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HERALD COLLEGE KATHMANDU

Academic Year	Module	Assessment Number	Assessment Type
S20	Introductory Data Structures and Algorithms (DipIT02)	A1	Assignment Submission

[Assignment Submission]

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8.10

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Tutorial - 8 - 1

1⇒ ~~We can divide a number by 2 until until~~
We can divide $\log_2(n)$ number by 2 until it reach 1.

2⇒ The worst case time for sequential search for finding an element in an array is linear time.

3⇒ Array must be sorted for binary search

4⇒ Two entries with different keys have the same exact hash value.

5⇒

key	Hash value = k % 9
5	5 % 9 = 5
29	29 % 9 = 2
20	20 % 9 = 2
0	0 % 9 = 0
27	27 % 9 = 0
18	18 % 9 = 0

By linear probing the hash table will be

Hash table:

0	0
1	27
2	29
3	20
4	18
5	5
6	
7	

Order by elements:
0, 27, 29, 20, 8, 5,
→ → →

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6-> load factor = $\frac{\text{no. of elements}}{\text{capacity of table}}$

$= \frac{81}{811}$

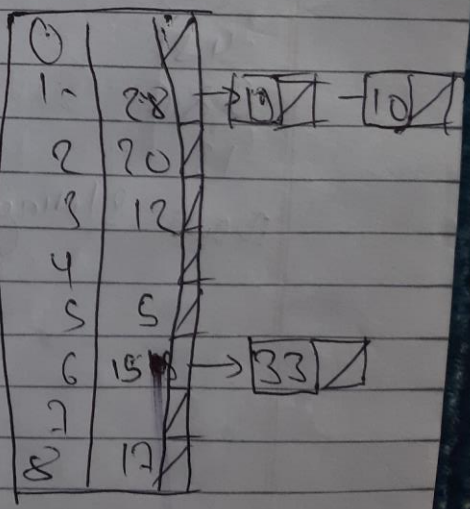
$= 0.099$

7-> Direct hashing → Distinct position for every passing key.

9->

keys	Hash value (hik) = key % 9
5	5 % 9 = 5
28	28 % 9 = 1
19	19 % 9 = 1
19	15 % 9 = 6
20	20 % 9 = 2
23	23 % 9 = 5
833	33 % 9 = 6
12	12 % 9 = 3
17	17 % 9 = 8
10	10 % 9 = 1.

Hash table for chaining.



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8→ Hashing is a search technique that rely on the concept of hash table we provide key to a hash function to generate hash value.

Ex. Assume that we have the following hash function.

$H(x) = x \bmod 10$

key (x): 21, 56, 72, 39, 48, 986, 13

Keys	Hash value
21	21 % 10 = 1
56	56 % 10 = 6
72	72 % 10 = 2
39	39 % 10 = 9
48	48 % 10 = 8
986	968 % 10 = 6 (collision occurred)
13	13 % 10 = 3

Now, storing the hash value in Hash table

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Hash table

0		
1	21	
2	72	
3	13	
4		
5		
6	56	→ 986
7		
8	48	
9	39	

10⇒ Soln. iLow = L Bound
iHigh = U Bound
Do while iLow <= iHigh
iMiddle = (iLow + iHigh)/2
if Target = Data Array (Middle) Then
bFound = True
Exit DO
Else if Target < Data Array (iMiddle) Then
iHigh = (iMiddle - 1)
else
iLow = (iMiddle + 1)
End if loop.

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Tutorial-8-2

1a). Solution

· Linear Probing.

keys	h(k) = k%7
19	19%7 = 5
26	26%7 = 5
13	13%7 = 6
48	48%7 = 6
17	17%7 = 3

Hash table.

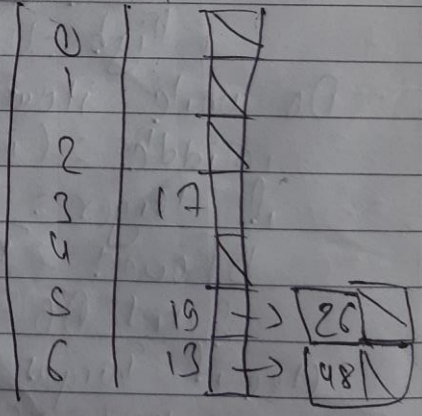
0	13
1	48
2	
3	17
4	
5	19
6	26

order by elements: 13, 48, _, 17, _, 19, 26

b)

keys	h(k) = k%7
19	19%7 = 5
26	26%7 = 5
13	13%7 = 6
48	48%7 = 6
17	17%7 = 3

Separate chaining hash table.



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c Double Hashing

keys	$h(k) = k \% 7$	$h'(k) = 5 - (k \% 5)$
19	$19 \% 7 = 5$	(Empty as no collision)
26	$26 \% 7 = 5$	$5 - (26 \% 5) = 4$
13	$13 \% 7 = 6$	(Empty)
48	$48 \% 7 = 6$	$5 - (48 \% 5) = 2$
17	$17 \% 7 = 3$	(Empty)

Hash table	
0	
1	48
2	26
3	17
4	
5	19
6	13

For hash value of 28 we use,
$\{h_1(k) + i * h_2(k)\}$ % table size where $0 < i <$ table size
$= (5 + 1 * 4) \% 7$
$= 2$ Similarly, for 48 new position is 1.

3 → As the functions have mod 10 so lets exclude them

keys	i^2	i^3	$12 * i^2$	$12 * i$
0	0	0	0	0
1	1	1	12	12
2	4	8	48	24
3	9	27	108	36
4	16	64	192	48
5	25	125	300	60
6	36	216	432	72
7	49	343	588	84
8	64	512	768	96
9	81	729	972	108

i represents the remainder after divided by 10.
As remainder value is repeated in every hash function.

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4-5 Solu

For a:

keys	h(k) = k % 10
46	46 % 10 = 6
42	42 % 10 = 2
34	34 % 10 = 4
52	52 % 10 = 2
23	23 % 10 = 3
33	33 % 10 = 3

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	

No. as it doesn't match table format

For b

34	4
42	2
23	3
52	2
33	3
46	6

No. as it does not match table format

For c

46	6
34	4
42	2
23	3
52	2
33	3

46 as it does not match table format

For d.

42	2
46	6
33	3
23	3
34	4
52	2

No as it does not match table format.

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5.) Solution.

keys	h(k) = keys % 11
113	113 % 11 = 3
117	117 % 11 = 7
97	97 % 11 = 9
100	100 % 11 = 1
114	114 % 11 = 4
108	108 % 11 = 9
116	116 % 11 = 6
105	105 % 11 = 6
99	99 % 11 = 0

Linear Probing.

0	99
1	100
2	
3	113
4	114
5	
6	116
7	117
8	105
9	97
10	108

B is correct order of element.