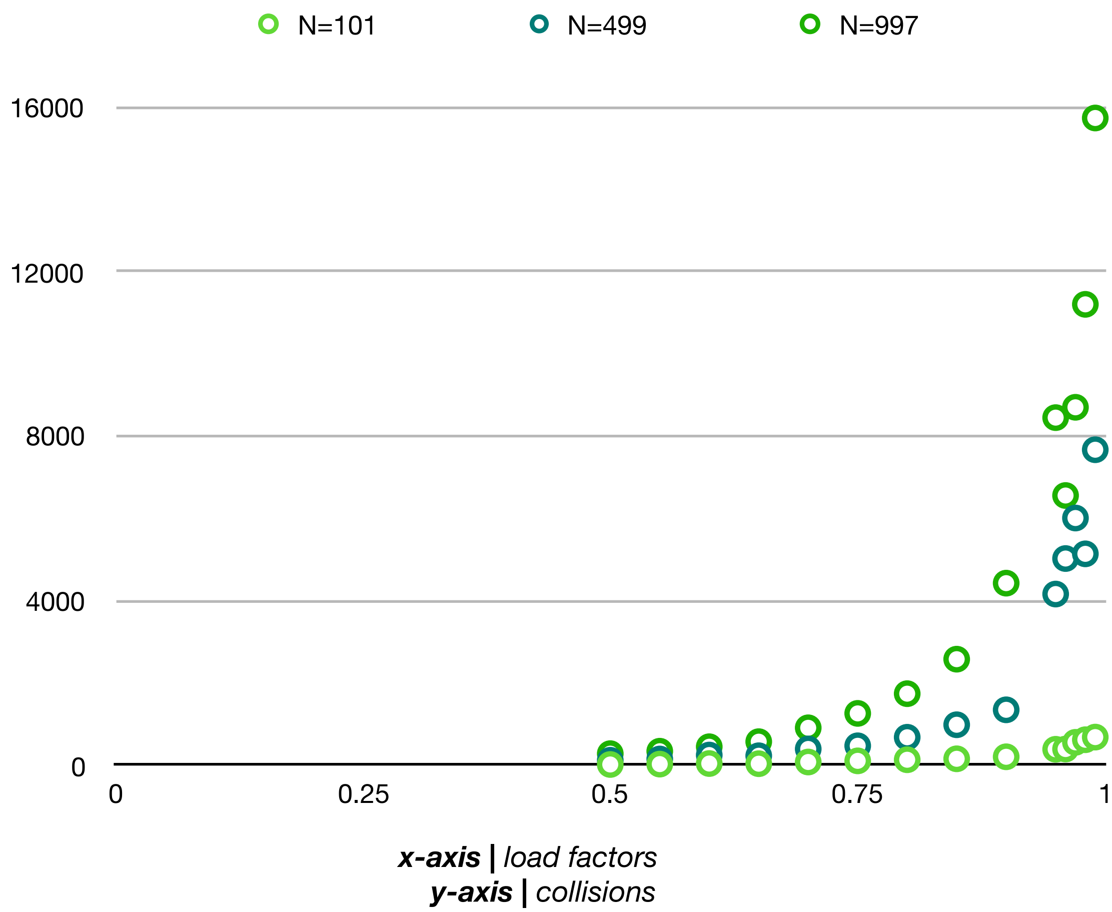
N=997

| n | LF | Avg. Collisions (out of 3 experiments) |
|---|---|---|
| 499 | 0.50 | 287 |
| 548 | 0.55 | 346 |
| 598 | 0.60 | 455 |
| 648 | 0.65 | 578 |
| 698 | 0.70 | 915 |
| 748 | 0.75 | 1265 |
| 798 | 0.80 | 1744 |
| 847 | 0.85 | 2582 |
| 897 | 0.90 | 4429 |
| 947 | 0.95 | 8450 |
| 957 | 0.96 | 6558 |
| 967 | 0.97 | 8701 |
| 977 | 0.98 | 11202 |
| 987 | 0.99 | 15729 |


N=101
N=499
N=997
16000
12000
8000
4000
0
0
0.25
0.5
0.75
1
***x-axis* | *load factors***
***y-axis* | *collisions***