Hashing Report

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Subject : Data Structures 2 assignment (Hash Table).

Some Assumptions for all hashing techniques:

1) Initial Table size = 32.
2) Number of collision after rehashing any table equal to zero and will count again.

Analysis for each Hashing Method

1. Open Hashing (Separate Chaining):

```
Initial Size = 32
When Adding 100 Elements in the Table :
Table Size = 192
Load Factor = 0.5208333333333334
Collision Number = 64
Time Taken = 1.0 ms

_____________________________________________________
When Adding 1000 Elements in the Table :
Table Size = 1152
Load Factor = 0.8680555555555556
Collision Number = 448
Time Taken = 4.0 ms

_____________________________________________________
When Adding 10000 Elements in the Table :
Table Size = 6912
Load Factor = 1.4467592592592593
Collision Number = 5841
Time Taken = 26.0 ms

_____________________________________________________
When Adding 100000 Elements in the Table :
Table Size = 41472
Load Factor = 2.4112654320987654
Collision Number = 75104
Time Taken = 38.0 ms
```

2. Bucket Hashing:

```
Initial Size = 32
When Adding 100 Elements in the Table :
Table Size = 162
Load Factor = 0.6172839506172839
Collision Number = 0
Time Taken = 2.0 ms

_____________________________________________________
When Adding 1000 Elements in the Table :
Table Size = 1860
Load Factor = 0.5376344086021505
Collision Number = 739
Time Taken = 3.0 ms

_____________________________________________________
When Adding 10000 Elements in the Table :
Table Size = 21196
Load Factor = 0.47178712964710323
Collision Number = 7762
Time Taken = 55.0 ms

_____________________________________________________
When Adding 100000 Elements in the Table :
Table Size = 241444
Load Factor = 0.4141747154619705
Collision Number = 7762
Time Taken = 38.0 ms
```

3. Linear Probing:

```
Initial Size = 32
When Adding 100 Elements in the Table :
Table Size = 162
Load Factor = 0.6172839506172839
Collision Number = 0
Time Taken = 1.0 ms

_____________________________________________________
When Adding 1000 Elements in the Table :
Table Size = 1860
Load Factor = 0.5376344086021505
Collision Number = 0
```

Time Taken = 3.0 ms

When Adding 10000 Elements in the Table :
Table Size = 21196
Load Factor = 0.47178712964710323
Collision Number = 0
Time Taken = 27.0 ms

When Adding 100000 Elements in the Table :
Table Size = 241444
Load Factor = 0.4141747154619705
Collision Number = 0
Time Taken = 50.0 ms

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4. Quadratic Probing:

Initial Size = 32
When Adding 100 Elements in the Table :
Table Size = 148
Load Factor = 0.6756756756756757
Collision Number = 0
Time Taken = 1.0 ms

When Adding 1000 Elements in the Table :
Table Size = 1564
Load Factor = 0.639386189258312
Collision Number = 0
Time Taken = 2.0 ms

When Adding 10000 Elements in the Table :
Table Size = 19904
Load Factor = 0.502411575562701
Collision Number = 0
Time Taken = 23.0 ms

When Adding 100000 Elements in the Table :
Table Size = 152468
Load Factor = 0.6558753312170422
Collision Number = 0
Time Taken = 34.0 ms

5. Pseudo Random Probing (using random sequence):

```
Initial Size = 32
When Adding 100 Elements in the Table :
Table Size = 162
Load Factor = 0.6172839506172839
Collision Number = 0
Time Taken = 0.0 ms

_____________________________________________________
When Adding 1000 Elements in the Table :
Table Size = 1860
Load Factor = 0.5376344086021505
Collision Number = 0
Time Taken = 3.0 ms

_____________________________________________________
When Adding 10000 Elements in the Table :
Table Size = 21196
Load Factor = 0.47178712964710323
Collision Number = 0
Time Taken = 37.0 ms

_____________________________________________________
When Adding 100000 Elements in the Table :
Table Size = 241444
Load Factor = 0.4141747154619705
Collision Number = 0
Time Taken = 48.0 ms
```

Double Hashing:

```
Initial Size = 32
When Adding 100 Elements in the Table :
Table Size = 162
Load Factor = 0.6172839506172839
Collision Number = 0
Time Taken = 1.0 ms

_____________________________________________________
When Adding 1000 Elements in the Table :
Table Size = 1860
Load Factor = 0.5376344086021505
```

```
Collision Number = 0
Time Taken = 5.0 ms

_____________________________________________________
When Adding 10000 Elements in the Table :
Table Size = 21196
Load Factor = 0.47178712964710323
Collision Number = 0
Time Taken = 35.0 ms

_____________________________________________________
When Adding 100000 Elements in the Table :
Table Size = 241444
Load Factor = 0.4141747154619705
Collision Number = 0
Time Taken = 44.0 ms
```

Comparing between the hashing methods

When inserting 100 element

	Table Size	Load Factor	Collision Number	Time Taken
1- Separate Chaining	192	0.5208333333333334	64	3.0 ms
2- Bucketing	162	0.6172839506172839	0	1.0 ms
3- Linear Probing	162	0.6172839506172839	0	2.0 ms
4- Quadratic Probin	148	0.6756756756756757	0	1.0 ms
5- Pseudo Random Probing	162	0.6172839506172839	0	0.0 ms
6- Double Hashing	162	0.6172839506172839	0	1.0 ms

When inserting 1000 element

	Table Size	Load Factor	Collision Number	Time Taken
1- Separate Chaining	1152	0. 8680555555555556	448	3.0 ms
2- Bucketing	1860	0.5376344086021505	739	4.0 ms
3- Linear Probing	1860	0.5376344086021505	0	4.0 ms
4- Quadratic Probin	1564	0.639386189258312	0	4.0 ms
5- Pseudo Random Probing	1860	0.5376344086021505	0	3.0 ms
6- Double Hashing	1860	0.5376344086021505	0	4.0 ms

When inserting 10000 element

	Table Size	Load Factor	Collision Number	Time Taken
1- Separate Chaining	6912	1.4467592592592593	5841	30.0 ms
2- Bucketing	21196	0.47178712964710323	7762	50.0 ms
3- Linear Probing	21196	0.47178712964710323	0	26.0 ms
4- Quadratic Probin	19904	0.502411575562701	0	48.0 ms
5- Pseudo Random Probing	21196	0.47178712964710323	0	38.0 ms
6- Double Hashing	21196	0.47178712964710323	0	31.0 ms

When inserting 100000 element

	Table Size	Load Factor	Collision Number	Time Taken
1- Separate Chaining	41472	2.4112654320987654	75104	35.0 ms
2- Bucketing	241444	0.4141747154619705	7762	45.0 ms
3- Linear Probing	241444	0.4141747154619705	0	48.0 ms
4- Quadratic Probin	152468	0.6558753312170422	0	59.0 ms
5- Pseudo Random Probing	241444	0.4141747154619705	0	48.0 ms
6- Double Hashing	241444	0.4141747154619705	0	48.0 ms