SNS COLLEGE OF ENGINEERING

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING-IOT Including CS&BCT

COURSE NAME : **19CS307**- DATA STRUCTURES

II YEAR / III SEMESTER

Unit III- **NON LINEAR DATA STRUCTURES - Tree**

Topic 5 : Applications of trees

Problem

Letter frequency table

Letter	z	k	m	c	u	d	l	e
Frequency	2	7	24	32	37	42	42	120

Huffman coding

- Huffman coding provides codes to characters such that the length of the code depends on the relative frequency or weight of the corresponding character. Huffman codes are of variable-length, and without any prefix (that means no code is a prefix of any other).

- Any prefix-free binary code can be displayed or visualized as a binary tree with the encoded characters stored at the leaves.

Huffman tree

➢ Huffman tree or Huffman coding tree defines as a full binary tree in which each leaf of the tree corresponds to a letter in the given alphabet.

➢ The Huffman tree is treated as the binary tree associated with minimum external path weight that means, the one associated with the minimum sum of weighted path lengths for the given set of leaves.

➢ So the goal is to construct a tree with the minimum external path weight.

Huffman tree

Letter frequency table

Letter	z	k	m	c	u	d	l	e
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Huffman tree

Huffman code

| Letter	Freq	Code	Bits
e	120	0	1
d	42	101	3
l	42	110	3
u	37	100	3
c	32	1110	4
m	24	11111	5
k	7	111101	6
z	2	111100	6

Huffman tree

Huffman encoding is a type of variable-length encoding that is based on the actual character frequencies in a given document.

• Huffman encoding uses a binary tree:

• to determine the encoding of each character

• to decode an encoded file – i.e., to decompress a compressed file, putting it back into ASCII
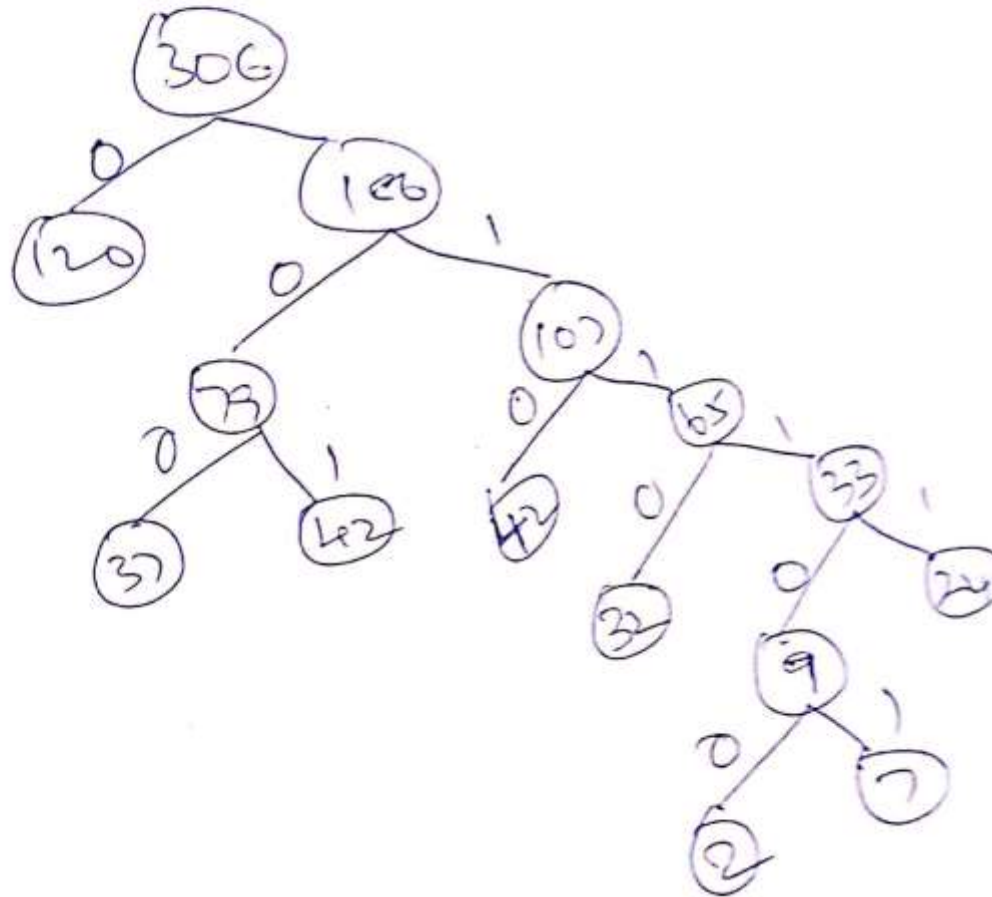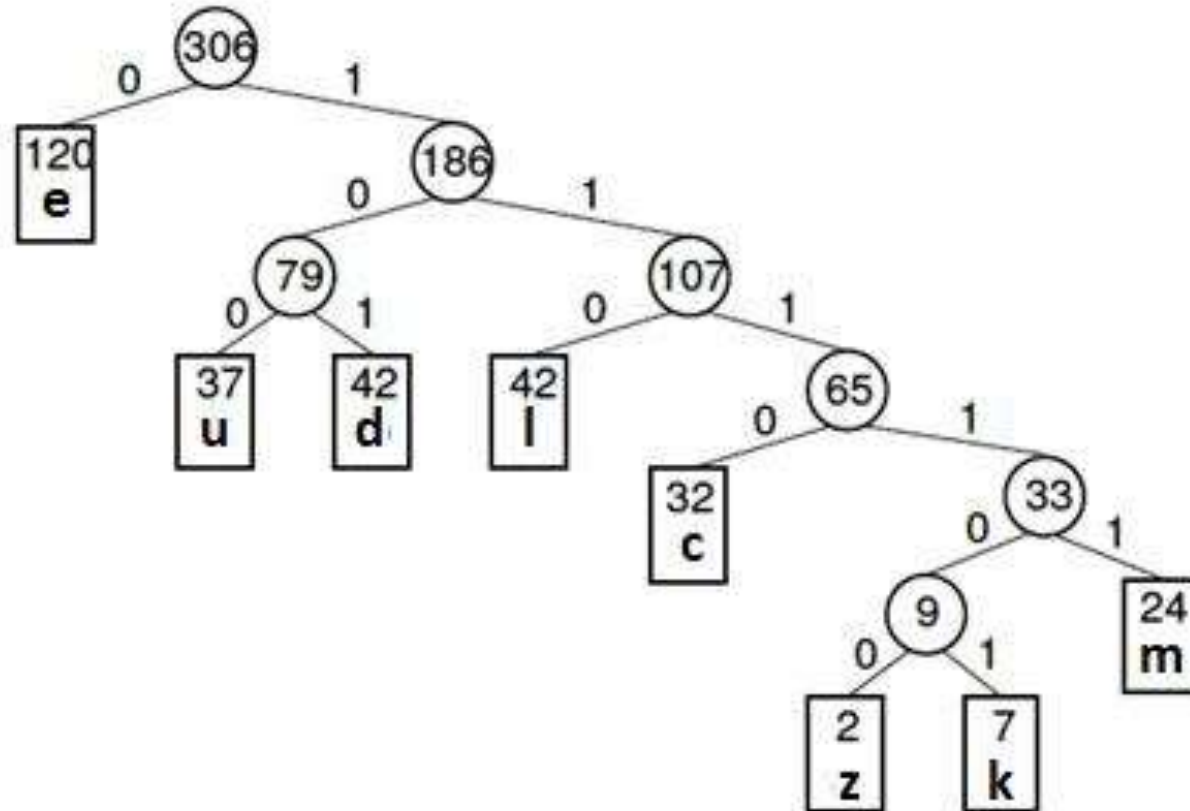
Huffman tree
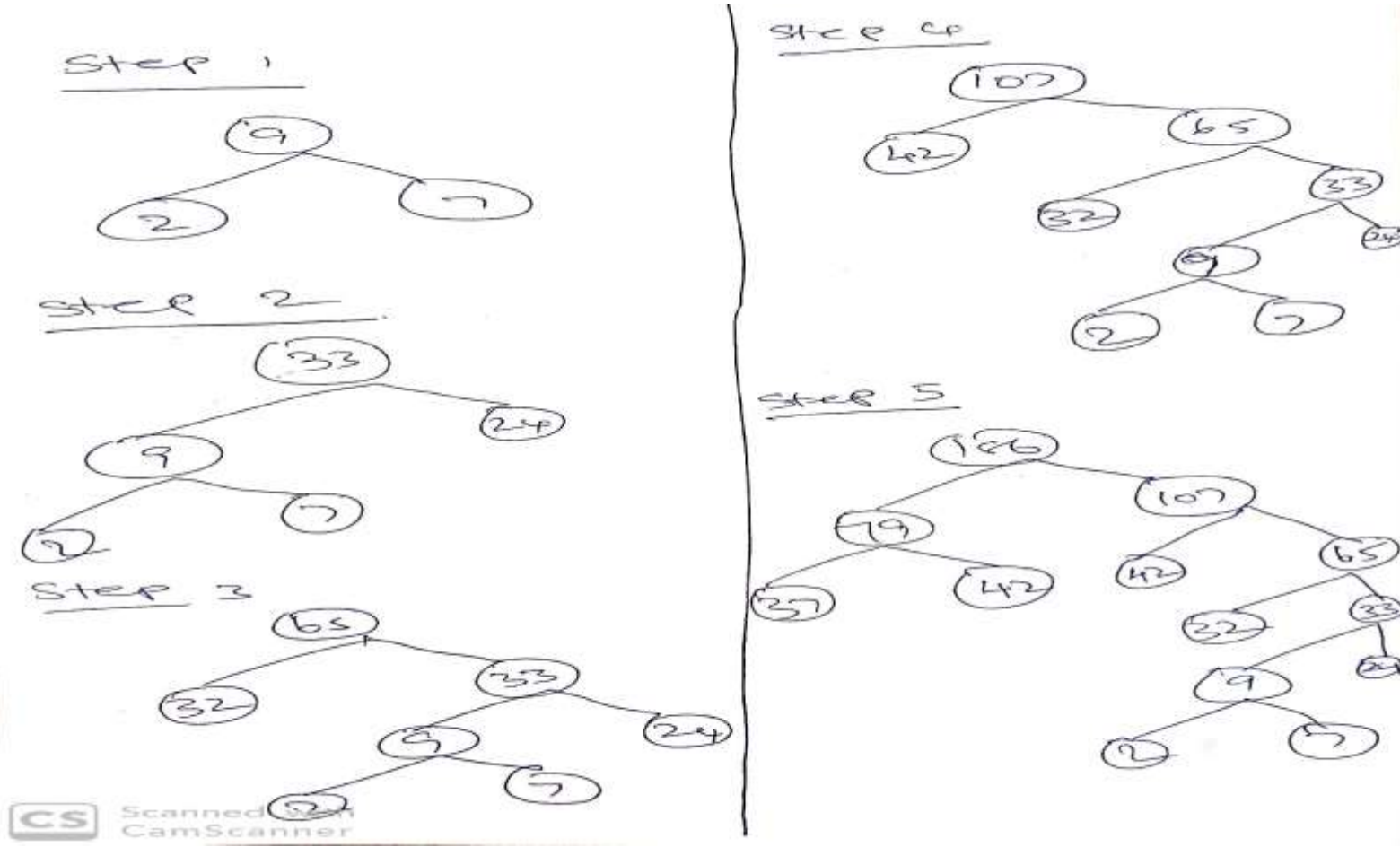
Huffman tree

Step 6

Huffman tree

Activity

MCQ

1. Which of the following algorithms is the best approach for solving Huffman codes?

    a) exhaustive search

    b) greedy algorithm

    c) brute force algorithm

    d) divide and conquer algorithm

2. The type of encoding where no character code is the prefix of another character code is called?

    a) optimal encoding

    b) prefix encoding

    c) frequency encoding

    d) trie encoding

Advantages

➤ This encoding scheme results in saving lot of storage space, since the binary codes generated are variable in length

➤ It generates shorter binary codes for encoding symbols/characters that appear more frequently in the input string

➤ The binary codes generated are prefix-free

Disadvantages

➢Lossless data encoding schemes, like Huffman encoding, achieve a lower compression ratio compared to lossy encoding techniques. Thus, lossless techniques like Huffman encoding are suitable only for encoding text and program files and are unsuitable for encoding digital images.

➢Huffman encoding is a relatively slower process since it uses two passes- one for building the statistical model and another for encoding. Thus, the lossless techniques that use Huffman encoding are considerably slower than others.

➢Since length of all the binary codes is different, it becomes difficult for the decoding software to detect whether the encoded data is corrupt. This can result in an incorrect decoding and subsequently, a wrong output.

Assessment 1

1. List out the advantages of Huffman Tree

   a)_____

   b)_____

   c)_____

   d)_____

2. Identify the disadvantages of Huffman Tree

   a)_____

   b)_____

   c)_____

   d)_____

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REFERENCES

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 8th Edition, 2007. [Unit I, II, III, IV,V]

2. A. V. Aho, J. E. Hopcroft and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 2nd Edition, 2007 [Unit IV].

3. A.M.Tenenbaum, Y. Langsam and M. J. Augenstein, "Data Structures using C",PearsonEducation, 1st Edition, 2003.(UNIT I,II,V)

4.https://www.youtube.com/watch?v=nGhEqf5RTDc&t=45s

THANK YOU