Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram

Department of Computer Science and Engineering

CS1003–Elementary Data Structures and Logical Thinking (Jan-April 2024)

Assignment-1 (20 Marks) Deadline-30th April 4:00 PM

Question 1 (12 Marks)

Consider your name in capital letters (as per institute record) as input sequence. The **TASK - 1** is to construct a Binary Search Tree (BST) with the characters present in your name (ignoring space) as per the steps provided below.

STEP – 1:

If your name has more than 16 characters then consider only the first 16 characters. If your name has less than 16 characters then do as discussed for two examples.

Example– 1: Consider the name as JOHNLENNON. Here, the total number of characters are 10, so we need 6 more characters to make it 16. To add six new characters, consider first six characters of the actual word i.e. JOHNLE and replace each character with its next character in alphabetical order i.e. KPIOMF. Now, the newly created set of six characters is added to the name and it becomes a 16 letter word.

Here, the resultant 16 characters will be **J,O,H,N,L,E,N,N,O,N,K,P,I,O,M,F**

Example– 2: Consider the name as ZUBRA. Here, the total number of characters is 5, so we need 11 more characters to make it 16.So, this can be done in three cycles. In the 1st cycle, consider the actual word i.e., ZUBRA and replace each character with its next character in alphabetical order i.e., AVCSB. In the second cycle, consider characters generated in 2nd cycle i.e., AVCSB and replace each character with its next character in alphabetical order i.e., BWDTC. In the third cycle, consider character generated in 3rd cycle i.e., BWDTC and replace only the first character with its next letter in alphabetical order i.e., C. Now, it becomes 16 letter word.

Here, the resultant 16 characters will be **Z,U,B,R,A,A,V,C,S,B,B,W,D,T,C,C**

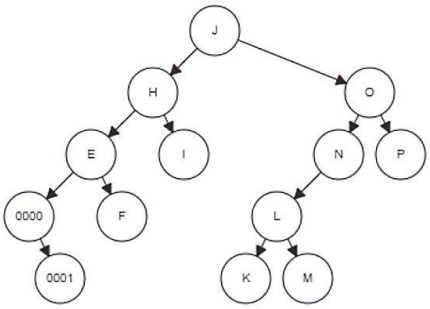
STEP – 2:

Once you get the 16 characters, check if any character has multiple occurrences. If no character has multiple occurrences then the character sequence obtained after STEP -1 is the final input sequence for STEP – 3, otherwise, do as discussed for the following example.

Example – 3: For the 16 characters **J,O,H,N,L,E,N,N,O,N,K,P,I,O,M,F** :N is present 4 times and O is present three times. So, you need to consider only two occurrences of a particular character. In cases with more than two occurrences, remove third occurrence onwards from the resultant word. Second occurrence of first letter N is replaced with number 0, second occurrence of the second letter O is replaced with 1. Now, the final input sequence will become **J, O, H, N, L, E, 0, 1, K, P, I, M, F** having 13 characters. Similarly, if third letter is repeating use number 2, if fourth letter is repeating use number 3 and so on. Here, the third occurrence of N and O are removed.

STEP – 3:

Use the dictionary order to create BST for the final input sequence by considering the position of numbers (in order) to be before the alphabets. The BST for the input sequence **J, O, H, N, L, E, 0, 1, K, P, I, M, F** is given below.



Complete the creation of BST and draw the tree after each and every character/number is inserted. Explain the complete procedure.

TASK – 2:

Once the Binary Search Tree is created, delete the nodes corresponding to 3rd and 4th letter inserted. Explain the complete procedure. Draw the tree after each deletion operation.

TASK – 3:

Once the deletion operation is performed write the pre-order, in-order and post-order traversal sequence of the BST with explanation using stack. [Here, you need to trace out the recursive call for all the tree traversals].

Question 2 (8 Marks)

Consider an array of size [-24:30, -22:36] and two variables **row** and **column**. The value of **row** is 68 less than the ASCII value of right most element of the BST obtained in Task – 1 of Problem 1 and **column** value is 55 less than ASCII value of the root of the BST obtained in Task – 1. [Always in Capital Letters]

If the last three digits of your roll number is odd then find the address of location [row][column], considering base address as 2000 and size of each array element as 4 bytes. Use row major order.

If the last three digits of your roll number is even then find the address of location [row][column], considering base address as 4000 and size of each integer as 4 bytes. Use column major order.

You need to explain in detail using suitable formulas.

Submission Instructions:

(1) Write your solutions in plain A4 sheet with your Own Handwriting. Write your Name and Roll No in each page. Don't forget to mention the Page Numbers in each page. Not following this instruction will lead to penalty.

(2) Submit the hard copy of the assignment to your Course Faculty in his/her cabin before the deadline (i.e. 30th April 4:00 PM).

(3) Late submission of hard copy will lead to penalty. To avoid last minute hustle, submit the assignment well before the scheduled deadline.

(4) Any form of plagiarism/copying from peer or Internet sources will lead penalty.