Sr. No. of Question Paper : 42   E   **Your Roll No................**

Unique Paper Code   : 234261

Name of the Course   : **B.Sc. Phy. Sc. / Math Sc.**

Name of the Paper   : DATA STRUCTURES [CSPT–202]

Semester   : II

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Question No. **1** is compulsory.

3. Attempt any **five** of Question Nos. **2** to **8.**

SECTION A

1. (a) What is a Stack ? How is it different from a Queue ?   (2)

    (b) Why is linear implementation of queues using arrays an inefficient method of implementation ?   (2)

    (c) What is the role of stacks in the implementation of recursion ?   (2)

    (d) Declare a class DLL for a doubly linked list having one integer and one float data member.   (2)

    (e) Give definitions :

         (i) Tree

         (ii) Binary Tree

         (iii) Binary Search Tree

         (iv) Height of a Tree   (4)

P.T.O.

(f) Considering root of the Binary tree at level 1, what is the maximum number of nodes :

   (i) in a Binary tree of height h ?

   (ii) at level i   (4)

(g) Write a function in C++ to calculate factorial using :

   (i) iteration

   (ii) recursion   (4)

(h) Given the values of a=2, b=3, c–8, d=2, evaluate the postfix expressions :

   (i) ab*cd/+ad^-

   (ii) ab+d^cd*-   (4)

(i) What is the precondition for Binary search ?   (1)

2. Create a class Stack. Declare appropriate data members. Declare and define push( ), pop( ) and display( ) member functions for inserting a value, removing a value and displaying the contents of the stack.   (10)

3. (a) Write a recursive function to evaluate x^n, where x and n are the parameters to the function.   (6)

   (b) Convert the following infix expression to (i) prefix notation, (ii) postfix notation :

$$(a+b) * ((c-d)/e^f) - g,$$

   Where ^ represents exponentiation.   (4)

3

4. (a) Write a C++ program to create a Circular Queue. Declare and define add( ) and delete( ) member functions for adding and deleting a value in the queue.   (8)

    (b) Write a function in C++ to sort a list of numbers using Selection sort.   (2)

5. (a) Write a C++ program to create a class List implementing a single linked list with appropriate data members. Declare and define methods to :

        (i) Insert a value in the list

        (ii) Display the contents of the list   (6)

    (b) What is the complexity of (i) Bubble sort, (ii) Merge sort, (iii) Linear Search, (iv) Binary Search.   (4)

6. (a) Create a Binary Search Tree using the following values :

        20, 5, 16, 12, 30, 14, 23, 17, 10, 7, 25, 3.   (6)

    (b) Write a function n C++ to count the number of elements in a linked list.   (4)

7. (a) Give the recursive functions for Preorder and Postorder traversals in a Binary Tree.   (6)

    (b) Show the sequence of steps involved in sorting the given list of numbers in ascending order using Insertion sort :

            10, 4, 8, 2, 22, 15, 6, 9, 7, 12   (4)

8. Write short notes on :

    (i) Role of stacks in function calls

    (ii) Priority Queues

    (iii) Dequeues

    (iv) Advantages of Doubly Linked List over Single Linked List   (10)

Sr. No. of Question Paper : 47   E   Your Roll No...............

Unique Paper Code   : 234461

Name of the Course   : **B.Sc. (Phy. Sc.) / B.Sc. (Math. Sc.)**

Name of the Paper   : Operating System [CSPT–404]

Semester   : IV

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1.   Write your Roll No. on the top immediately on receipt of this question paper.

2.   Question No. 1 is compulsory.

3.   Attempt any **five** from remaining **seven** questions.

4.   All parts of a question must be done together.

1.   (a)   What is the purpose of an operating system ?   (2)

     (b)   Can traps be generated intentionally by a user program ? If so, for what purpose ?   (2)

     (c)   Explain system program.   (2)

     (d)   Differentiate between job scheduling and process scheduling.   (2)

     (e)   What is symmetric multiprocessing ?   (2)

     (f)   What are the advantages of multithread programming ?   (3)

     (g)   What is race condition ? Explain.   (2)

     (h)   What is internal fragmentation ?   (2)

     (i)   List the attributes of a file.   (3)

(j) What is FAT ?   (2)

(k) What is command interpreter ? Why is it usually kept separate from kernel ?   (3)

2. (a) Consider the following set of processes, with the length of the CPU burst given in milliseconds :   (2+4)

Process	Arrival Time	Burst time
P1	0	1
P2	2	5
P3	3	1
P4	6	3

   (i) Draw Gantt charts illustrating the execution of these processes using pre-emptive and non-pre-emptive SJF scheduling.

   (ii) Calculate average turnaround time and average waiting time for pre-emptive and non-pre-emptive SJF scheduling algorithms.

  (b) What is Context Switch ? Describe the actions taken by Kernel to switch context

   (i) Among Processes

   (ii) Among Threads   (4)

3. (a) Enumerate major activities of an operating system in regard to :

   (i) Memory management

   (ii) File Management   (6)

  (b) Define the essential properties of a Real time Operating System.   (4)

4. (a) Explain the dynamic loading and linking briefly.   (6)

    (b) Explain the difference between internal and external fragmentation.   (4)

5. (a) Consider the following page reference string :

         1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

         How many Page faults would occur if (i) FIFO and (ii) optimal page
         replacement algorithm are used ? Assume four frames are available and all
         are initially empty.   (6)

    (b) Consider a logical address space of 32 pages with 1024 words per page,
         mapped onto a physical memory of 16 frames.   (4)

         (i) How many bits are required in the logical address ?

         (ii) How many bits are required in the Physical address ?

6. (a) Explain the Paging Scheme of memory management. Why is it needed ?

                                                                          (6)

    (b) List the advantages and disadvantages of :

         (i) Single-Level directory

         (ii) Tree structured directory   (4)

7. (a) What is critical section ? List the essential conditions required to solve critical
         section problem.   (4)

    (b) Given memory partitions of 500 KB, 300 KB, 100 KB, 200 KB and 600 KB
         (in order), how would each of the first fit, best fit and worst fit algorithm
         place processes of 250 KB, 350 KB, 100 KB and 426 KB (in order) ?
         Which algorithm makes the most efficient use of memory ?   (6)

8. Write short notes on any **two** :

   (a) Direct Access method for files

   (b) Linked allocation of disk blocks

   (c) Segmentation scheme of memory management   (2×5)