

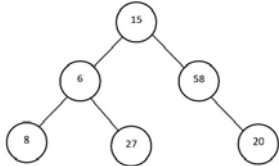
2018SS

Question 43

[1 mark] What data structure is typically used to implement a file system?

- (a) List
- (b) Tree
- (c) Stack
- (d) Queue
- (e) None of the above

Use the following binary tree for the following three questions:



Question 44

[1 mark] What would be the output if we used the post-order print function to print the nodes of the binary tree? The function is defined below:

```
def basic_print(t):  
    if t != None:  
        basic_print(t.get_left())  
        basic_print(t.get_right())  
        print(t.get_data())
```

- (a) 8 27 6 20 58 15
- (b) 8 27 6 58 20 15
- (c) 8 27 6 15 58 20
- (d) 15 6 8 27 58 20
- (e) None of the above

Question 45

[1 mark] What would be the output if we used the in-order print function to print the nodes of the binary tree? The function is defined below:

```
def basic_print(t):  
    if t != None:  
        basic_print(t.get_left())  
        print(t.get_data())  
        basic_print(t.get_right())
```

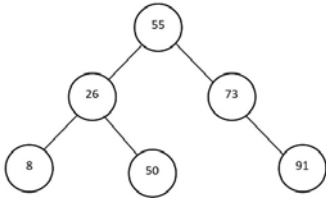
- (a) 15 6 8 27 58 20
- (b) 8 6 27 15 58 20
- (c) 8 6 27 15 20 58
- (d) 8 27 6 20 58 15
- (e) None of the above

Question 46

[1.5 marks] Which of the following is the correct nested list representation of the binary tree?

- (a) [15, [6, [8, 27], [58, 0, 20]]
- (b) [15, [6, [8, 0, 0], [27, 0, 0]], [58, 0, [20, 0, 0]]]
- (c) [15, [6, [8, 27], [58, None, 20]]
- (d) [15, [6, [8, None, None], [27, None, None]], [58, None, [20, None, None]]]
- (e) None of the above

For the following question use the Binary Search Tree shown below:



Question 47

[1.5 marks] If we insert a new node into the Binary Search Tree with a value of 71, where would it be positioned in the tree?

- (a) To the right of the node with value 55
- (b) To the right of the node with value 50
- (c) To the left of the node with value 73
- (d) To the left of the node with value 91
- (e) None of the above

Question 48

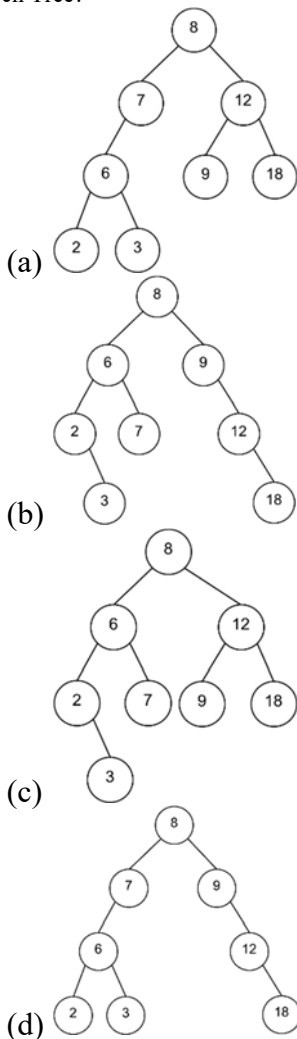
[1 mark] What is the Big-O time complexity for searching for a value in a **balanced** binary search tree?

- (a) $O(n \log n)$
- (b) $O(n)$
- (c) $O(1)$
- (d) $O(\log n)$
- (e) None of the above

2017 S2

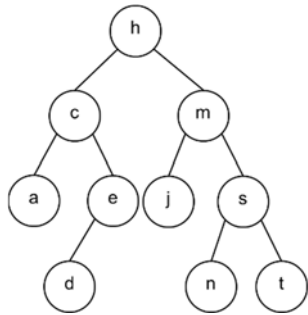
Question 31

[2 marks] What does the binary search tree look like after inserting the values [8, 9, 6, 2, 12, 7, 18, 3] in this order into an initially empty Binary Search Tree?



Question 32

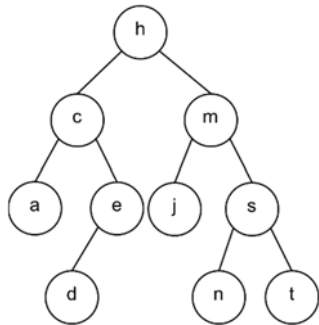
[2 marks] Given is the tree in the picture below. What is the node sequence when traversing the tree in INORDER?



- (a) a d e c j n t s m h
- (b) h c a e d m j s n t
- (c) a c e d h m j s n t
- (d) a c d e h j m n s t
- (e) None of the above.

Question 33

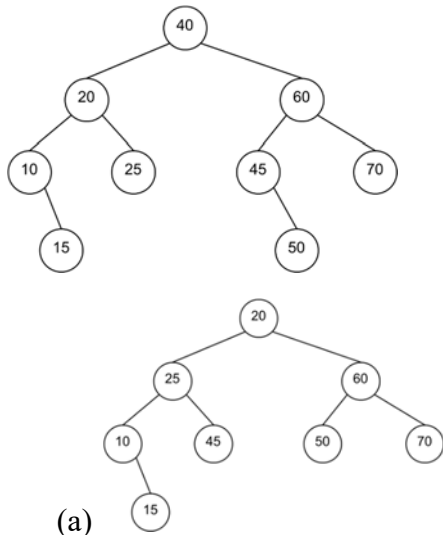
[2 marks] Given is the tree in the picture below. What is the node sequence when traversing the tree in POSTORDER?



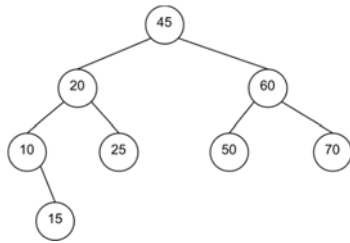
- (a) a c e d h m j s n t
- (b) a d c e h j m s n t
- (c) a d e c j n t s m h
- (d) h c a e d m j s n t
- (e) None of the above.

Question 35

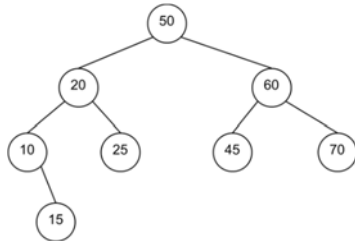
[2 marks] Given the binary search tree in the picture below. What does the tree look like after removing the root using the method presented in lectures?



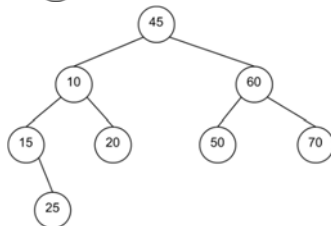
(a)



(b)



(c)



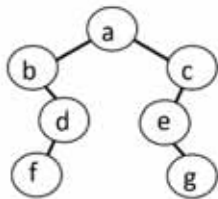
(d)

(e) None of the above.

2017 S1

Question 45

[2 marks] Given the tree in the picture below, what is the node sequence when traversing the tree in preorder?



(a) b f d a e g c

(b) a b c d e f g

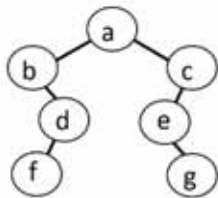
(c) a b d f c e g

(d) f d b g e c a

(e) None of the above.

Question 46

[2 marks] Given the tree in the picture below, what is the node sequence when traversing the tree in inorder?



(a) f d b g e c a

(b) a b c d e f g

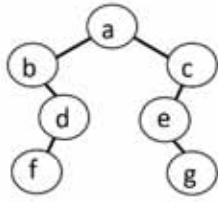
(c) a b d f c e g

(d) b f d a e g c

(e) None of the above.

Question 47

[2 marks] Given the tree in the picture below, what is the node sequence when traversing the tree in postorder?



- (a) a b c d e f g
- (b) f d b g e c a
- (c) a b d f c e g
- (d) b f d a e g c
- (e) None of the above.

Question 48

[2 marks] The `magic` function below takes as input an object of type `RefBinaryTree` (you can assume that the tree is not **None**, i.e. has a root). What does this function compute, i.e., what is the return value? (Note that the use of the backslash symbol ‘\’ here is for line continuation purpose.)

```

def magic(tree):
    if (tree == None):
        return -1
    else:
        return 1 + max(magic (tree.get_left_subtree()), \
                       magic (tree.get_right_subtree()))
  
```

- (a) The height of the input variable `tree`
- (b) The sum of the nodes’ values of the input variable `tree`
- (c) The number of nodes of the input variable `tree`
- (d) The number of leaves of the input variable `tree`
- (e) None of the above

Question 49

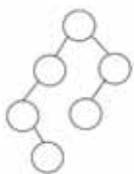
[2 marks] Given a tree with the following traversal sequences:

Inorder: s d a b k r

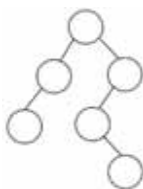
Preorder: a d s r b k

what is the shape of the tree?

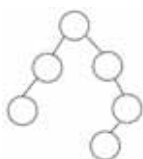
Hint: reconstruct the tree from the traversal sequences given above.



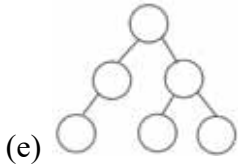
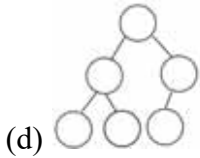
(a)



(b)



(c)



Question 52

[2 marks] In what order do we need to insert the values 1,...,13 into an initially empty binary search tree in order to get a complete binary search tree?

- (a) 8, 7, 6, 5, 4, 3, 2, 1, 9, 10, 11, 12, 13
- (b) 7, 3, 1, 2, 6, 4, 5, 10, 8, 9, 12, 11, 13
- (c) 7, 4, 2, 1, 3, 6, 5, 12, 10, 8, 9, 11, 13
- (d) 8, 4, 2, 1, 3, 6, 5, 7, 12, 10, 9, 11, 13
- (e) None of the above

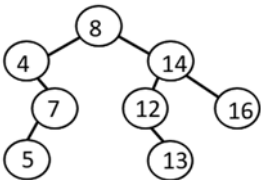
Question 53

[2 marks] Given a binary search tree with n values, what is the best case, average case and worst case complexity (running time) for finding the $n/2$ smallest values using the most suitable algorithm for this presented in lectures?

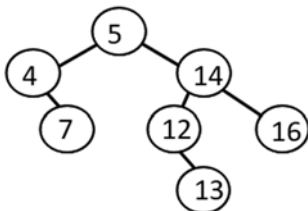
- | | | |
|------------------------------|-----------------------------|---------------------------|
| (a) Best case: $O(n)$ | Average case: $O(n)$ | Worst case: $O(n)$ |
| (b) Best case: $O(n)$ | Average case: $O(n \log n)$ | Worst case: $O(n^2)$ |
| (c) Best case: $O(n \log n)$ | Average case: $O(n^2)$ | Worst case: $O(n^2)$ |
| (d) Best case: $O(n)$ | Average case: $O(n \log n)$ | Worst case: $O(n \log n)$ |
| (e) Best case: $O(n \log n)$ | Average case: $O(n \log n)$ | Worst case: $O(n^2)$ |

Question 55

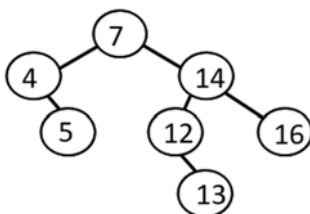
[2 marks] Given the binary search tree in the picture below:



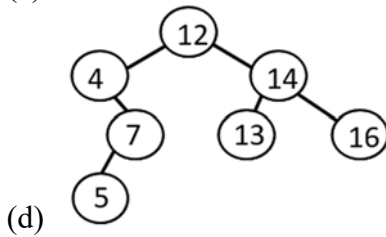
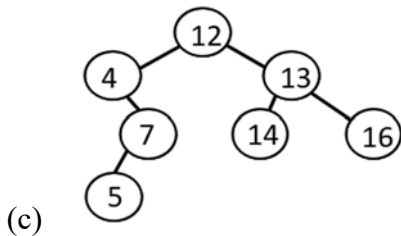
what does the tree look like after removing the root (node 8) using the method presented in lectures?



(a)



(b)



2017 SS

Question 24

A binary tree is represented by the following nested list:

```
[1, None, [3, [6, None, None], [7, [14, None, None], [15, None, None]]]]
```

What is the correct order, from left to right, of an **in-order** traversal of this tree?

- (a) [6, 14, 15, 7, 3, 1]
- (b) [1, 6, 3, 14, 7, 15]
- (c) [1, 6, 14, 3, 7, 15]
- (d) [1, 3, 6, 7, 14, 15]
- (e) [6, 3, 1, 15, 14, 7]

Question 25

A binary tree is represented by the following nested list:

```
[1, [2, None, None], [3, [4, None, None], [5, None, None]]]
```

What is the correct order, from left to right, of a **post-order** traversal of this tree?

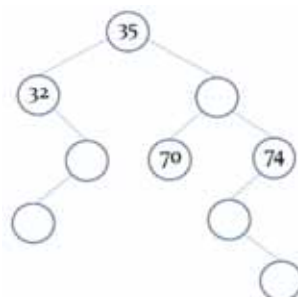
- (a) [4, 2, 3, 5, 1]
- (b) [1, 2, 3, 4, 5]
- (c) [2, 1, 4, 3, 5]
- (d) [2, 4, 5, 3, 1]
- (e) [5, 4, 3, 2, 1]

Question 35

[8 marks]

The diagram below shows a **binary search tree**, with a root value of “35”, however some of the values are not shown in the nodes. Please note: in this binary search tree, all values are **integers**, and all values are **unique**.

Complete the diagram by filling in the **five** missing integer values (as each value is unique, these must be different from all other values in the tree). You should ensure that the **binary search tree** property is maintained.



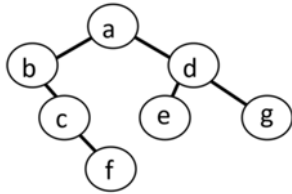
b) Give the **preorder** traversal of the tree above:

c) Give the **postorder** traversal of the tree above:

2016 S2

Question 41

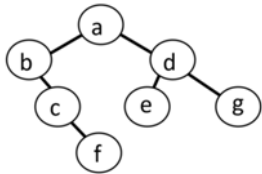
[2 marks] Given is the tree in the picture below. What is the node sequence when traversing the tree in preorder?



- (a) a b c d e f g
- (b) f c b e g d a
- (c) f c b a e g d
- (d) a b c f d e g
- (e) None of the other answers.

Question 42

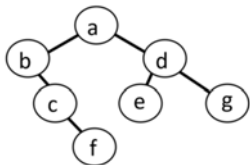
[2 marks] Given is the tree in the picture below. What is the node sequence when traversing the tree in inorder?



- (a) f c b e g d a
- (b) a b c f d e g
- (c) a b c d e f g
- (d) f c b a e g d
- (e) None of the other answers.

Question 43

[2 marks] Given is the tree in the picture below. What is the node sequence when traversing the tree in postorder?



- (a) f c b a e g d
- (b) a b c d e f g
- (c) f c b e g d a
- (d) a b c f d e g
- (e) None of the other answers

Question 44

[2 marks] The function `magic` below takes as input an object of type `RefBinaryTree`. What does this function compute, i.e. what is the return value? (Note that the use of the backslash symbol `\` here is for line continuation purpose.)

```
def magic(tree):
    if (tree == None):
        return 0
    else:
        return 1 + magic(tree.get_left_subtree()) + \
            magic(tree.get_right_subtree())
```

- (a) The sum of the nodes' values of the input variable `tree`.
- (b) The number of leaves of the input variable `tree`.
- (c) The height of the input variable `tree`.
- (d) The number of nodes of the input variable `tree`.
- (e) None of the other answers.

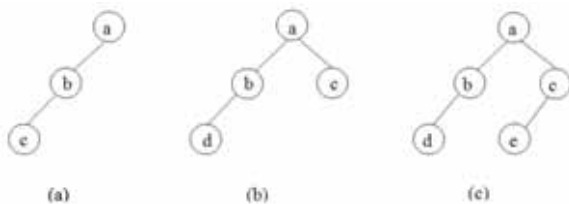
Question 47

[2 marks] Which of the following statements is false (if any)?

- (a) If a binary search tree is balanced, then inserting a value, deleting a value, and finding a value takes $O(\log n)$ time.
- (b) All of the other statements are true.
- (c) A binary search tree is always balanced.
- (d) If we traverse a binary search tree in preorder and insert the values in that order into an initially empty tree, then we get back the original tree.
- (e) If we traverse a binary search tree in inorder, then we get the values of the tree in sorted order.

Question 48

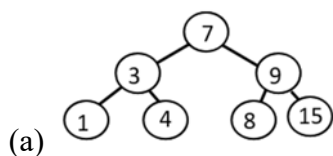
[2 marks] Given are three trees (a), (b) and (c) as shown in the image below. Which of the following statements is true?

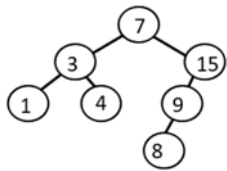


- (a) Only tree (b) is complete and only trees (b) and (c) are balanced.
- (b) Only tree (b) is complete and only tree (c) is balanced.
- (c) Only trees (b) and (c) are complete and trees (a), (b) and (c) are balanced.
- (d) Only trees (b) and (c) are complete and only trees (b) and (c) are balanced.
- (e) Only tree (b) is complete and trees (a), (b) and (c) are balanced.

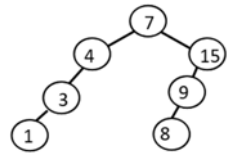
Question 49

[2 marks] What does the binary search tree look like after inserting the values [7, 3, 4, 15, 9, 8, 1] in this order into an initially empty Binary Search Tree?

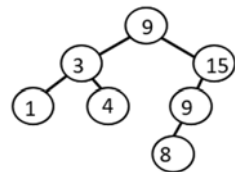




(b)



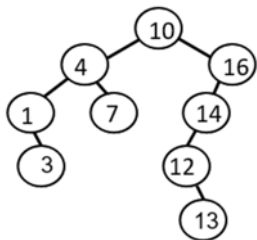
(c)



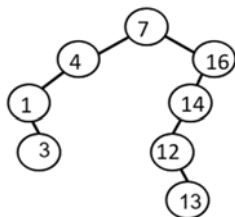
(d)

Question 50

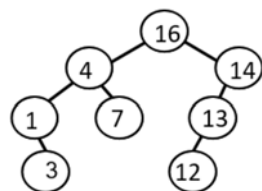
[2 marks] Given is the binary search tree in the picture below.



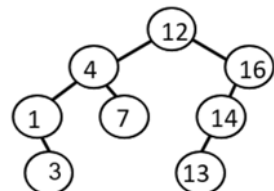
What does the tree look like after removing the root using the method presented in the lecture?



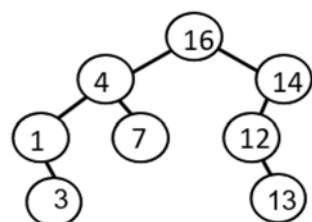
(a)



(b)



(c)



(d)