

**Government College of Engineering, Amravati**  
(An Autonomous Institute of Government of Maharashtra)

**Fourth Semester B. Tech. (Computer Science & Engg.)**

**Summer – 2018**

**Course Code: CSU402**

**Course Name: Data structure**

**Time: 2 hrs. 30min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

- |    |  |    |
|----|--|----|
| 1. | a) What is time-space tradeoff explain with proper example.  | 06 |
|    | b) Write and explain slow pattern matching algorithm.  | 06 |
| 2. | a) Write a procedure which finds the location LOC1 of the largest element and the location LOC2 of the second largest element in array. Also find the values of largest and second largest elements. | 06 |
|    | b) Derive the table and corresponding graph by mentioning step by step procedure for the given pattern P=aaabb using fast pattern matching   |    |

algorithm.

06

3. Solve any TWO

- a) Write binary search algorithm with example. 06
- b) Write all required algorithms to insert a given item in sorted linked list.
  - An algorithm to find location of item in linked list.
  - An algorithm to insert an item into linked list at its proper position.06
- c) Suppose a linked list LIST is in memory. Give an algorithm which deleted the given item of information from the LIST. 06

4. Solve any TWO

- a) Using stack translate following infix expression into its equivalent postfix expression, show all the steps.  
 $((A+B) * (C-D) \uparrow (E * F) / G)$  06
- b) Write recursive procedure for Tower of Hanoi problem and show that recursive solution requires  $f(n)=2^n-1$  moves for n disks. 06
- c) Write and explain non recursive procedure for solving Tower of Hanoi problem using stack. 06

5. Solve any TWO

- a) Write the algorithm for insertion into heap tree and build a max heap tree from the given list of numbers: 06  
44, 30, 50, 22, 60, 55, 77, 55
- b) Write algorithm for DFS. Consider a given adjacency list of a graph G. Find and print all the nodes reachable from node J using DFS, show all steps. 06

06

Adjacency List

Node	Adjacent Nodes	Node	Adjacent Nodes
A	F, C, B	F	D
B	G, C	G	C, E
C	F	J	D, K
D	C	K	E, G
E	D, C, J		

06

- c) Sort the following numbers using Radix sort.

348, 143, 361, 423, 538, 128, 321, 543, 366

06

06

06

06

06

**Government College of Engineering, Amravati**  
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**Second Semester B. Tech.**  
**(Computer Science and Engineering)**

**Summer Term – 2017**

**Course Code: CSU402**

**Course Name: Data Structure**

**Time: 2 Hrs. 30 Min.      Max. Marks: 60**

**Instructions to Candidate**

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- 4) Use of logarithmic table, drawing instruments and non programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

**1. Solve any TWO**

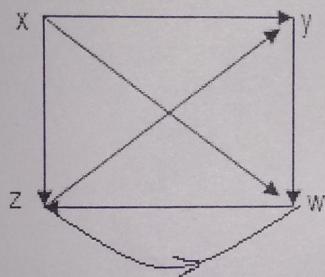
- a) Define the complexity of Algorithm? Explain 06 Time-Space Trade-Off with example.
  - b) What are the different String operations in string 06 processing? Explain with example.
  - c) Write a procedure which finds the location LOC1 06 of the largest element and the location LOC2 of the second largest element in array. Also find the values of largest and second largest elements.
2. a) Derive the table and corresponding graph by 06

*Contd..*

- mentioning step by step procedure for the given pattern  $P=aaabb$  using fast pattern matching algorithm.
- 5.** **a)** Solve : Explain shortest  
**b)** Explain  
**c)** Consider nodes follow DATA
- b)** Explain with example how pointers array can be **06** useful over the conventional one dimensional and two dimensional arrays.
- 3. a)** Write all required algorithms to insert a given item **08** in sorted linked list.
  - i. An algorithm to find location of item in linked list.
  - ii. An algorithm to insert an item into linked list at its proper position.
- b)** Suppose a linked list LIST is in memory. Give an **04** algorithm which deleted the last node from the LIST.
- 4. Solve any TWO**
- a)** Suppose the Fibonacci numbers  $F_{11}=89$  and **06**  $F_{12}=144$  are given:
  - i. Should one use recursion or iteration to obtain  $F_{16}$ ? Find  $F_{16}$ .
  - ii. Write an iterative procedure to obtain the first  $N$  Fibonacci numbers  $F[1], F[2], \dots, F[N]$ , where  $N>2$ .
- b)** Consider the following infix expression: **06**  
 $Q: ((A+B)*D) \uparrow (E-F)$   
 Using POLISH algorithm translate  $Q$  into its equivalent postfix expression  $P$ .
- c)** Write an algorithm for deleting the root of the **06** heap.

5. **Solve any TWO**

- a) Explain Warshall's Algorithm for finding the 06 shortest path with suitable example
- b) Explain the algorithm, with example for DFS. 06
- c) Consider the following graph and suppose the 06 nodes are stored in memory in an array DATA as follows:
- DATA: X, Y, Z, W
- Find the adjacency matrix A of the graph.
  - Find the Path Matrix P using powers of adjacency Matrix A.



**Government College of Engineering, Amravati**  
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**Fourth Semester B. Tech. (CS/IT)**

**Summer Term – 2018**

**Course Code: CSU402**

**Course Name: Data Structure**

**Time: 2 Hrs. 30 Min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

1. a) Prove that “increasing storage space required for an algorithm may decrease the time required to process the algorithm and vice versa”. 06
- b) Write and explain algorithm for finding location LOC and largest number MAX from array DATA with and without iteration logic. 06
2. **Solve any TWO**
- a) Write a procedure which counts the number NUM of times the word “”the” (ignore case) appears in the story S, with length of 80. Do not count “the” in

"mother" and assume no sentence ends with the word "the.", so count the word "the" with two cases "The[]" and "[]the[]".

(Note use only SUBSTRING operation)

5. a) Write an algorithm for fast string pattern matching. 06  
Also, derive graph and table for P=ababab.
- b) State and explain three important asymptotic notations with neat diagram. 06
3. a) Write all required algorithms to insert a given item in sorted linked list.  
An algorithm to find location of item in linked list.  
An algorithm to insert an item into linked list at its proper position. 06
- b) Suppose a linked list LIST is in memory. Give an algorithm which deleted the given item of information from the LIST. 06

4. Solve any TWO

- a) Write algorithm to evaluate postfix arithmetic expression using stack and evaluate the following postfix expression using the algorithm, show table containing symbol scanned and content of stack.  
 $P: 12, 7, 3, -, /, 2, 1, 5, +, *, +$  06
- b) Transform following infix expression into postfix expression using POLISH algorithm. Tabulate all steps.  
 $((A + B) * D) \uparrow (E - F)$  06
- c) Write algorithm for quick sort and using the same find the final position of 'D' in following string.  
 $S = \{D, A, T, A, S, T, R, U, C, T, U, R, E, S\}$  06

5. a) Solve any TWO  
Write the algo build a min he 44, 30, 50, 22, Write algorithm list of a graph show all steps.
- b)

Node	Adj No
A	F, C,
B	G, C
C	F
D	C
E	D, C

- c) Sort the follow 348, 143, 361,

**5. Solve any TWO**

a) Write the algorithm for insertion into heap tree and build a min heap tree from the given list of numbers:  
44, 30, 50, 22, 60, 55, 77, 55

06

b) Write algorithm for BFS. Consider a given adjacency list of a graph G. Find path from A to J using BFS, show all steps.

06

06

Adjacency List			
Node	Adjacent Nodes	Node	Adjacent Nodes
A	F, C, B	F	D
B	G, C	G	C, E
C	F	J	D, K
D	C	K	E, G
E	D, C, J		

c) Sort the following numbers using Radix sort.

348, 143, 361, 423, 538, 128, 321, 543, 366

06

06

06

06

**Government College of Engineering, Amravati**  
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Second Semester B. Tech. (Computer Sci. & Engg.)

Summer 2015

Course Code:CSU402

Course Name:Data Structure

Time: 2 Hrs. 30 Min.      Max. Marks: 60

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

- 1.
- a) Write analgorithm LARGEST (DATA, N, LOC, 08 MAX) which finds the location LOC and value MAX of the largest element in an array DATA with  $N > 1$  elements.  
Consider the complexity function  $C(n)$ , which measures the number of times the LOC and MAX are updated in algorithm. (The number of comparisons is independents of the order of the elements in DATA.)  
So find,
    - i.  $C(n)$  for Worst Case

*Contd..*

- ii.  $C(n)$  for Best Case  
 iii.  $C(n)$  for Average Case when  $N=3$ ,  
       assuming all arrangements of the  
       elements in DATA are equally likely.
- b) Write and explain procedures for:  
 i. Find the LENGTH( $S$ ) of any String      04  
 ii. To CONCAT( $S_1, S_2$ ) any two Strings
- 2.** Solve any TWO
- a) Describe the problem of deciding whether a given string pattern  $P$  appears in a string  $T$ , with example      06  
 b) using slow pattern matching algorithm.  
 iii.
- c) State binary search algorithm. Explain its idea using Appropriate example. 06  
 Find the number  $C$  of comparisons and the number  $D$  of interchange which alphabetize the  $n=6$  letters in PEOPLE using Bubble sort Algorithm. 06
- 3.** Solve any TWO
- a) Discuss the advantages , if any , of a two way list over a one way list for each of the following operations:  
 i) Traversing the list to process each node  
 ii) Deleting a node whose location LOC is given.  
 iii) Searching an unsorted list for a given element ITEM.  
 iv) Searching a sorted list for a given element of ITEM.  
 v) Inserting a node before the node with a given location LOC.
- b) Suppose LIST is header list in memory. Write an 06
- c) algorithm  
 Suppose  
 algorithm  
 NAME:
4. a) Translation  
 express  
 i)(A-B)  
 iii)  $A^*(E)$   
 b) Suppose  
 character  
 D  
 C  
 Suppose  
 alphabet  
 the final
5. a) Solve an  
 Suppose  
 recursive  
 i.  
 ii.  
 b) Construct  
 following  
 tree:  
 M      Q  
 T  
 c) Perform  
 data item  
 348      14  
 54

- algorithm which deletes the last node from list.
- c) Suppose NAME1 is a list in memory. Write an 06 algorithm which copies NAME1 into a list NAME2.

04 4. a) Translate, by inspection and hand, each infix 06 expression into its equivalent Postfix expression.

i)  $(A-B)^*(D/E)$       ii)  $(A+B \uparrow D)/(E-F)+G$   
iii)  $A^*(B+D)/E-F^*(G+H/K)$

b) Suppose S is the following list of 14 alphabetic 06 characters :

D      A      T      A      S      T      R      U  
C      T      U      R      E      S

Suppose the characters in S are to be stored alphabetically. Use the quick sort algorithm to find the final position of the first character D.

5. Solve any TWO

a) Suppose a binary tree T is in memory. Write 06 recursive procedure which find:

- i. The number NUM of nodes in T.  
ii. Depth DEP of tree.

b) Construct a B-Tree of order 3 by inserting the 06 following keys in the order shown into an empty B-tree:

M      Q      A      N      P      W      X  
T      G      E      J

c) Perform the Radix Sort on the following sets of 06 data items:

348      143      361      423      538      128      321  
543      366

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**Government College of Engineering, Amravati**  
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**Fourth Semester B. Tech. (CS / IT)**

**Summer – 2016**

**Course Code: CSU402**

**Course Name: Data Structures**

**Time: 02 Hr 30 Min**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

**1. Solve (Each carry 02 Marks) 12**

- a) What does the following function do for a given Linked List with first node as *head*?  
void fun1(struct node\* head)  
{ if(head == NULL)  
return;  
fun1(head->next);  
printf("%d ", head->data);  
}

- A.Prints all nodes of linked lists  
B.Prints all nodes of linked list in reverse order  
C. Prints alternate nodes of Linked List  
D. Prints alternate nodes in reverse order

- b) What is the output of following function for start pointing to first node of following linked list?  
1->2->3->4->5->6  
void fun(struct node\* start)  
{  
if(start == NULL)

Cont.

```

return;
printf("%d ", start->data);
if(start->next != NULL )
    fun(start->next->next);
printf("%d ", start->data);
}

```

2)

- (A) 1 4 6 6 4 1      (B) 1 3 5 1 3 5  
 (C) 1 2 3 5            (D) 1 3 5 5 3 1

c) Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the inorder transversal sequence of the resultant tree ?

- (A) 7 5 1 0 3 2 4 6 8 9 (B) 0 2 4 3 1 6 5 9 8 7  
 (C) 0 1 2 3 4 5 6 7 8 9 (D) 9 8 6 4 2 3 0 1 5 7

d) The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the height of the binary search tree (tree height is the maximum distance of a leaf node from the root) ?

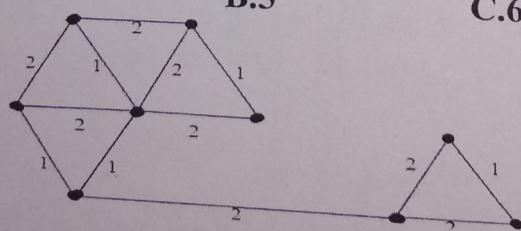
- A.2      B. 3      C. 4      D.5

e) A circularly linked list is used to represent a Queue. A single variable  $p$  is used to access the Queue. To which node should  $p$  point such that both the operations enQueue and deQueue can be performed in constant time ?

- A. rear node      B. front node  
 C. not possible with a single pointer  
 D. node next to front

f) The number of distinct minimum spanning trees for the weighted graph below is \_\_\_\_\_

- A.4      B.5      C.6      D.7



- 2) a) Write a procedure which counts the number NUM 06 of times the word "the" appears in the short story S(do not count "the" in "mother")

- b) 1) Let n denote a positive integer .Suppose 06 function L is recursively defined as

$$L(n)=\begin{cases} 0 & \text{if } n=1 \\ L(\text{"floor of "(n/2)+1}) & \text{if } n>1 \end{cases}$$

**Find L(25) what this function do?**

2) Let A be an integer array with N elements.

Suppose X is an integer function defined by

$$X(K)=X(A,N,K)=\begin{cases} 0 & \text{if } K=0 \\ X(K-1)+A(K) & \text{if } 0<K\leq N \\ X(K-1) & \text{if } K>N \end{cases}$$

**Find X(5) for N=8 A:3,7,-2,5,6,-4,2,7**

- 3) a) Translate, by inspection , each infix expression 06 into its equivalent postfix expression

- a)  $(A - B) * (D / E)$   
b)  $(A + B \uparrow D) / (E - F) + G$   
c)  $A * (B + D) / E - F * (G + H / K)$

- b) Suppose LIST is in memory. Write an algorithm 06 which deletes the last node from LIST .Illustrate with an example

**Solve Any Two**

- a) Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are 06 inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree? Write an algorithm for inserting a element into binary search Tree.

- b) Which data structure is efficient for following applications and why?

- 1) Finding duplicates in a given list of numbers  
2) Representation of mathematical or logical expression

- 3) Binary Space Partition - Used in almost every

06

Cont.

3D video game to determine what objects need to be rendered.

- 4) Huffman Code construction  
5) Binary Tries - Used in almost every high-bandwidth router for storing router-tables.  
6) Storing a set of names, and being able to lookup based on a prefix of the name. (Used in internet routers.)

c) 1) How many stacks are needed to implement a queue. Consider the situation where no other data structure like arrays, linked list is available to you. 02

2) A Priority-Queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is given below: 10, 8, 5, 3, 2 Two new elements "1" and "7" are inserted in the heap in that order. The level-order traversal of the heap after the insertion of the elements is:

3) Which of the following is true about linked list implementation of queue? 02

- A. In push operation, if new nodes are inserted at the beginning of linked list, then in pop operation, nodes must be removed from end.  
B. In push operation, if new nodes are inserted at the end, then in pop operation, nodes must be removed from the beginning.

5) Solve Any Two 12

a) With an example explain working of selection sort? 06

b) Consider the weighted matrix below. Assume v1=R, v2=S, v3=T and v4=U. Apply Shortest Path algorithm to find shortest path between every node 06

$$\begin{matrix} & R & S & T & U \\ R & \begin{pmatrix} 7 & 5 & 0 & 0 \\ 7 & 0 & 0 & 2 \\ 0 & 3 & 0 & 0 \\ 4 & 0 & 1 & 0 \end{pmatrix} \\ S & & & & \\ T & & & & \\ U & & & & \end{matrix}$$

Cont.

- d to
- gh-
- a 02
- ita
- u.
- x- 02
- er
- 2
- e
- e
- t 02
- 12
- 06
- 06
- c) Suppose a company with 68 employees assigns 4 digit employee numbers to each employee which is used as the primary key in the company's employee file. Suppose L-the set of memory addresses of the locations in table T consist of 100 two digit addresses .By applying the Division method ,Folding method find the primary key for the following employees

**3205,7148,2345**

06

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algorithm.

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44, 30, 50, 22, 60, 55, 77, 55
  - b) Write algorithm for DFS. Consider a given adjacency list of a graph G. Find and print all the nodes reachable from node J using DFS, show all steps. 06

Adjacency List			
Node	Adjacent Nodes	Node	Adjacent Nodes
A	F, C, B	F	D
B	G, C	G	C, E
C	F	J	D, K
D	C	K	E, G
E	D, C, J		

- c) Sort the following numbers using Radix sort.  
348, 143, 361, 423, 538, 128, 321, 543, 366 06