COMP 352: Data Structure and Algorithms

Name: Wang Haochen

Assignment 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | J | L | T | F | L | S | V | E | Y | Y | K | E | S |  |  |

2.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  | U | U |  |  |  |  |  |  |

16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

3. (1)

(2)

(3)

(4)

(5)

(6)

(7)

(8) removeMin()=2

(8) removeMin()=6

(8) removeMin()=9

4. add(24)

add(13)

add(30)

add(2)

add(27)

add(88)

add(94)

add(17)

add(19)

add(53)

add(28)

add(9)

add(88)

add(10)

add(30)

add(6)

add(48)

5.(i)

***This proposal have an advantage of the achieved complexity?***

***You should analyze both time-complexity and space-complexity.***

The time-complexity is O(n) which is sam the AVAILABLE.

The space-complexity is same a=n/N.

***Additionally, will this approach result in misbehaviors (in terms of functionalities)? If so, explain clearly through illustrative examples.***

No, this method just replace the nomal misbehavior. This method remove negative number you are searching for. In som cases, it has been replaced.

(ii)

***This proposal have an advantage of the achieved complexity?***

***You should analyze both time-complexity and space-complexity.***

The time-complexity is O(n) and is fast.

The space-complexity is same a=n/N.

***Additionally, will this approach result in misbehaviors (in terms of functionalities)? If so, explain clearly through illustrative examples.***

No,.

6. h(k)=k mod 13

(i).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| k | 32 | 147 | 265 | 195 | 207 | 180 | 21 | 16 | 189 | 202 | 91 | 94 | 162 | 75 | 37 | 77 | 81 | 48 |
| H(k) | 6 | 4 | 5 | 0 | 12 | 11 | 8 | 3 | 7 | 7 | 0 | 3 | 6 | 10 | 11 | 12 | 3 | 9 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |

48

81

77

37

75

162

94

91

202

21

189

16

32

147

265

180

207

195

(ii).The maximum number of collisions is 3 with 16, 94, 81 in location 3.

7. h(k)=k mod 15

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| k | 32 | 147 | 265 | 195 | 207 | 180 | 21 | 16 | 189 | 202 | 91 | 94 | 162 | 75 | 37 | 77 | 81 | 48 |
| H(k) | 2 | 12 | 10 | 0 | 12 | 0 | 6 | 1 | 9 | 7 | 1 | 4 | 12 | 0 | 7 | 2 | 6 | 3 |

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| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

195

48

94

202

189

16

21

147

265

32

77

81

37

75

162

91

180

207

The maximum number of collisions is 3 with 195, 180, 75 in location 0.

The load factor can be reduced if the number of entries is reduced or the array size is increased; which implies in this case that the chance of one element colliding with another one is lower.

8. h(k)=k mod 19

d(k)=11 - k mod 11

(i)

|  |  |  |  |
| --- | --- | --- | --- |
| K | h(k) | d(k) | Probes |
| 38 | 0 | 6 | 0 |
| 15 | 15 | 7 | 15 |
| 43 | 5 | 1 | 5 |
| 22 | 3 | 11 | 3 |
| 71 | 14 | 6 | 14 |
| 8 | 8 | 3 | 8 |
| 28 | 9 | 5 | 9 |
| 37 | 18 | 7 | 18 |
| 19 | 0 | 3 | 0, 3, 6 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 38 |  |  | 22 |  | 43 | 19 |  | 8 | 28 |  |  |  |  | 71 | 15 |  |  | 37 |

(ii). The size of the longest cluster is 2.

(iii). The number of occurred collision is 2.

(iv). Load factor = = 9/19

9.

(i).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| k | 29 | 53 | 14 | 95 | 32 | 19 | 30 | 12 | 72 |
| H(K) | 10 | 15 | 14 | 0 | 13 | 0 | 11 | 12 | 15 |
|  |  |  |  |  |  | 1 |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 |  |  |  |  |  |  |  |  |  | 29 |  |  |  | 14 | 53 |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 |  |  |  |  |  |  |  |  |  | 29 |  |  |  | 14 | Ava |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 |  |  |  |  |  |  |  |  |  | Ava |  |  |  | 14 | Ava |  |  |  |

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| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 | 19 |  |  |  |  |  |  |  |  | Ava |  |  | 32 | 14 | Ava |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 | 19 |  |  |  |  |  |  |  |  | Ava |  |  | 32 | 14 | Ava |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 | 19 |  |  |  |  |  |  |  |  | Ava |  |  | 32 | Ava | Ava |  |  |  |

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| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| key | 95 | 19 |  |  |  |  |  |  |  |  | Ava | 30 | 12 | 32 | Ava | 72 |  |  |  |

(ii). The longest cluster is 6.

Big(O) is O(n).

(iii). One collision which is when 19 collided in 95 at location 0.

10.

(i)

C

A

B

A

A

C

B

B

C

(ii). Put(74

Big-O is O(log(n))

(iii).remove70)

A

C

B

Big-O is O(log(n))

(iv). Remove(91)

Big-O is O(log(n))