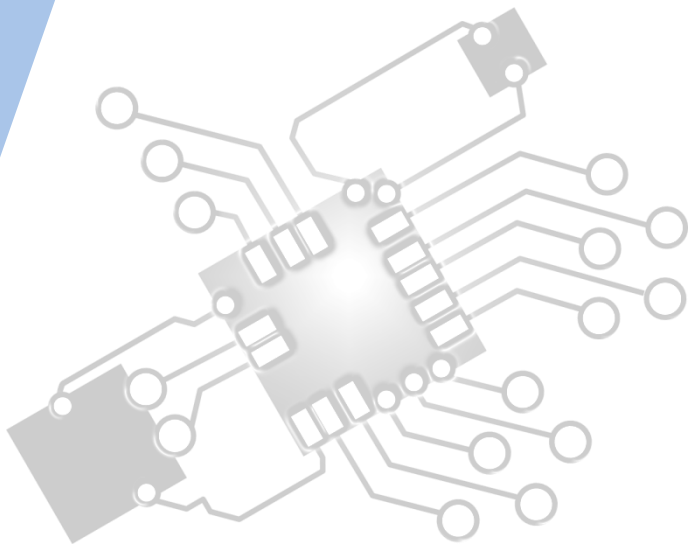
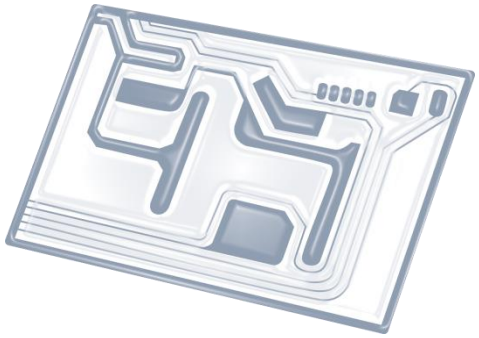
Abstract Data Structures

IB Computer Science



Content developed by
Dartford Grammar School
Computer Science Department

HL Topics 1-7, D1-4



1: System design

2: Computer Organisation

3: Networks

4: Computational thinking

5: Abstract data structures

6: Resource management

7: Control

D: OOP

HL only 5 Overview

Thinking recursively
5.1.1 Identify a situation that requires the use of recursive thinking
5.1.2 Identify recursive thinking in a specified problem solution
5.1.3 Trace a recursive algorithm to express a solution to a problem
Abstract data structures
5.1.4 Describe the characteristics of a two-dimensional array
5.1.5 Construct algorithms using two-dimensional arrays
5.1.6 Describe the characteristics and applications of a stack
5.1.7 Construct algorithms using the access methods of a stack
5.1.8 Describe the characteristics and applications of a queue
5.1.9 Construct algorithms using the access methods of a queue
5.1.10 Explain the use of arrays as static stacks and queues
Linked lists
5.1.11 Describe the features and characteristics of a dynamic data structure
5.1.12 Describe how linked lists operate logically
5.1.13 Sketch linked lists (single, double and circular)
Trees
5.1.14 Describe how trees operate logically (both binary and non-binary)
5.1.15 Define the terms: parent, left-child, right-child, subtree, root and leaf
5.1.16 State the result of inorder, postorder and preorder tree traversal
5.1.17 Sketch binary trees
Applications
5.1.18 Define the term dynamic data structure
5.1.19 Compare the use of static and dynamic data structures
5.1.20 Suggest a suitable structure for a given situation

1: System design

2: Computer Organisation

3: Networks

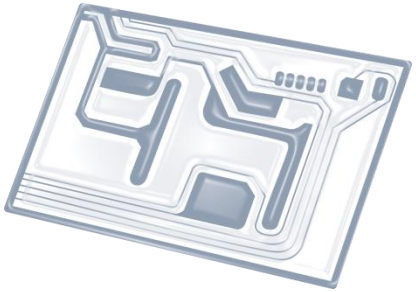
4: Computational thinking

5: Abstract data structures

6: Resource management

7: Control

D: OOP

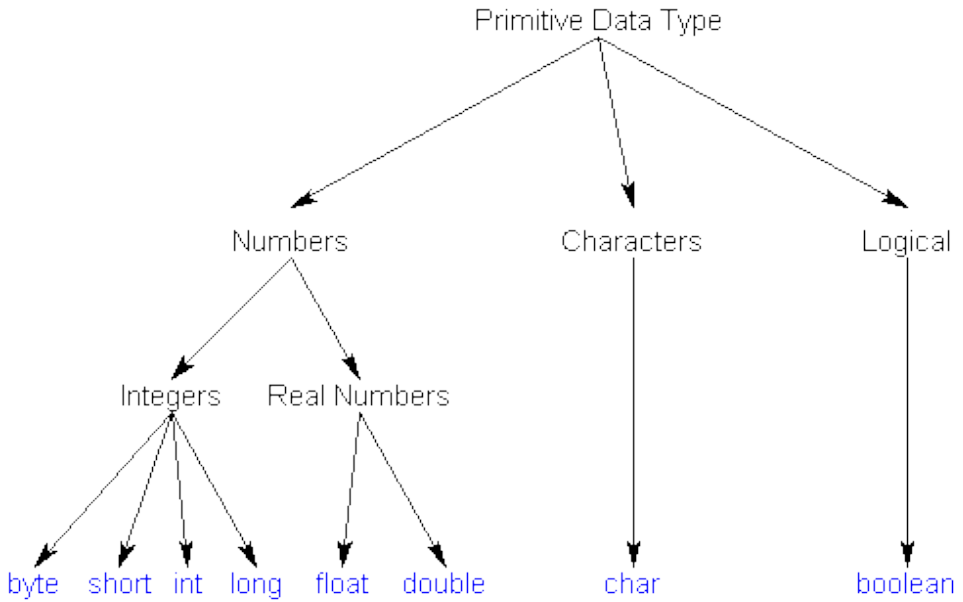


Topic 5.1.17

Sketch binary trees

Abstract Data Structures (ADTs)

- 2D array
- Stack
- Queue
- Linked List
- **(Binary) Tree**
- Recursion

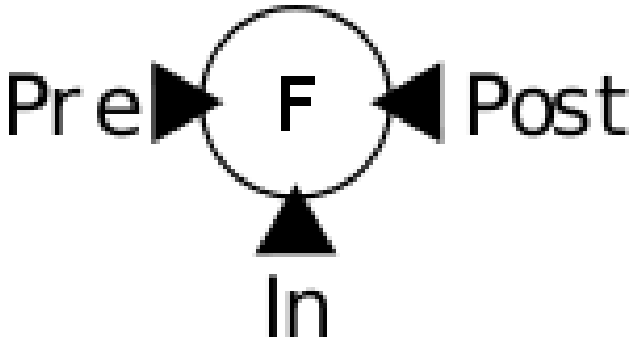


Practice sketching

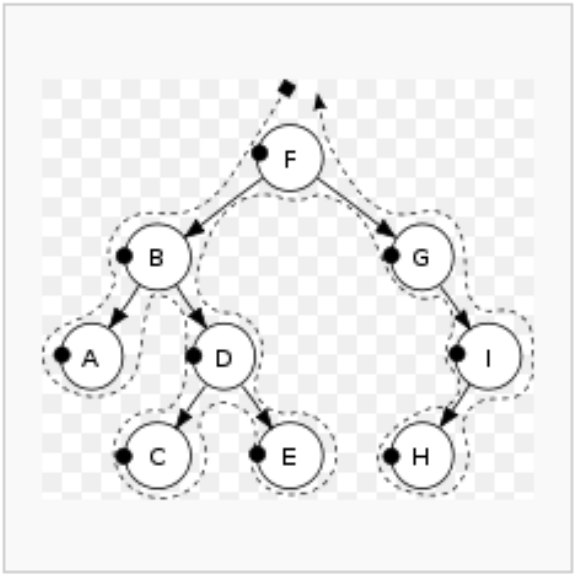
Draw a binary tree for:

1. 88, 25, 67, 97, 79, 99, 53, 87, 24, 76, 66, 32, 40, 42, 95
2. GH, WZ, AG, GM, IL, ZH, SV, RZ, HE, LZ, IJ
3. The names of the people in this class
4. Cities you've visited in the last 10 years
5. Brands of mobile phones
6. NB, GA, RI, WS, FL, NY, NJ, IL, MS, CL, SD, VA, MD, AK
7. CF, CAR, CAF, CA, CEY, CFM, CT, CL, CM

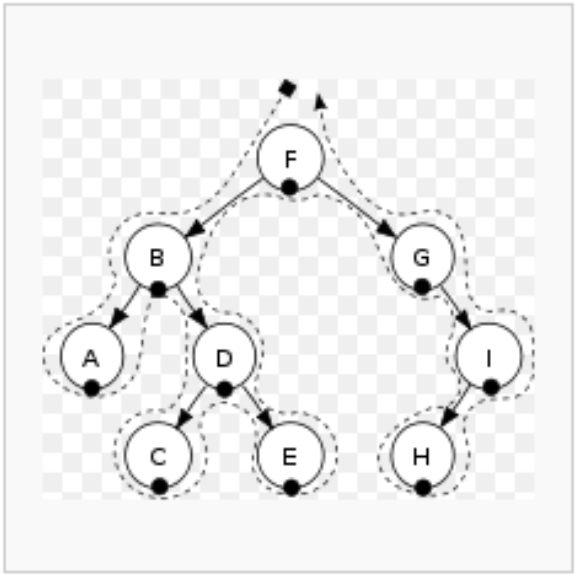
Flag/Thread rule



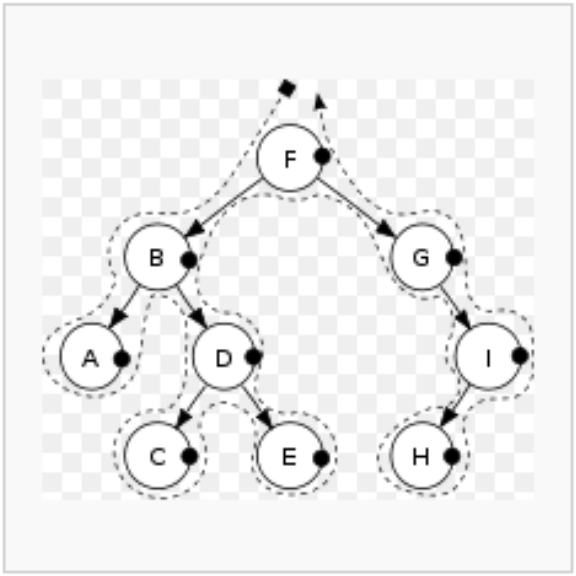
The 3 different types of traversal



Pre-order Traversal
FBADCEGIH



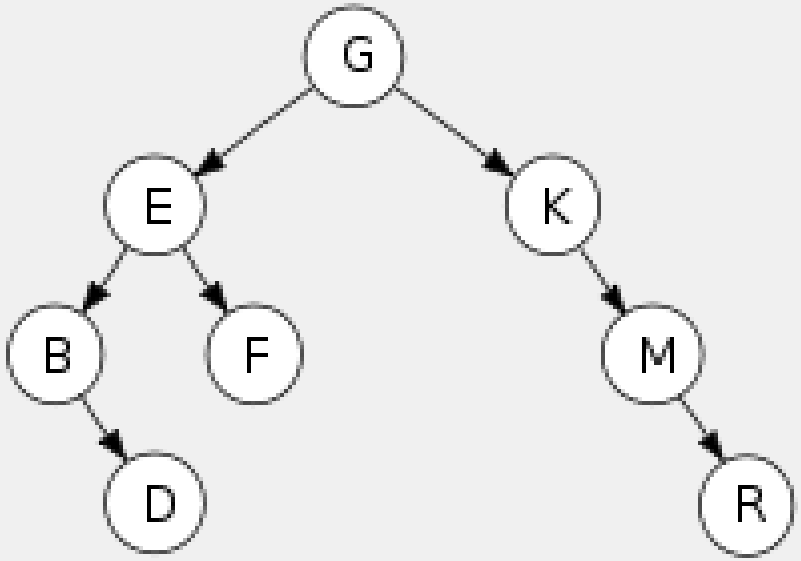
In-order Traversal
ABCDEFGHI



Post-order Traversal
ACEDBHIGF

Question 1

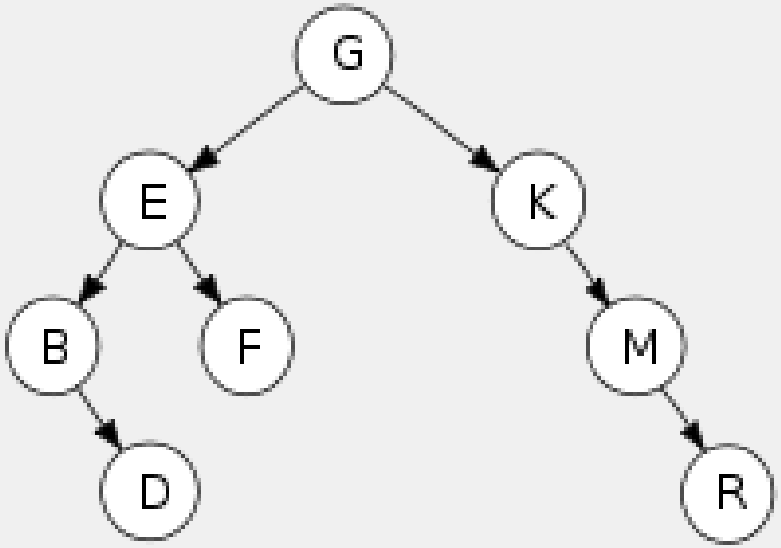
For the following binary tree perform the following:



- Pre-order traversal
- In-order traversal
- Post-order traversal

Answer 1

For the following binary tree perform the following:

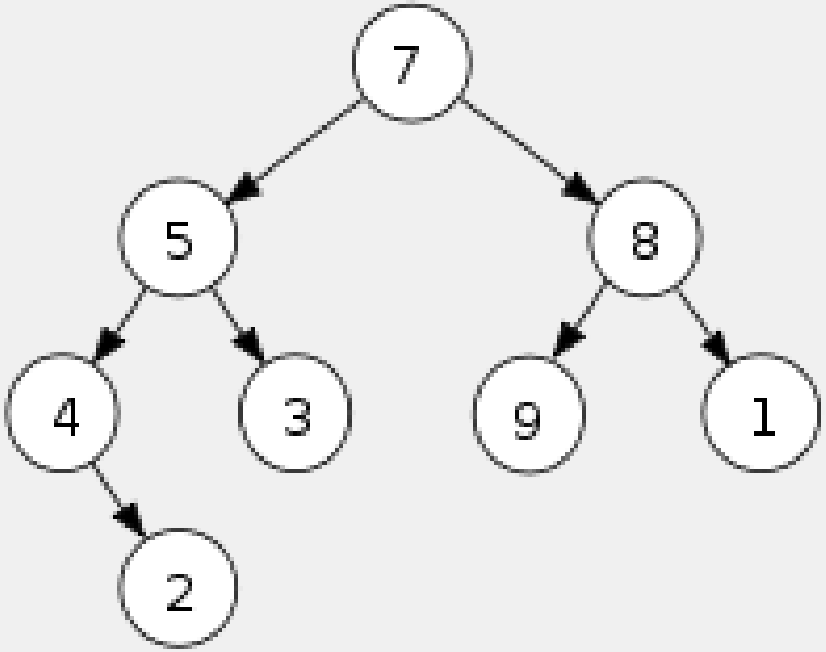


- Pre-order traversal
- In-order traversal
- Post-order traversal

- Pre-order traversal: GEBDFKMR
- In-order traversal: BDEFGKMR
- Post-order traversal: DBFERMKG

Question 2

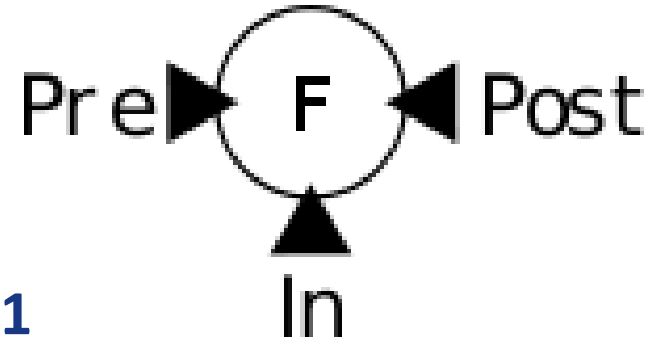
Using the following binary tree:



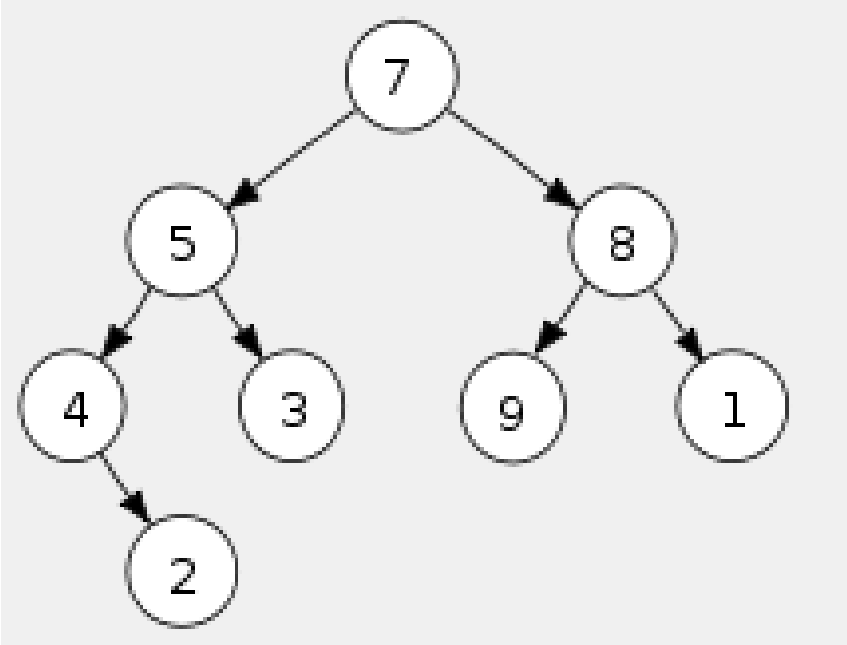
what would be the outputs for:

- Pre-order traversal
- In-order traversal
- Post-order traversal

Answer 2



- **Pre-order** traversal: **7,5,4,2,3,8,9,1**
- **In-order** traversal: **4,2,5,3,7,9,8,1**
- **Post-order** traversal: **2,4,3,5,9,1,8,7**



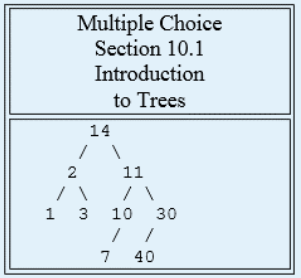
Useful practice questions (advanced)

Multiple Choice

1. There is a tree in the box at the top of this section. How many leaves does it have?
   - A. 2
   - B. 4
   - C. 6
   - D. 8
   - E. 9

2. There is a tree in the box at the top of this section. How many of the nodes have at least one sibling?
   - A. 5
   - B. 6
   - C. 7
   - D. 8
   - E. 9

3. There is a tree in the box at the top of this section. What is the value stored in the parent node of the node containing 30?
   - A. 10
   - B. 11
   - C. 14
   - D. 40
   - E. None of the above



Link: http://www.cs.colorado.edu/~main/questions/chap10q.html