Q1:

a)

Nameless returns the common parent node which is at the lowest position in the tree.

Stacks P_u and P_v respectively store the nodes from u and v to the root. We remove the top element from both stack until they are different, and return the reference to the last node that is still the same, therefore the node reference refers to the lowest common parent.

b)

worst case:

u and v are both child of one node and are both lowest leaves(maximum height).

Let h be the height of the tree.

Building stack P_u: $\theta(h)$

Building stack P_v: $\theta(h)$

Pop procedure while loop execute: $\theta(1)$

Pop procedure while loop times: h times

Total: $\theta(h) + \theta(h) + h(\theta(1)) = \theta(h)$.

best case:

u and v are both root node.

Building stack P_u: $\theta(1)$

Building stack P_v: $\theta(1)$

Pop procedure while loop execute: $\theta(1)$

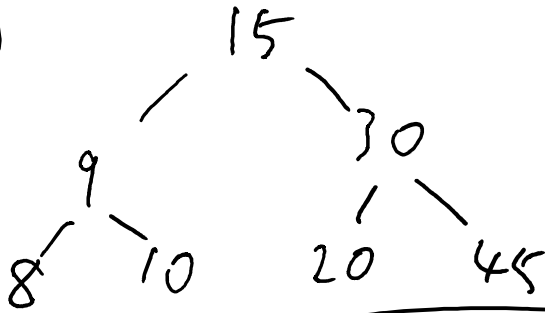Pop procedure while loop times: 1 times

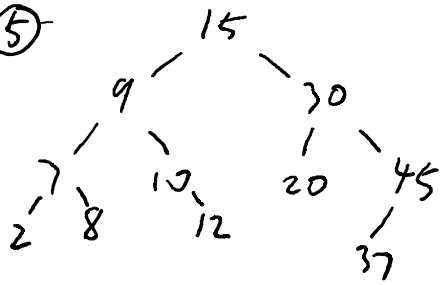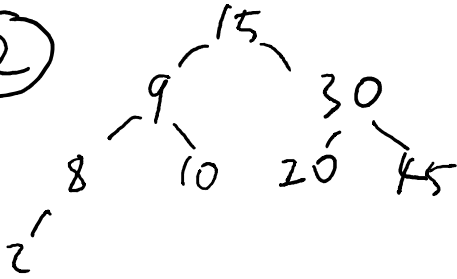Total: $\theta(1) + \theta(1) + 1 \times \theta(1) = \theta(1)$.
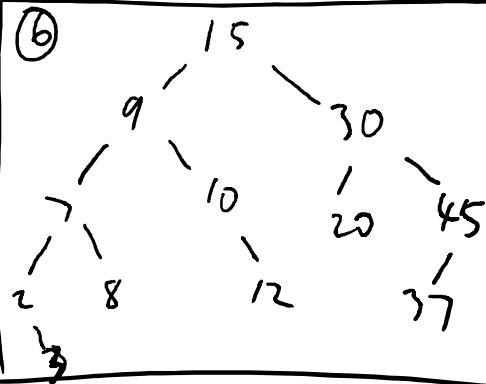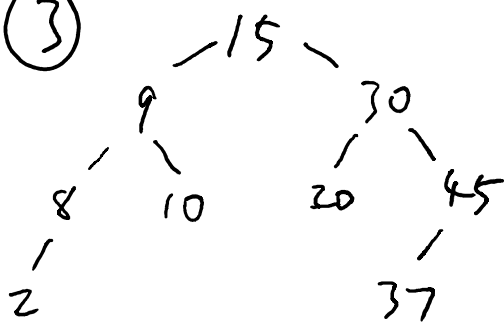
Q2:

I:

a)

①
```
        15
    9       30
  8  10   20    45
```

⑤
```
        15
    9        30
  7   10  20    45
 2  8   12      37
```

②
```
         15
    9       30
  8  10  20  45
 2
```

⑥
```
        15
    9        30
  7     10    20   45
 2   8      12    37
       3
```

③
```
      15
    9      30
  8  10  20   45
 2            37
```

⑦
```
         15
    9         30
  7     10  20     37
 2    8  12      36    45
   3
```

④
```
        15
    9       30
  7   10  20   45
 2  8         37
```