Course Code: 15XW23 No of Pages: 3

Roll No:

(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

MAY 2017 SEMESTER EXAMINATIONS.

MSc -- SOFTWARE SYSTEMS Semester: 2

15XW23 DATA STRUCTURES AND ALGORITHMS

Time: 3 Hours **Maximum Marks: 100**

INSTRUCTIONS:

- Answer **ALL** questions from GROUP I.
- 2. Answer any 4 questions from GROUP II.
- 3. Answer any **ONE** question from GROUP III.
- 4. Ignore the box titled as "Answers for Group III" in the Main Answer Book.

Marks: $10 \times 3 = 30$ **GROUP - I**

1. Analyze the time complexity of the following code,

for a=1 to n a=a+n/2Print "hello"

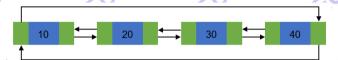
end

- $(n^2 n) = \Theta(n^2)$ or not. Verify whether
- 3. Represent the following sparse matrix using arrays and linked list

- 4. Suppose one character at a time comes as an input from a string of letters. There is an option either to (i) print the incoming letter or to (ii) put the incoming letter on to a stack. Also a letter from top of the stack can be popped out at any time and printed. What is the PSG TECH PSG total number of distinct words that can be formed out of a string of three letters in this fashion for 'A' 'B' 'C'?
- State the differences between linked list and arrays.

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6. Consider the following circular linked list,



where head represents the first node that has data as '10' and *front* and *prev* represents the forward and backward pointers respectively. What is the value at front(front(prev(data)))=front(prev(data)))+front(front(front(data)))?

- 7. What is the minimum height of a binary tree with 56 nodes? Why?
- 8. State the advantages of chaining over linear probing in hashing keys.
- 9. Draw an expression tree for the expression $(-A+B*C/D^*E*F)$.
- 10. State how insertion sort is performed in the following list of elements 34, 12, 8, 6, 45? Is it stable?

- 11. a. Discuss the worst and best case time complexities with examples. (6)
 - b. Consider the following recursive procedure, find what the procedure in intended to do and give the contents of stack activation record for the value n = 4, m = 2.

```
function abc (n, m)
    if n = 1 or m = 0 or m = n then
        return 1.
    else
        return abc (n-1, m) + abc (n -1, m-1).
    end
end
```

- a. Write algorithms to insert and delete elements in a priority queue and provide the corresponding time complexities.
 - b. Compare linked stack and linked queue and bring out the algorithms for insertion and deletion.(6)
- 13. a. What is the advantage of doubly linked list? Write an algorithm to swap the contents of two adjacent nodes in a doubly linked list with even number of nodes, where content of first and second, third and fourth will be swapped. Mention the time complexity of this operation. (6.5)
 - b. Compare circular and singly linked list. Write an algorithm to delete alternate nodes in a circular linked list, till the list is left with a single node.(6)

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14. a. Write an algorithm to construct a binary tree. How null links are used efficiently in binary trees? Give an example. (6.5)

- b. Define max heap. Write an algorithm to construct a heap. What is the time complexity of its construction? Why?
- 15. a. Explain binary tree traversal with examples. Write the algorithms and analyse the (6.5) complexities.
 - b. Write a note on selection sort and give the algorithm to perform the sort. Using this, sort the keys 65, 87, 9, 23, 5, 45, 6, 1.

GROUP - III Marks: $1 \times 20 = 20$

- 16. What is hashing? How to select a good hash function? The following are the list of keys 34, 56, 78, 102, 95, 45, 33, 66, 56, 42, 12 that are to be hashed into a hash table with 2 slots with hash function H(X)=X mode 11. Resolve collision by using rehashing with hash function H'(X)= X mod 9. Also, write algorithm to search for an element using linear probing. Compare the performance of searching for an element in a hash table implemented with linear probing and chaining.
- 17. Write an algorithm to convert a given text to Huffman codes and hence construct the Huffman tree for the given text "BOOT REBOOT BOT BOAT". What additional data PSGTECH PSGTECH PSGTECH PSGTECH PSGTECH structures are used for the construction? How? If fixed size coding was used for decoding the above text, then what is the size of the code? Compare the length of the codes using fixed and variable size coding. Suppose a Huffman tree is constructed for a=3, b=5, c=7, and d=9, then what is your inference on the length of the code? PSGTECH PSGTECH
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