Given a binary tree, print out all of its root-to-leaf paths one per line.
Asked by Varun Bhatia

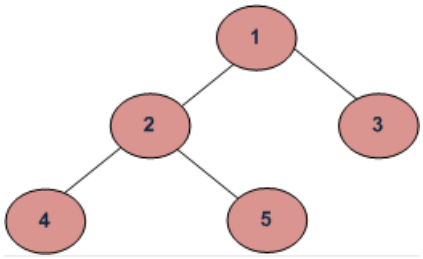
Here is the solution.

Algorithm:

```
initialize: pathlen = 0, path[1000]
/*1000 is some max limit for paths, it can change*/

/*printPathsRecur traverses nodes of tree in preorder */
printPathsRecur(tree, path[], pathlen)
   1) If node is not NULL then
         a) push data to path array:
                path[pathlen] = node->data.
         b) increment pathlen
                pathlen++
   2) If node is a leaf node then print the path array.
   3) Else
        a) Call printPathsRecur for left subtree
                printPathsRecur(node->left, path, pathLen)
        b) Call printPathsRecur for right subtree.
                printPathsRecur(node->right, path, pathLen)
```

Example:



Example Tree

Output for the above example will be

```
1 2 4
1 2 5
1 3
```

Implementation:

C

```
/*program to print all of its root-to-leaf paths for a tree*/
#include <stdio.h>
#include <stdlib.h>

/* A binary tree node has data, pointer to left child
   and a pointer to right child */
struct node
{
    int data;
    struct node* left;
    struct node* right;
};
```

```
void printArray(int [], int);
void printPathsRecur(struct node*, int [], int);
struct node* newNode(int );
void printPaths(struct node*);

/* Given a binary tree, print out all of its root-to-leaf
   paths, one per line. Uses a recursive helper to do the work.*/
void printPaths(struct node* node)
{
  int path[1000];
  printPathsRecur(node, path, 0);
}

/* Recursive helper function -- given a node, and an array containing
 the path from the root node up to but not including this node,
 print out all the root-leaf paths. */
void printPathsRecur(struct node* node, int path[], int pathLen)
{
  if (node==NULL) return;

  /* append this node to the path array */
  path[pathLen] = node->data;
  pathLen++;

  /* it's a leaf, so print the path that led to here */
  if (node->left==NULL && node->right==NULL)
  {
    printArray(path, pathLen);
  }
  else
  {
  /* otherwise try both subtrees */
    printPathsRecur(node->left, path, pathLen);
    printPathsRecur(node->right, path, pathLen);
  }
}

/* Helper function that allocates a new node with the
   given data and NULL left and right pointers. */
struct node* newNode(int data)
{
  struct node* node = (struct node*)
                      malloc(sizeof(struct node));
  node->data = data;
  node->left = NULL;
  node->right = NULL;

  return(node);
}

/* Utility that prints out an array on a line */
void printArray(int ints[], int len)
{
  int i;
  for (i=0; i<len; i++) {
    printf("%d ", ints[i]);
  }
  printf("\n");
}

/* Driver program to test mirror() */
int main()
{
  struct node *root = newNode(1);
  root->left        = newNode(2);
  root->right       = newNode(3);
  root->left->left  = newNode(4);
  root->left->right = newNode(5);

  /* Print all root-to-leaf paths of the input tree */
  printPaths(root);

  getchar();
```

```
  getchar();
  return 0;
}
```

Java

```
// Java program to print all root to leaf paths

/* A binary tree node has data, pointer to left child
   and a pointer to right child */
class Node
{
    int data;
    Node left, right;

    Node(int item)
    {
        data = item;
        left = right = null;
    }
}

class BinaryTree
{
     Node root;

    /* Given a binary tree, print out all of its root-to-leaf
       paths, one per line. Uses a recursive helper to do the work.*/
    void printPaths(Node node)
    {
        int path[] = new int[1000];
        printPathsRecur(node, path, 0);
    }

    /* Recursive helper function -- given a node, and an array containing
       the path from the root node up to but not including this node,
       print out all the root-leaf paths. */
    void printPathsRecur(Node node, int path[], int pathLen)
    {
        if (node == null)
            return;

        /* append this node to the path array */
        path[pathLen] = node.data;
        pathLen++;

        /* it's a leaf, so print the path that led to here */
        if (node.left == null && node.right == null)
            printArray(path, pathLen);
        else
            {
            /* otherwise try both subtrees */
            printPathsRecur(node.left, path, pathLen);
            printPathsRecur(node.right, path, pathLen);
        }
    }

    /* Utility that prints out an array on a line */
    void printArray(int ints[], int len)
    {
        int i;
        for (i = 0; i < len; i++)
            System.out.print(ints[i] + " ");
        System.out.println("");
    }

    /* Driver program to test all above functions */
    public static void main(String[] args)
    {
        BinaryTree tree = new BinaryTree();
```

```
        tree.root = new Node(1);
        tree.root.left = new Node(2);
        tree.root.right = new Node(3);
        tree.root.left.left = new Node(4);
        tree.root.left.right = new Node(5);

        /* Print all root-to-leaf paths of the input tree */
        tree.printPaths(tree.root);

    }
}
```

References:

http://cslibrary.stanford.edu/110/BinaryTrees.html