

- d) Suppose multidimensional array A (-2:2, 2:22) and B(1:8, -5:5, -10:5). Find the length of each dimension and the number of element in A and B. 02
- e) Consider the circular queue of defined length n, FRONT and REAR are pointed to first location. What is the condition for queue is full and queue is empty. 02
- f) A binary tree T has 9 nodes. Draw the tree T. 02  
 Inorder: E A C K F H D B G  
 Preorder: F A E K C D H G B
- 2) Solve any two. 06
- a) Write a bubble sort algorithm. Using the bubble sort algorithm, find the number C of comparisons and the number D of interchanges which alphabetize the n = 6 letters in PEOPLE 06
- b) Each student in class of 30 students takes 6 test in which scores range between 0 and 100. Suppose the test score are store in a 30 X 6 array TEST. Write a module which: 06
- Find the average grade for each test
  - Find the final grade for each student where the final grade is the average of the student's five highest test score.
- c) Suppose LIST is a linked list in memory consisting of numerical values. Write a procedure for each of the following. 06
- Finding the maximum MAX of the values in LIST.
  - Finding the average MEAN of the value in LIST.
  - Finding the product PROD of the elements in LIST.
- 3) Solve the following.
- a) Solve the following recurrence
- 1) Let N be an integer and suppose H(N) is recursively

defined as

06

$$H(N) = \begin{cases} 3*N & \text{if } N < 5 \\ 2*H(N-5) + 7 & \text{otherwise} \end{cases}$$

**Find H(24)**

2) Let M and N be integer and suppose F(M, N) is recursively defined by

$$F(M, N) = \begin{cases} 1 & \text{if } M=0 \text{ or } M \geq N \geq 1 \\ F(M-1, N) + F(M-1, N-1) & \text{Otherwise} \end{cases}$$

**Find (4,2)**

b) Write a procedure to obtain the capacity of the linked stack represented by its top pointer TOP. The capacity of a linked stack is the number of element in the list following the stack. 06

4) Solve any two.

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

i) Depth DEP of T. ii) Number NUM of nodes in T

b) 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 in-order traversal sequence of the resultant tree? Write an algorithm for inserting a element into binary search Tree. 06

c) Consider a heap H with N elements is store in the array TREE, and an ITEM of the information is given. Write a procedure to insert ITEM as new element of H. Build 06

*Contd..*

heap from following list of number 44, 30, 50, 22, 60, 55, 77, 55

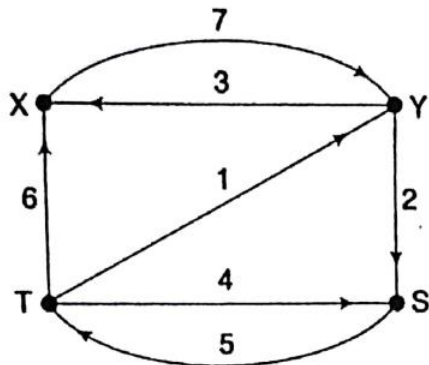
5)

Solve the following.

a) Consider the weighted graph  $G$  in following figure. 06

Suppose the nodes are store in an array

DATA : X, Y, S, T



Find the weight matrix  $W$  of  $G$ , Find the matrix  $Q$  of shortest path using Warshall's algorithm.

b) Write insertion sort algorithm to sort the array  $A$  with  $N$  element. Test your algorithm using: 06  
44,33,11,55,77,90,40, 60,99,22



**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.
- b) Write all required algorithms to insert a given item in sorted linked list.

06

An algorithm to find location of item in linked list.

An algorithm to insert an item into linked list at its proper position.

- c) Suppose a linked list LIST is in memory. Give an algorithm which deleted the given item of information from the LIST.

06

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  $f(n)=2n-1$  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:  
44, 30, 50, 22, 60, 55, 77, 55

06

- 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

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

**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**

- 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 any TWO**

- a) Define the complexity of Algorithm? Explain Time-Space Trade-Off with example. **06**
- b) What are the different String operations in string processing? Explain with example. **06**
- c) 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**

- 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.

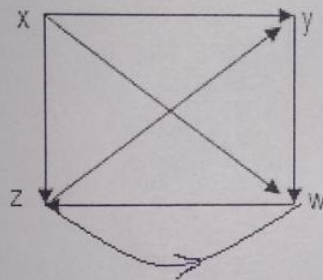
- b) Explain with example how pointers array can be useful over the conventional one dimensional and two dimensional arrays. 06
3. a) Write all required algorithms to insert a given item in sorted linked list. 08
- i. An algorithm to find location of item in linked list.
  - ii. An algorithm to insert an item into linked list at its proper position.
- b) Suppose a linked list LIST is in memory. Give an algorithm which deleted the last node from the LIST. 04
4. **Solve any TWO**
- a) Suppose the Fibonacci numbers  $F_{11}=89$  and  $F_{12}=144$  are given: 06
- 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 heap. 06

5.

- Solve :**
- a) Explain shortest
- b) Explain
- c) Consider nodes follow DATA
- i.
  - ii.



5. **Solve any TWO**
- a) Explain Warshall's Algorithm for finding the shortest path with suitable example 06
- b) Explain the algorithm, with example for DFS. 06
- c) Consider the following graph and suppose the nodes are stored in memory in an array DATA as follows: 06  
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**  
(An Autonomous Institute of Government of Maharashtra)

**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 processed 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).

- b) Write an algorithm for fast string pattern matching. Also, derive graph and table for  $P=ababab$ . 06
- c) 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. **Solve any TWO**

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

Node	Adj
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

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.

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



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

**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 an algorithm **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 independent 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(S1,S2)** 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 06  
using Appropriate example.  
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: 06
  - 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  
Suppos  
algorithm  
NAME

4. a) Transla  
express  
i)(A-B)  
iii)A\*(E

b) Suppose  
characte  
D  
C  
Suppose  
alphabet  
the final

5. **Solve an**  
a) Suppose  
recursive

i.  
ii.  
b) Construc  
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 algorithm which copies NAME1 into a list NAME2. 06

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

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 characters : 06

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 recursive procedure which find: 06

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

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

M	Q	A	N	P	W	X
	T	G	E	J		

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

348	143	361	423	538	128	321
	543	366				

Contd..

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

**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) ?

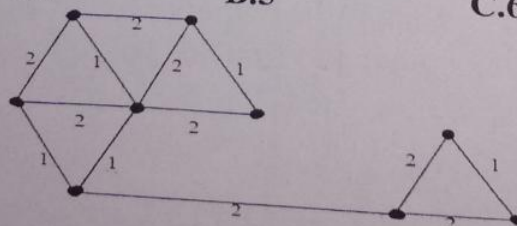
- A.2 B.3 C.4 D.5

- 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 of times the word "the" appears in the short story S (do not count "the" in "mother") 06

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

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

**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 into its equivalent postfix expression 06

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 which deletes the last node from LIST. Illustrate with an example 06

4) **Solve Any Two**

- a) 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 in-order traversal sequence of the resultant tree? Write an algorithm for inserting an element into binary search Tree. 06

- 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 06

3) Binary Space Partition - Used in almost every

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)

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: 02

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

	R	S	T	U
R	7	5	0	0
S	7	0	0	2
T	0	3	0	0
U	4	0	1	0

Cont.

- d to
- gh-
- a 02  
ta  
u.  
x- 02  
er  
2  
e  
e
- t 02
- 12  
06  
06
- c) Suppose a company with 68 employees assigns 4 06 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**



16007051

**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

- Write binary search algorithm with example.
- 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.
- Suppose a linked list LIST is in memory. Give an algorithm which deleted the given item of information from the LIST.

06

06

06

4. Solve any TWO

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

06

06

06

5. Solve any TWO

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