HW5

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9.3-1) Groups of 7

$4\left(\frac{1}{2}\lceil\frac{n}{7}\rceil - 2\right) \geq \frac{2n}{7} - 8$

worst case $5n/7 + 8$

Prove $T(n) \leq cn$

$$T(n) \leq \begin{cases} T\lceil n/7\rceil + T(5n/7+8) + O(n) & \text{if } n \geq n_0 \\ O(1) & \text{if } n < n_0 \end{cases}$$

$T(n) \leq c\lceil n/7\rceil + c + 5cn/7 + 8c + an$

$\leq 6cn/7 + 9c + an$

$= cn + (-cn/7 + 9c + an)$

$\leq cn$

$\boxed{= O(n)}$

must hold: $(-cn/7 + 9c + an) \leq 0$

$c(n/7 - 9) \geq an$

$\frac{c(n-63)}{7} \geq an$

$c \geq \frac{7an}{n-63}$

$n_0 = 126$ and $\frac{n}{(n-63)} \leq 2$

d.3-1) Groups of 3

$$2\left(\left\lceil \tfrac{1}{2}\left\lceil \tfrac{n}{3}\right\rceil\right\rceil - 2\right) \geq \frac{n}{3} - 4$$

worst case: $\frac{2n}{3} + 4$

$$T(n) = T(\lceil n/3 \rceil) + T(2n/3 + 4) + O(n)$$

Prove: $T(n) \geq cn$

$$T(n) \geq c\lceil n/3 \rceil + c(2n/3+4) + an$$

$$\geq cn/3 + c + 2cn/3 + 2c + an$$

$$= cn + 3c + an$$

$$\geq cn$$

must hold that ($c > 0$, $a > 0$, $n > 0$)

$$= w(n)$$

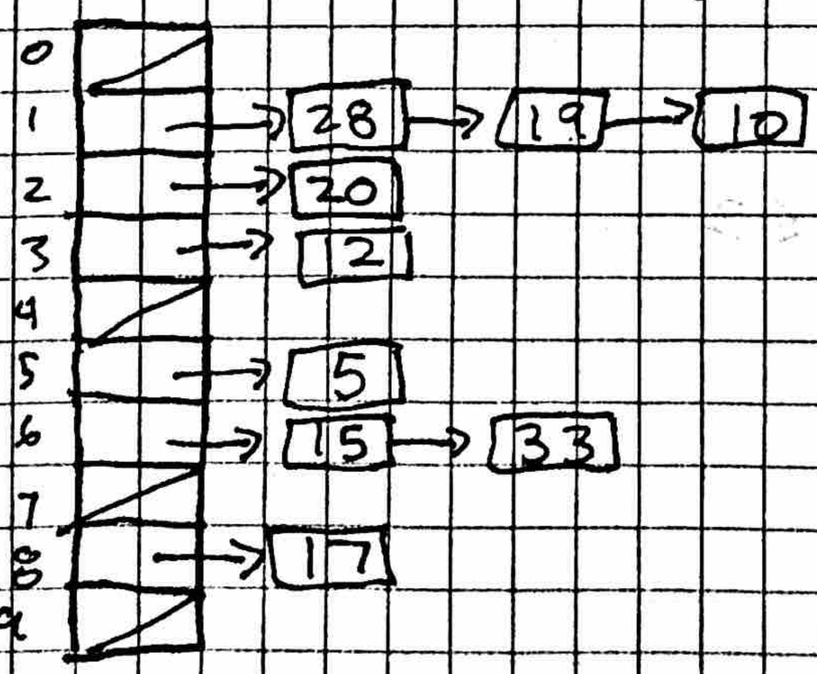
11.2-1) expected cardinality is n/m

number of distinct keys that can be placed in an array of length m.

11.2-2)

5	28	19	15	20	33	12	17	10

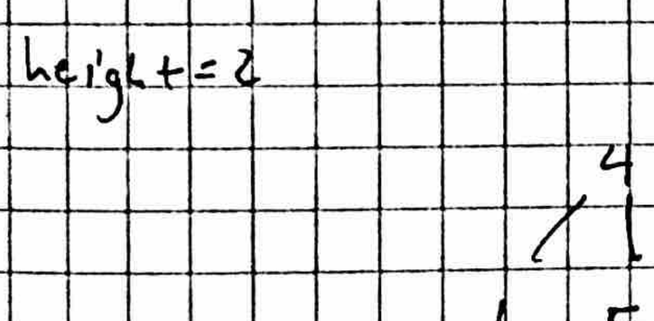
$h(k) = k \bmod 9$



11.2-5) If $|U| > nm$. That means that U should be divided by m positions. And each position expects n elements so there will be at least one position with n+1 elements. This means we basically have a linked list plus time to run the hash function. Searching in a linked list requires $\Theta(n)$ time to find. This case with hashing with chaining results in the worst case search time is $\Theta(n)$ because one position will have n+1 elements in it.

12.1-1) {1, 4, 5, 10, 16, 17, 21}

height = 2



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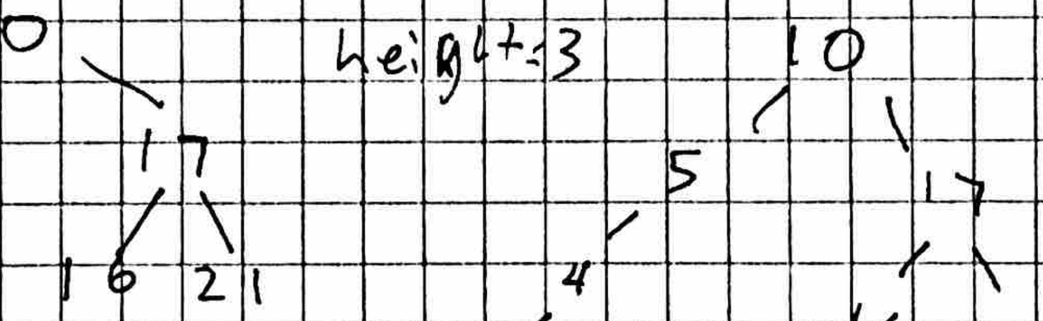

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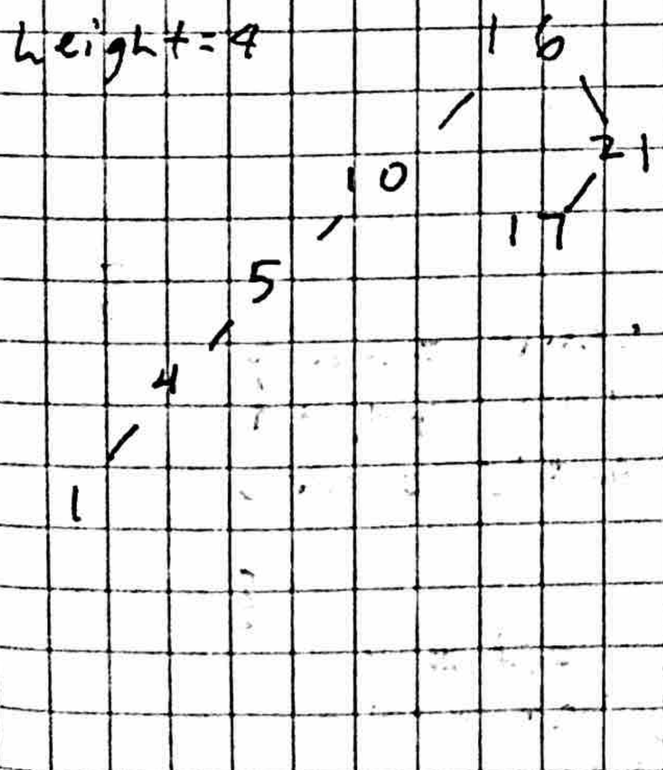

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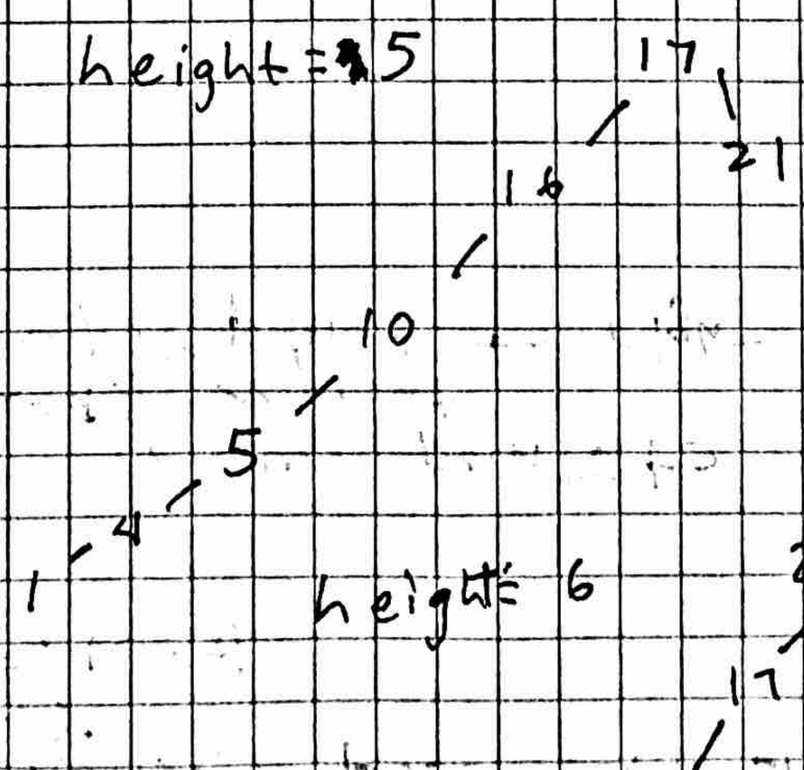


height = 6

12.1-3)

```
void inorder (TreeNode root)
    if(root == null){ // Base case
        return;
    }
    TreeNode curr = root; // pointer to root
    Stack s;
    while (!s.isEmpty()){
        while (curr != null){ // push left side of tree first
            s.push(curr);
            curr= curr.left;
        }

        curr = s.pop(); // curr points to whatwas poppedoff
        print(curr.data); // print
        curr = curr.right; // point to right side of popped off node
    }
```

12.2-1)

a) 2 ok

252

401

398

330

334

397

363

b) ok 924

220

911

244

898

258

362

363

c)

925

202

911

240

912

245

363

d) 2 ok

399

387

219

266

382

38

278

363

e)

935

278

347

621

299

392

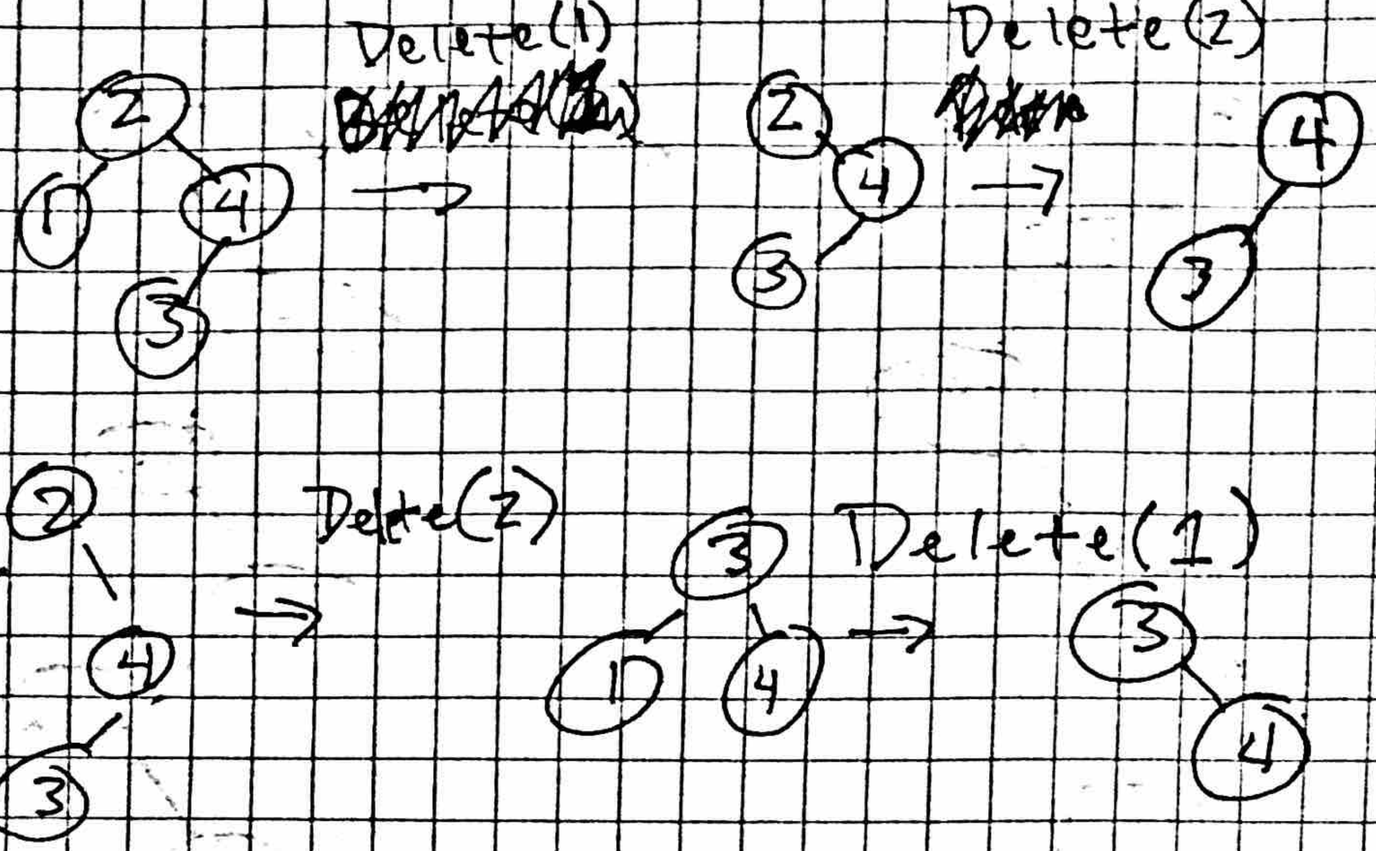
358

363

↑ incorrect ↙ needs to be less than 911.

← incorrect needs to be larger than 347

(2,3,-4)



Delete is not communitive.