



Reg. No. :

Name :

**Third Semester B.Tech. Degree Examination, October 2016
(2013 Scheme)**

13.306 : DATA STRUCTURES AND ALGORITHMS (FR)

Time : 3 Hours

Max. Marks : 100

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PART – A

Answer **all** questions.

(10×2=20 Marks)

1. Algorithm 1 does $f(n) = 5n^2 + 14n$ steps in the worst case and algorithm 2 does $g(n) = 9n + 13$ steps in the worst case, for an input of size n . For what input sizes is Algorithm 1 faster than Algorithm 2 (in the worst case) ?
2. Is it necessary to check the overflow condition in a linked list ? Justify your answer.
3. Given a sequence of numbers in order. i.e. $\{0, 1, 2, \dots, n\}$. One number in the sequence is missing. Write an algorithm to find the missing number with a time complexity of $O(n)$.
4. Using stacks check if a given expression is properly parenthesized.
Trace for the expression : $((A) * \{([B + C])\})$.
5. Write a pseudocode to find the smallest and largest element in a binary search tree.
6. Write a pseudocode to print the vertices of a graph represented using adjacency lists.
7. Is garbage collection essential ? Justify your answer.
8. Differentiate fragmentation and compaction.
9. What is the best sorting technique to sort an almost sorted list ? Provide justifications to your answer.
10. Analyse the best and worst case behavior of the binary search algorithm.

P.T.O.



PART - B

Module - I

Answer **one full** question from **each** Module :

11. a) Design an efficient algorithm to calculate x^n with a running time no longer than $(\log n)$. 6

b) Write a pseudocode to print a 2-D array in a spiral fashion. For eg. If the given 2-D array is

a_{00}	a_{01}	a_{02}	a_{03}
a_{10}	a_{11}	a_{12}	a_{13}
a_{20}	a_{21}	a_{22}	a_{23}
a_{30}	a_{31}	a_{32}	a_{33}

then the output should be $a_{00}, a_{01}, a_{02}, a_{03}, a_{13}, a_{23}, a_{33}, a_{32}, a_{31}, a_{30}, a_{20}, a_{10}, a_{11}, a_{12}, a_{22}, a_{21}$. 8

c) Write a pseudocode to split a linked list into two equal halves. 6

12. a) Write an algorithm to merge two sorted linked lists without using a temporary node. 10

b) Given an array of positive integers, print all the numbers that are repeated an even number of times. Is it possible to find a solution without an additional storage? 10

Module - II

13. a) Consider a state that has M Buses running between different cities. Given the start and the destination, design a data structure, to find the number of buses required to transit between the start and the destination city.

(Hint : If there is no direct bus, choose the next lowest number of buses needed in that route). 16

b) Consider a system which implements only a stack data structure. Write a pseudocode to support the normal operations like insertion and deletion in a queue using the stack operations. Use the minimum number of stacks. 4

14. a) Given a binary tree and a number x , modify the original tree to reflect the following :
left node value = parent node value / x
right node value = parent node value % x . 10
- b) Given a string write a pseudocode to print all possible strings that can be made by placing spaces in between them. 10

Module - III

15. a) Illustrate the process of memory management using the boundary tag method with suitable figures. 10
- b) Compare and bring out the differences between the boundary tag method and buddy system. 10
16. Consider a memory management system that employs the best fit strategy. Create an application using doubly linked lists that allocates space using the first fit strategy and can display the location and size of the fragments at any given time. Provide option to coalesce adjacent fragments. 20

Module - IV

17. A university grades the students as S, A, B, C, D, E and F. Write an algorithm to sort the students based on their grade. Note that the alphabetical ordering of the names should be preserved. 20
18. Given the keys {129, 240, 333, 974, 580, 559, 835, 591, 421, 554} and the midsquare hash function, show the contents of the hash table of size 10 which resolves collision using
- i) Linear probing
 - ii) Quadratic probing
 - iii) Double hashing with second hash function $h(x) = x \pmod{10}$
 - iv) Bucket with 2 slots
 - v) Chaining.

What will be effect of rehashing on the hash table, when the size of the hash table increases to 100 ? 20