به نام خدا

* LinearProbing:Hash Table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  | 10 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  |  |  |  |  |  |  | 10 |

10 🡪 h(10) = 10

22 🡪 h(22) = 22 mod 11 = 0

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  |  |  |  |  |  | 31 | 10 |

31 🡪 h(31) = 31 mod 11 = 9

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 |  |  |  |  | 31 | 10 |

4 🡪 h(4) = 4

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 | 15 |  |  |  | 31 | 10 |

25 🡪 h(15) = 25 mod 11 = 4 🡪 A[4] = full

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 | 15 | 28 |  |  | 31 | 10 |

4+1=5 🡪 A[5] is empty

28 🡪 h(28) =28 mod 11 = 6

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 | 15 | 28 | 17 |  | 31 | 10 |

17 🡪 h(17) = 17 mod 11 = 6 🡪 A[6] is full

6+1 = 7 🡪 A[7] is empty

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 | 88 |  |  | 4 | 15 | 28 | 17 |  | 31 | 10 |

88 🡪 h(88) = 88 mod 11 = 0 A[0] is full

0+1=1 🡪 A[1] is empty

59 🡪 h(59) = 59 mod 11 = 4 A[4] is full 🡪 4+1=5 🡪 A[5] is full

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 | 88 |  |  | 4 | 15 | 28 | 17 | 59 | 31 | 10 |

5+1=6 🡪 A[6] is full 🡪 6+1=7 🡪 A[7] is full

7+1=8 🡪 A[8] is empty

* Quadratic Probing : Hash Table

h(k) = h’(k) + c1\*i + c2\*i2

10 🡪 h’(10) + 1\*0 + 3\*02 = h’(10) = 10

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  | 10 |

22 🡪 h’(22) = 22 mod 11= 0

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  |  |  |  |  |  |  | 10 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  |  |  |  |  |  | 31 | 10 |

31🡪 h’(31) = 31 mod 11 = 9

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 |  |  |  |  | 31 | 10 |

4 🡪 h’(4) = 4

15 🡪 h’(15) = 15 mod 11 = 4 🡪 A[4] is full 🡪 i+=1

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 |  |  |  | 15 | 31 | 10 |

h(15) = h’(15) + 1\*1 + 3\*1 = 4 + 1 + 3 = 8 🡪 A[8] is empty

28 🡪 h’(28) = 28 mod 11 = 6

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 |  | 28 |  | 15 | 31 | 10 |

17 🡪 h’(17) = 17 mod 11 = 6 🡪 A[6] is full 🡪 i+=1

h(17) = h’(17) + 1 + 3 = 10 🡪 A[10] is full 🡪 i+=1

h(17) = h’(17) + 1\*2 + 3\*22  mod 11 = 9 🡪 A[9] is full 🡪 i+=1

h(17) = h’(17) + 1\*3 + 3\*32 mod 11 = 3 🡪 A[3] is empty

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  | 17 | 4 |  | 28 |  | 15 | 31 | 10 |

88 🡪 h’(88) = 88 mod 11 = 0 🡪 A[0] is full 🡪 i+=1

h(88) = h’(88) + 1 + 3 = 4 🡪 A[4] is full 🡪 i+=1

h(88) = h’(88) + 2 + 12 mod 11 = 3 🡪 A[3] is full 🡪 i+=1

h(88) = h’(88) + 3 + 27 mod 11 = 8 🡪 A[8] is full 🡪 i+=1

h(88) = h’(88) + 4 + 48 mod 11 = 8 🡪 A[8] is full 🡪 i+=1

h(88) = h’(88) + 5 + 75 mod 11 = 3 🡪 A[3] is full 🡪 i+=1

h(88) = h’(88) + 6 + 108 mod 11 = 4 🡪 A[4] is full 🡪 i+=1

h(88) = h’(88) + 7 + 147 mod 11 = 0 🡪 A[0] is full 🡪 i+=1

h(88) = h’(88) + 8 + 192 mod 11 = 2 🡪 A[2] is empty

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  | 88 | 17 | 4 |  | 28 |  | 15 | 31 | 10 |

59 🡪 h’(59) = 59 mod 11 = 4 🡪 A[4] is full 🡪 i+=1

h(59) = h’(59) + 1 + 3 =8 🡪 A[8] is full 🡪 i+=1

h(59) = h’(59) + 2 + 6 mod 11 = 1 🡪 A[1] is empty

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 | 59 | 88 | 17 | 4 |  | 28 |  | 15 | 31 | 10 |

* Double Hashing : Hash Table

Base = h1(k) = k , offset = h2(k) = 1 + k mod(m-1)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  | 10 |

10 🡪 h1(10) = 10

22 🡪 h1(22) = 22 mod 11 = 0

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  |  |  |  |  |  |  | 10 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  |  |  |  |  |  | 31 | 10 |

31 🡪 h1(31) = 31 mod 11 = 9

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 |  |  |  |  | 31 | 10 |

4 🡪 h1(4) = 4

15 🡪 h1(15) = 15 mod 11 = 4 🡪 A[4] is full

h2(15) = offset = 1+ (15 mod 10) = 6

h(15) = h1(15) + offset = h1­(15) + h2(15) = 4 + 1 + (15 mod 10) mod 11 = 10 🡪 A[10] is full

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 | 15 |  |  |  | 31 | 10 |

h(15) = h(15) + offset = 10 + h2(15) = 10 + 6 = 5 🡪 A[5] is empty

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  |  | 4 | 15 | 28 |  |  | 31 | 10 |

28 🡪 h1(28) = 28 mod 11 = 6

17 🡪 h1(17) = 17 mod 11 = 6 🡪 A[6] is full

h2­(17) = offset = 1 + 17 mod 10 = 8

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  | 17 | 4 | 15 | 28 |  |  | 31 | 10 |

h(17) = h1(17) + offset = (h1(17) + h2­(17)) mod 11 = 3 🡪 A[3] is empty

88 🡪 h1(88) = 88 mod 11 = 0 🡪 A[0] is full

h2(88) = offset = 1 + 88 mod 10 = 9

h(88) = h1(88) + h2­(88) = 9 🡪 A[9] is full

h(88) = h1(88) + h2(88) = 9 + 9 mod 11 = 7 🡪 A[7] is empty

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  |  | 17 | 4 | 15 | 28 | 88 |  | 31 | 10 |

59 🡪 h1(59) = 59 mod 11 = 4 🡪 A[4] is full

h2(59) = offset = (1 + 59 mod 10) mod 11 = 10

h(59) = h1(59) + offset = (h1(59) + h2(59)) mod 11 = 3 🡪 A[3] is full

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 |  | 59 | 17 | 4 | 15 | 28 | 88 |  | 31 | 10 |

h(59) = h(59) + offset = 3 + 10 mod 11 = 2 🡪 A[2] is empty