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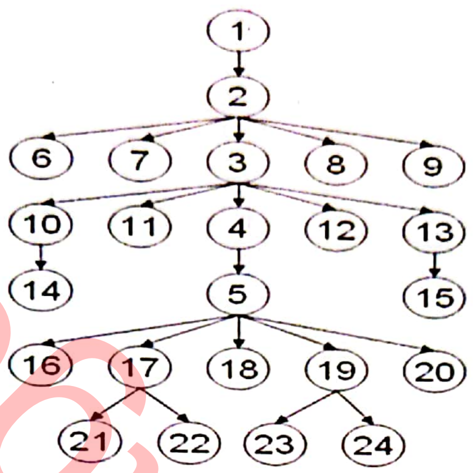
END OF SEMESTER EXAM **June 2022 Session** **DESIGN AND IMPLEMENTATION OF DATA STRUCTURES**

Level: I Academic year: 2021/2022 Speciality: Software Engineering Duration: 02h

Problem A: (1.75 + 1.75 + 1.5 = 5 marks)

Given the tree T:

1) Determine for tree T, the root, the size, the height, the depth, its interior nodes and its leaves



2) For node 4, determine its parent, it sisters, it's height, its depth, its ancestors and proper descendants
3) Determine the nodes which are on the left of node 4, on those on its right

Problem B: (1.5 + 2 + 3 = 6,5 marks)

1. Write in a prefixed form the expression **((((A+B) +D)>H) V(E<F)**
2. Give the different steps involved in the evaluation of the post fixed expression **A B / C D - *** with A=30, B=15, C=15 and D=5. You should at least indicate the different state of the stack from its initialization up to its final result.
3. Write a function which takes a post fixe arithmetic expression stored in the form of a linked list of characters, evaluates and returns the result.
   NB: We can distinguish between the least binary **(EX: A-B)** and the least unary **(EX: -A)**.
   Let's equally assume that there already exists a function **is_Operand** which takes as parameter a character and indicates if it's an operand or not.

Problem C: (1.75+ 1.75 + 1.75 + 1.75 + 1.5 = 8.5 marks)

Consider the table below representing a binary trees T which is a triplet (data, right, left)

23	2	3	5	7	11	13	37	41	19
-1	5	3	-1	-1	9	-1	8	6	-1
-1	0	0	1	-1	-1	2	1	-1	-1

The first column, (index 0) represents the node which the field data is 23(value of node), the left field is -1 (index of left child) and the right field is -1 (index of right child). The second column (index 1) represents the node which the field data is 2 (value of node) and the right field is 5(index of left child) and right field is 0, and so on. The value -1 signifies the absence of a left or right child.

1) Draw the binary tree T and determine its height
2) Give the C language code to represent this structure
3) Write a function that determines the root of the tree T
4) Write a procedure to list all the leaves of the tree T
5) What is the result of the traverse of the binary tree T:
   i. In an infix order
   ii. In a prefix order
   iii. In a postfix order

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