CS 2210B

Assignment #3

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1. $h(k) = k \bmod 7$

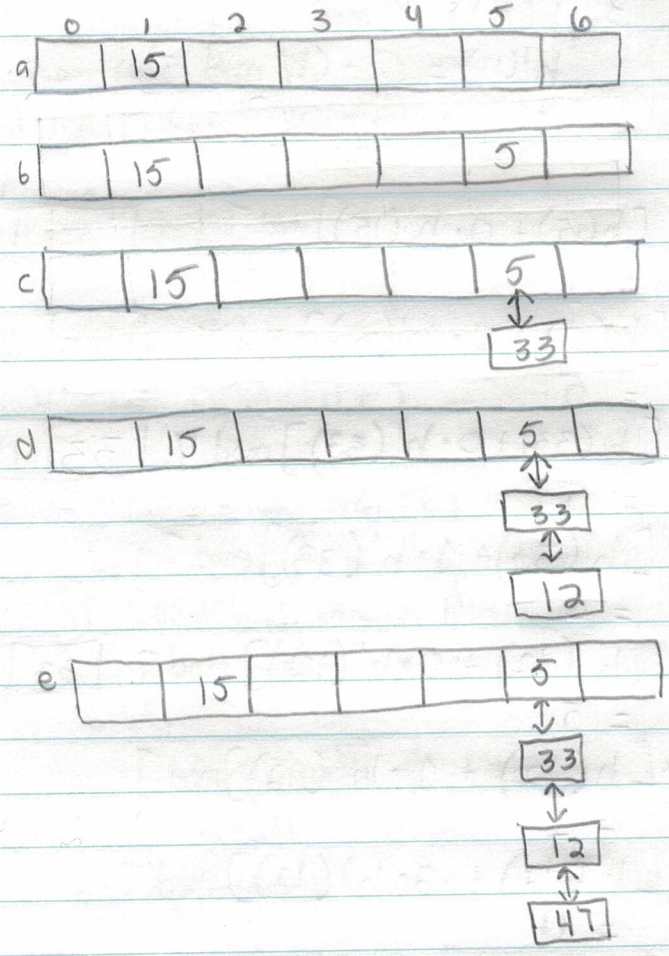
a) $h(15) = 15 \bmod 7$
$= 1$

b) $h(5) = 5 \bmod 7$
$= 5$

c) $h(33) = 33 \bmod 7$
$= 5$

d) $h(12) = 12 \bmod 7$
$= 5$

e) $h(47) = 47 \bmod 7$
$= 5$



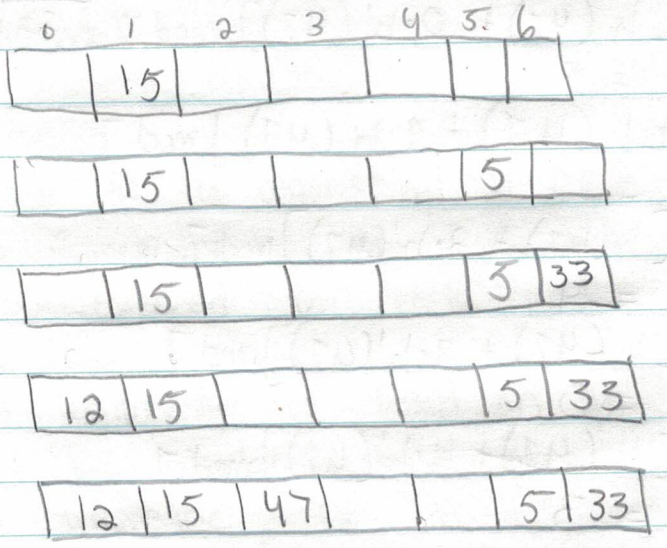
2. $h(15) = 1$

$h(5) = 5$

$h(33) = 5$

$h(12) = 5$

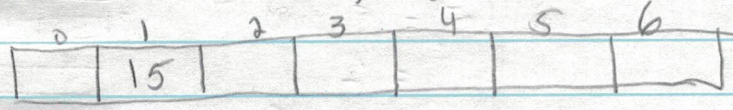
$h(47) = 5$



3. $h(x) = x \bmod 7$

$h'(x) = 5 - (x \bmod 5)$

$[h(x) + p \cdot h'(x)] \bmod 7$ for $p = 0, 1, \ldots, N$



✓ $[h(15) + 0 \cdot h'(15)] \bmod 7$

$= 1$

✓ $[h(5) + 0 \cdot h'(5)] \bmod 7$

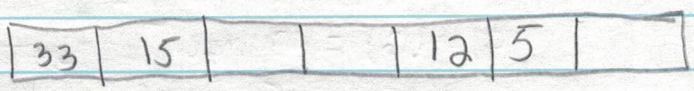
$= 5$

× $[h(33) + 0 \cdot h'(33)] \bmod 7$

$= 5$

✓ $[h(33) + 1 \cdot h'(33)] \bmod 7$

$= 0$



× $[h(12) + 0 \cdot h'(12)] \bmod 7$

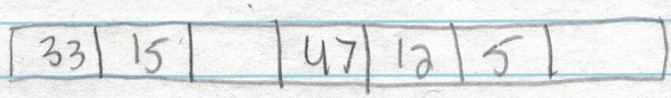
$= 5$

× $[h(12) + 1 \cdot h'(12)] \bmod 7$

$= 1$

✓ $[h(12) + 2 \cdot h'(12)] \bmod 7$

$= 4$



× $[h(47) + 0 \cdot h'(47)] \bmod 7$

$= 5$

× $[h(47) + 1 \cdot h'(47)] \bmod 7$

$= 1$

× $[h(47) + 2 \cdot h'(47)] \bmod 7$

$= 4$

× $[h(47) + 3 \cdot h'(47)] \bmod 7$

$= 0$

✓ $[h(47) + 4 \cdot h'(47)] \bmod 7$

$= 3$

4. Algorithm isSymmetric(r)
↳input: the root, r, of a tree
↳output: return true if tree is symmetric, false otherwise

```
1       Symmetric ← true

1       if( isInternal(r)) then
1           AllChildren ← children(r)

n           while 'Allchildren.hasNext()
n               currentChild ← Allchildren.next()
n               if currentChild.value = Allchildren.next().value then
n                   Symmetric ← true
n               else
n                   Symmetric ← false
n                   break
n               isSymmetric(currentChild)

        return Symmetric
```

5.

- The worst case for the algorithm is when the tree IS symmetric as the isSymmetric(r) function is executed for each node in the tree
- The time complexity is based on the number of times the algorithm takes place. If the tree is symmetric, the algorithm will loop through and occur for EACH node in the tree. Although the algorithm will be called for each node, the while loop will only iterate for internal nodes. shown above.
- Time complexity is O(n)