Tree: terminology

A Level Advanced
P P P P

Drag and drop the given terms from the list below into the correct spaces to complete the text.

A tree is a ________ graph, which means that there always exists a path from a node to any other node. In fact, in a tree there is **only one** possible path between any two nodes because a tree doesn't have ________. The edges of the tree do not have a direction, which makes a tree an ________ graph.

There is a set of terms that describe the hierarchy of the nodes in a tree:

- The topmost node of a tree is called the ________.
- Nodes are connected by parent–child relationships. If you think of a path from the root towards a node, then a parent node is a node that comes directly before another connected node, which is called its child node.
- A ________ is a node with no children.
- A ________ is a path from the root to a leaf.
- The ________ of a tree is equal to the number of edges that connect the root node to the leaf node that is furthest away from it (ie the longest branch).

Items:

root leaf branch height cycles connected undirected

Tree: rooted tree definition

A Level Advanced

P P P P

Which of these properties will prevent a graph being classified as a rooted tree?

○ The root node has more than two children.

○ There is a unique cycle between two nodes.

○ There is only one path between two nodes.

○ It has an even number of leaves.

Home > Tree: Parallel 1D arrays

Tree: Parallel 1D arrays

A Level Advanced

C C C C

As Santa's reindeer are brought in from the icy tundra, they are added to a binary search tree (in the order that they arrive in). Dasher is the first to arrive, followed by Dancer, Prancer, Vixen, Comet, Cupid, Donner, and Blitzen.

The reindeer's logical position in the tree is decided by comparing the names alphabetically.

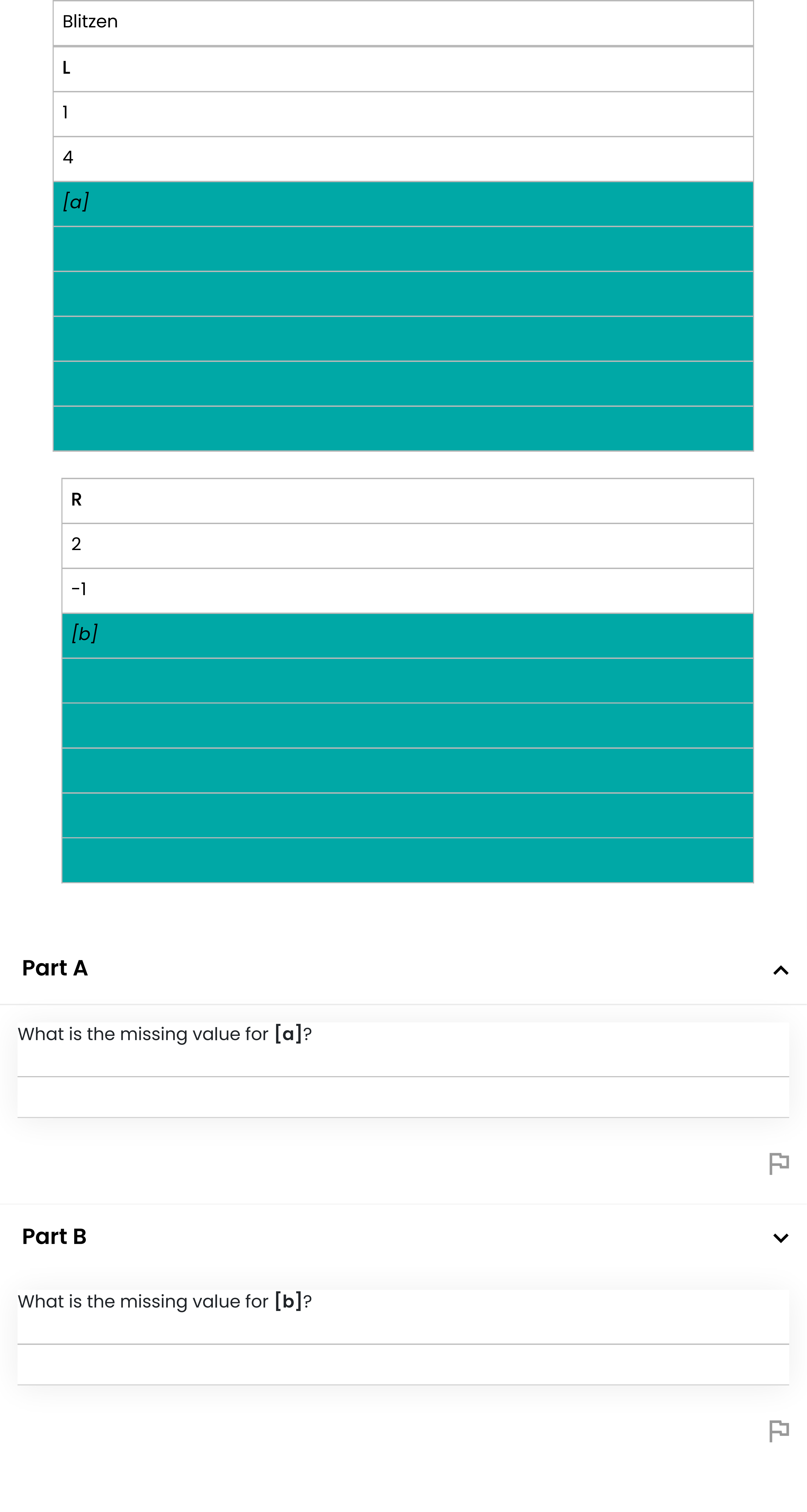
The tree is stored as three one-dimensional arrays:

- Array D stores the data (the name of the reindeer)
- Array L stores the left 'pointer' (index numbers)
- Array R stores the right 'pointer' (index numbers)

The diagram below shows the three arrays with several missing values (indicated by shaded cells).

0
1
2
3
4
5
6
7

D
Dasher
Dancer
Prancer
Vixen
Comet
Cupid
Donner



Blitzen

L
1
4
[a]

R
2
-1
[b]

Part A

What is the missing value for **[a]**?

Part B

What is the missing value for **[b]**?

Binary tree: array of records 1

A Level Advanced

C C C C

A **binary tree** can be implemented as an array of records. The record for each node will contain:

- The data
- A left child pointer
- A right child pointer

Index pointers are used because the data is stored in an array. There will be a separate index pointer to indicate the root node.

The table that follows represents a binary tree. The value of the `root` index pointer is 0.

Index	Data	Left	Right
0	1	1	2
1	4	4	5
2	3	Null	3
3	8	6	Null
4	12	Null	Null
5	6	7	8
6	2	Null	Null
7	10	Null	Null
8	5	Null	Null

What are the **data values** of the child node(s) of the node that has the data value 6?

○ 7 and 8

○ 2 and Null

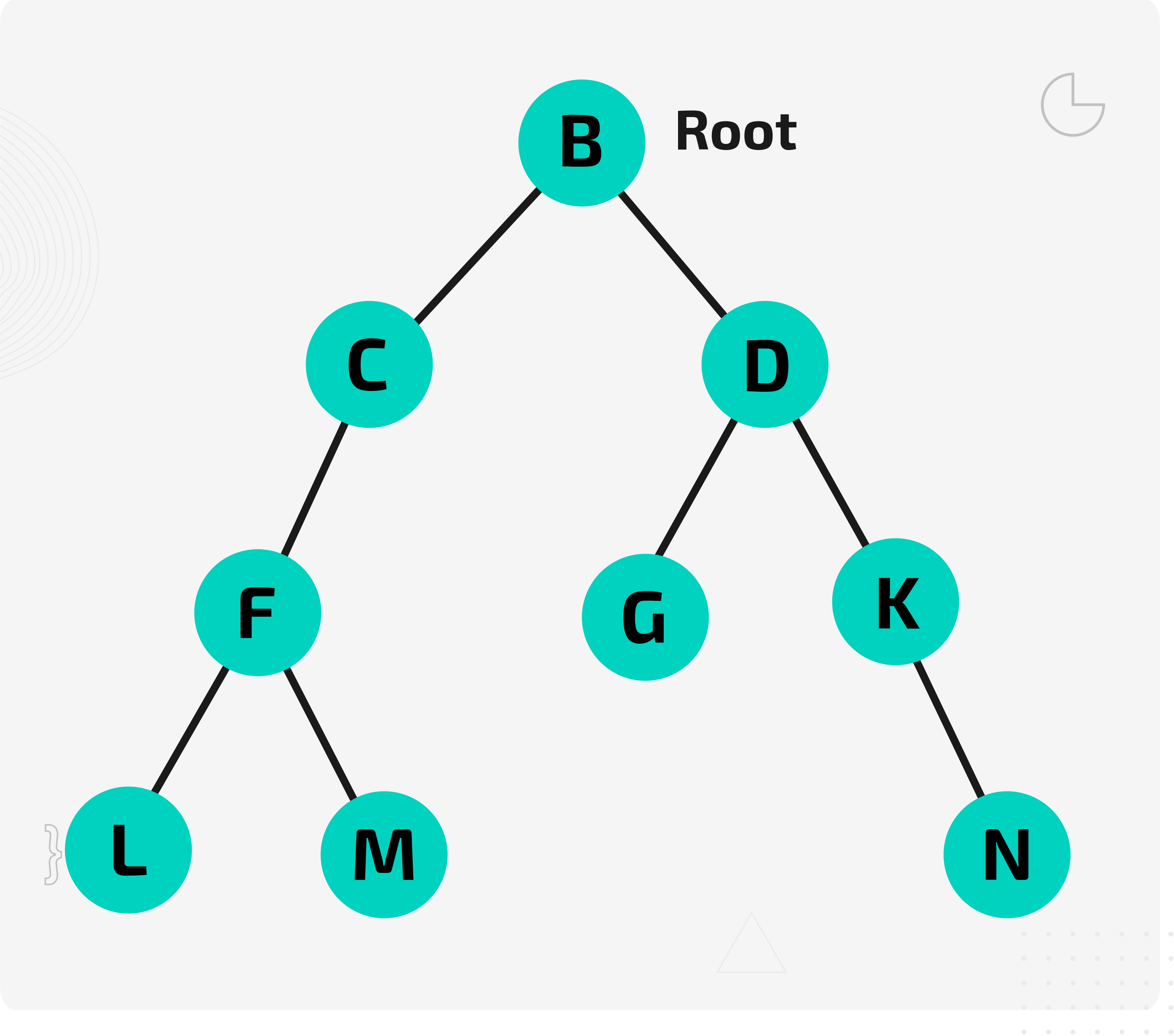
○ 10 and 5

○ 2 and 10

Binary tree: array of records 2

A Level Advanced

The image below shows a binary tree with nine nodes: B, C, D, F, G, K, L, M, and N. The root of the tree is node B.



A binary tree with nine nodes

A binary tree can be implemented as an array of records. The following table represents the array of records for the binary tree in the image.

Drag and drop the given values in the correct spaces to complete the array. Each value can be used more than once.

Index	Data	Left	Right
0	B	1	2
1	C	3	
2	D		
3	F		7

4	G	Null	Null
5	K	Null	
6	L	Null	Null
7	M	Null	Null
8	N		

Items:

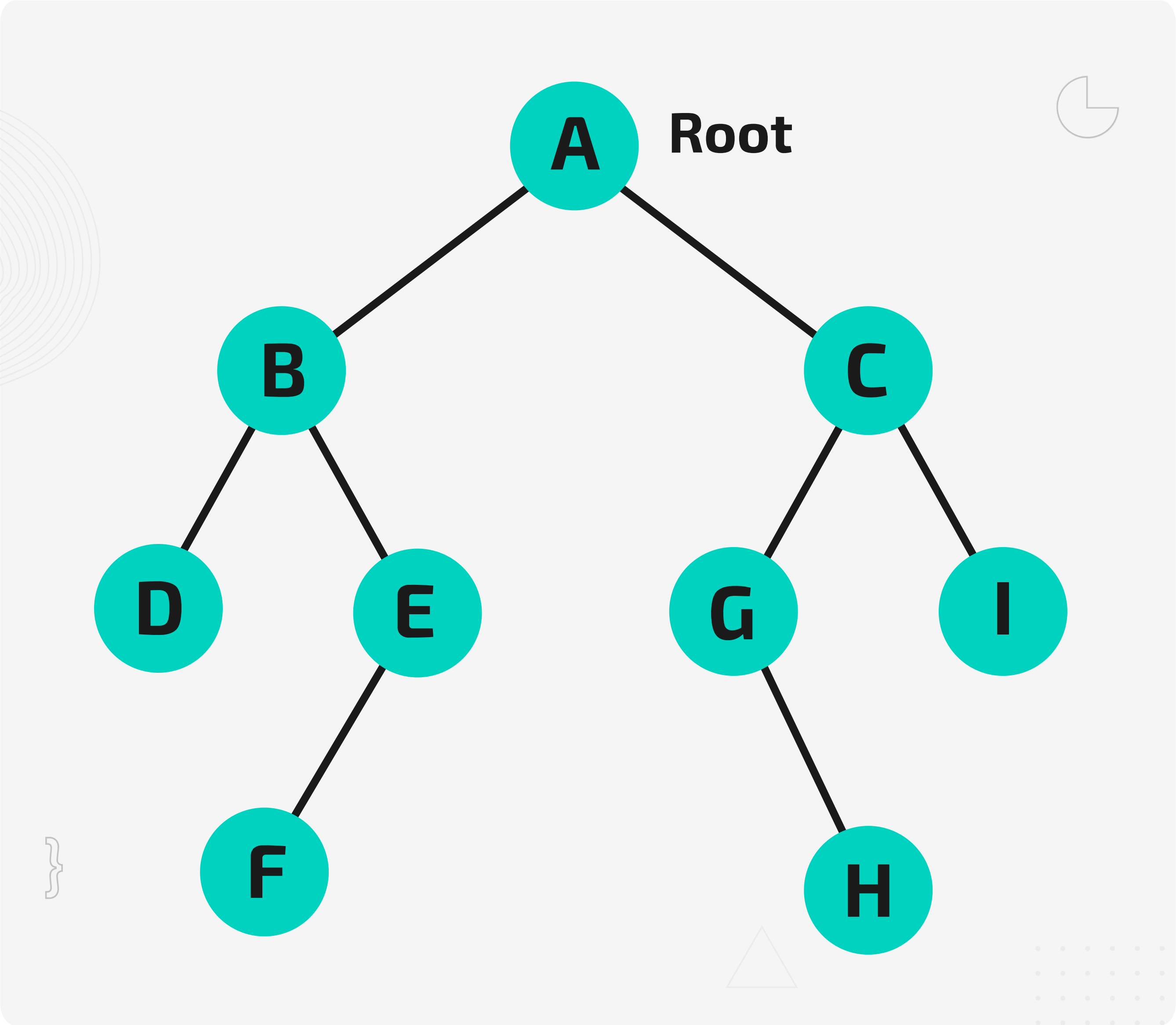
Null 4 6 8 5

Tree: rooted tree traversal 1

A Level Advanced

P P P P

Akram is designing a content management system (CMS) application. He is using a file system to organise the files (that hold the content) in folders so that each file can be retrieved easily. To do that, the folders are structured as a **rooted tree**. A diagram of the tree is presented in the image below. For example, the folder assigned to node G is stored inside the folder assigned to node C, which is stored in the root folder assigned to node A.



A tree data structure with nine nodes.

Drag and drop the given letters into the correct spaces to complete the following text.

To access a file that is stored in the folder assigned to node G, an algorithm needs to follow the path starting from the root of the tree down to node G. On its way it visits all the other nodes in the path. One way to do that is to use a depth-first traversal algorithm.

In this example, the tree in the image above is traversed from left to right. In which order will the nodes of the tree be visited using a depth-first traversal?

The nodes will be visited in the following order: □ □ □ □ □ □ □

Items:

A B C D E F G H I

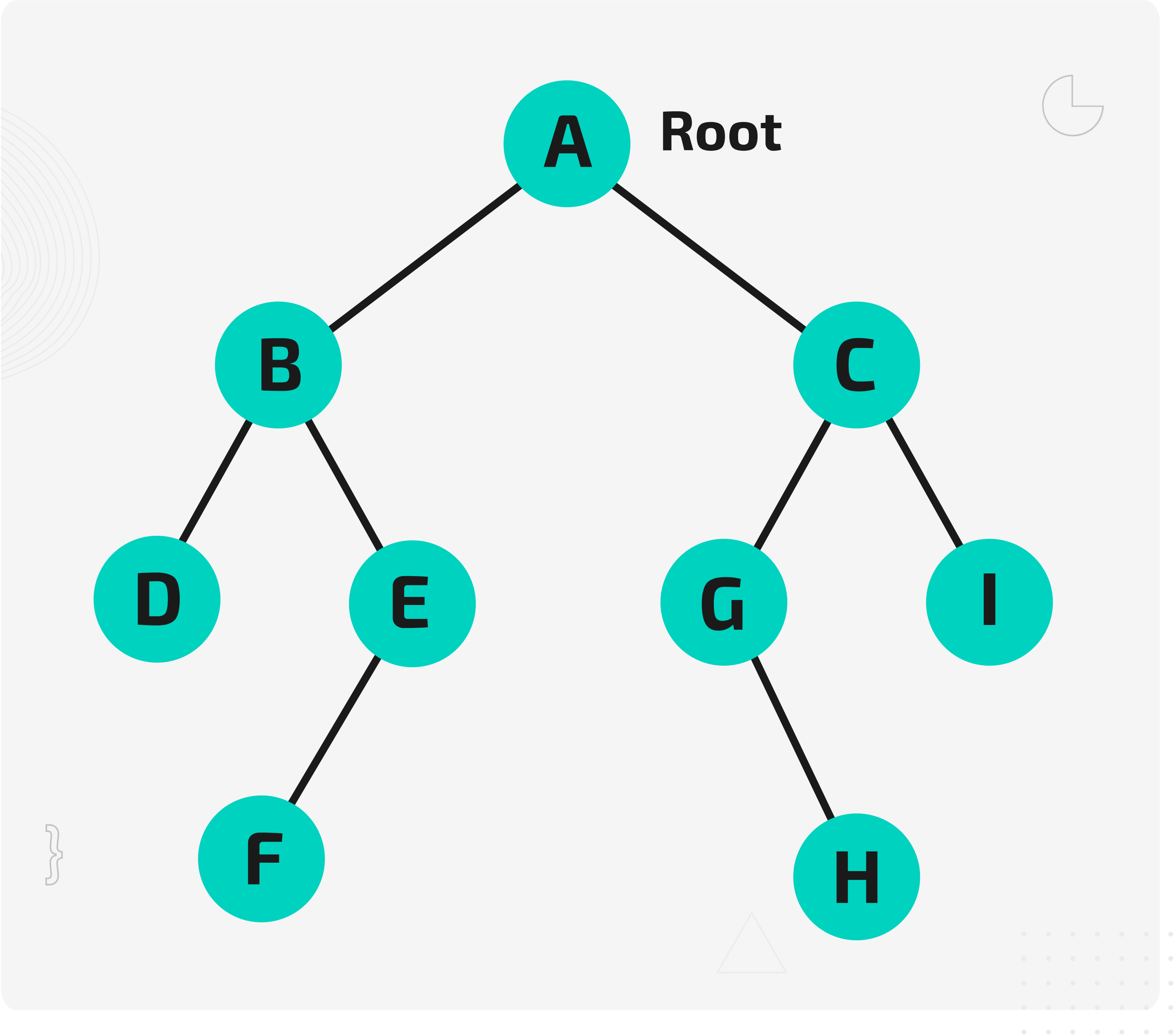
Home > Tree: rooted tree traversal 2

Tree: rooted tree traversal 2

A Level Advanced

C C C C

Akram is designing a content management system (CMS) application. He is using a file system to organise the files (that hold the content) in folders so that each file can be retrieved easily. To do that, the folders are structured as a **rooted tree**. A diagram of the tree is presented in the image below. For example, the folder assigned to node G is stored inside the folder assigned to node C which is stored in the root folder assigned to node A.



A tree data structure with nine nodes.

Drag and drop the given terms in the correct spaces to complete the following text.

Akram is exploring how the nodes of the rooted tree will be processed using the pre-order, post-order, and in-order tree traversals.

- In a pre-order traversal, each node is visited ________ either of the node's subtrees are visited
- In an in-order traversal, each node is visited ________ each of its subtrees

- In a post-order traversal, each node is visited □ both of its subtrees are visited

In this example, the tree in the image above is traversed from left to right.

- With a pre-order traversal, the order that the nodes of the tree are visited is □
- With an in-order traversal, the order that the nodes of the tree are visited is □
- With a post-order traversal, the order that the nodes of the tree are visited is □

Items:

before **between** **after** ABDEFCGHI DBFEAGHCI DFEBHGICA

Home > Tree: trace traversal

Tree: trace traversal

A Level Advanced

C C C C

A tree has been set up as a set of nodes, where each node contains three attributes:

- `data`
- `left` (a pointer to the node's left child)
- `right` (a pointer to the node's right child)

An algorithm has been written that carries out a post-order traversal of the tree. This algorithm is expressed in pseudocode below.

Pseudocode

```
FUNCTION traverse(node)
    IF node.data == Null THEN
        RETURN
    ELSE
        traverse(node.left)
        traverse(node.right)
        PRINT(node.data)
    ENDIF
ENDFUNCTION
```

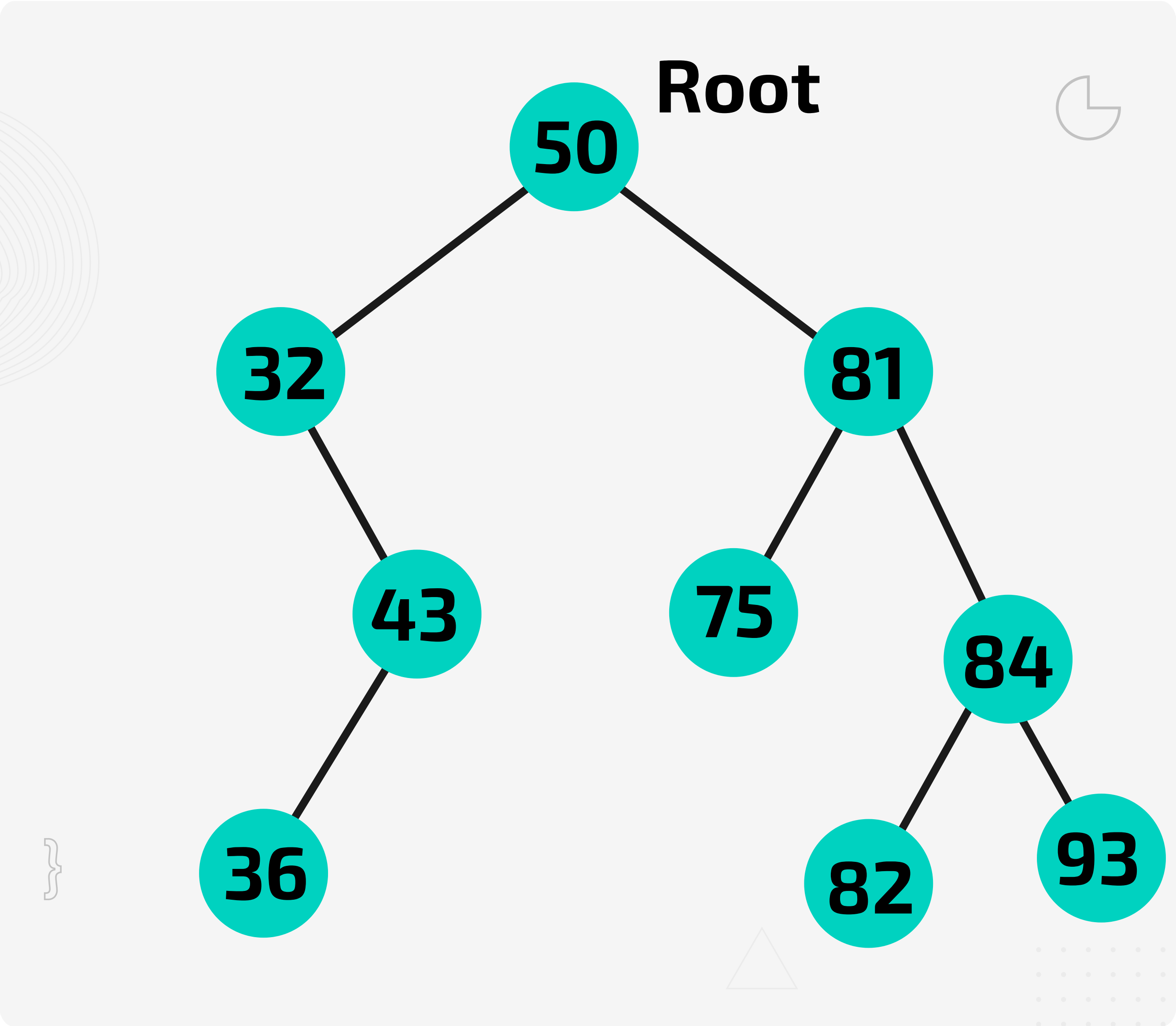


Figure 1: A binary tree

Select the correct results of tracing the pseudocode against the tree shown in **Figure 1**.

○ 36, 43, 32, 75, 82, 93, 84, 81, 50

○ 50, 32, 43, 36, 81, 75, 84, 82, 93

○ 32, 36, 43, 50, 75, 81, 82, 84, 93

○ 36, 43, 32, 50, 81, 75, 84, 82, 93

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