

CS3353 C Programming and Data Structures

UNIT- I

1. List the different data types available in C?

Floating-point, integer, double, character. Union, structure, array, etc. The basic data types are also known as the primary data types in C programming.

2. What do you mean by variables in 'C'?

Variables are **containers for storing data values**. In C, there are different types of variables (defined with different keywords), for example: int - stores integers (whole numbers), without decimals, such as 123 or -123. float - stores floating point numbers, with decimals, such as 19.99 or -19.99.

3. What is the use of sizeof() operator in C.

It is a compile-time operator as it returns the size of any variable or a constant at the compilation time. The size, which is calculated by the sizeof() operator, is the amount of RAM occupied in the computer. Syntax of the sizeof() operator is given below: **sizeof(data_type);**

4. What is the difference between ++a and a++?

++a returns the value of an after it has been incremented. It is a pre-increment operator since ++ comes before the operand. a++ returns the value of a before incrementing. It is a post-increment operator since ++ comes after the operand.

5. What are Operators? Mention their types in C

An operator is a symbol which operates on a variable or value. There are types of operators like **arithmetic, logical, conditional, relational, bitwise, assignment operators** etc. Some special types of operators are also present in C like sizeof(), Pointer operator

6. What do you mean by conditional or ternary operator?

A ternary operator **evaluates the test condition and executes a block of code based on the result of the condition**. Its syntax is condition ? expression1 : expression2; Here, condition is evaluated and. if condition is true , expression1 is executed.

7. What are the types of looping statements available in C

Loop is used to execute the block of code several times according to the condition given in the loop. It means it executes the same code multiple times so it saves code and also helps to traverse the elements of an array.

There are 3 types of loop –

- **while loop**
- **do – while loop**
- **for loop**

8.What is the difference between ‘=’ and ‘==’ operator?

The “=” is an assignment operator is used to assign the value on the right to the variable on the left. The ‘==’ operator checks whether the two given operands are equal or not.

9.What are the types of I/O statements available in ‘C’?

input/output statement or IO statement is **a portion of a program that instructs a computer how to read and process data**. It pertains to gathering information from an input device, or sending information to an output device.

10.Define Array

An array is a variable that can store multiple values. For example, if you want to store 100 integers, you can create an array for it.

```
int data[100];
```

UNIT -II

1.What is a pointer? give examples

A pointer is **a variable that stores the address of another variable**. example, an integer variable holds (or you can say stores) an integer value, however an integer pointer holds the address of a integer variable.

2. List the advantages of using pointers

(i) Pointers make the programs simple and reduce their length.

(ii) Pointers are helpful in allocation and de-allocation of [memory](#) during the execution of the program. Thus, pointers are the instruments of dynamic [memory](#) management.

(iii) Pointers enhance the execution speed of a program.

(iv) Pointers are helpful in traversing through arrays and character strings. The strings are also arrays of characters terminated by the null character ('\0').

(v) Storage of strings through pointers saves memory space.

3. Outline the use of the function in C?

A function is a block of code which only runs when it is called. You can pass data, known as parameters, into a function. **Functions are used to perform certain actions, and they are important for reusing code:** Define the code once, and use it many times.

4. Demonstrate what is meant by recursion with example

Recursion is **the process of repeating items in a self-similar way.** In programming languages, if a program allows you to call a function inside the same function, then it is called a recursive call of the function.

5. What is meant by structure

Structure in c is **a user-defined data type that enables us to store the collection of different data types.** Each element of a structure is called a member.

6. Tell how to access a member using structure

Array elements are accessed using the Subscript variable, Similarly Structure members are accessed **using dot [.] operator.** Structure written inside another structure is called as nesting of two structures.

7. Write a brief note on typedef

The typedef is **a keyword used in C programming to provide some meaningful names to the already existing variable in the C program.**

8. What is Union

Union is a user-defined data type, just like a structure. Union combines objects of different types and sizes together. The union variable allocates the memory space equal to the space to hold the largest variable of union. It allows varying types of objects to share the same location.

9.differences between structure and union:

Struct	Union
The struct keyword is used to define a structure.	The union keyword is used to define union.
When the variables are declared in a structure, the compiler allocates memory to each variables member. The size of a structure is equal or greater to the sum of the sizes of each data member.	When the variable is declared in the union, the compiler allocates memory to the largest size variable member. The size of a union is equal to the size of its largest data member size.
Each variable member occupied a unique memory space.	Variables members share the memory space of the largest size variable.
Changing the value of a member will not affect other variables members.	Changing the value of one member will also affect other variables members.
Each variable member will be assessed at a time.	Only one variable member will be assessed at a time.
We can initialize multiple variables of a structure at a time.	In union, only the first data member can be initialized.
All variable members store some value at any point in the program.	Exactly only one data member stores a value at any particular instance in the program.
The structure allows initializing multiple variable members at once.	Union allows initializing only one variable member at once.
It is used to store different data type values.	It is used for storing one at a time from different data type values.
It allows accessing and retrieving any data member at a time.	It allows accessing and retrieving any one data member at a time.

10.Define Enumerated Data type

Enumeration or Enum in C is **a special kind of data type defined by the user**. It consists of constant integrals or integers that are given names by a user. The use of enum in C to name the integer values makes the entire program easy to learn, understand, and maintain by the same or even different programmer.

UNIT -III

1. Define Data Structures

Data Structures is defined as the way of organizing all data items that consider not only the elements stored but also stores the relationship between the elements.

2. Define Linked Lists

Linked list consists of a series of structures, which are not necessarily adjacent in memory. Each structure contains the element and a pointer to a structure containing its successor. We call this theNext Pointer. The last cell'sNext pointer points to NULL.

3. State the different types of linked lists

The different types of linked list include

1. singly linked list
2. doubly linked list
3. circular linked list.

4. List out the advantages of using a linked list?

- It is not necessary to specify the number of elements in a linked list during its declaration
- Linked list can grow and shrink in size depending upon the insertion and deletion that occurs in the list
- Insertions and deletions at any place in a list can be handled easily and efficiently
- A linked list does not waste any memory space

5. State the difference between arrays and linked lists

Arrays	Linked Lists
Size of an array is fixed	Size of a list is variable
It is necessary to specify the number of elements during declaration	It is not necessary to specify the number of elements during declaration
Insertions and deletions are somewhat difficult	Insertions and deletions are carried out easily
It occupies less memory than a linked list for the same number of elements	It occupies more memory

6. Define an Abstract Data Type (ADT)

An abstract data type is a set of operations. ADTs are mathematical abstractions; nowhere in an ADT's definition is there any mention of how the set of operations is implemented. Objects such as lists, sets and graphs, along with their operations can be viewed as abstract data types.

7. Define a stack

Stack is an ordered collection of elements in which insertions and deletions are restricted to one end. The end from which elements are added and/or removed is referred to as top of the stack. Stacks are also referred as piles, push-down lists and last-in-first out (LIFO) lists.

8. List out the basic operations that can be performed on a stack :

The basic operations that can be performed on a stack are

- Push operation
- Pop operation
- Peek operation
- Empty check
- Fully occupied check

9. State the rules to be followed during infix to postfix conversions :

- Fully parenthesize the expression starting from left to right. During parenthesizing, the operators having higher precedence are first parenthesized
- Move the operators one by one to their right, such that each operator replaces their corresponding right parenthesis
- The part of the expression, which has been converted into postfix is to be treated as single operand

10. Define a queue

Queue is an ordered collection of elements in which insertions are restricted to one end called the rear end and deletions are restricted to other end called the front end. Queues are also referred as First-In-First-Out (FIFO) Lists.

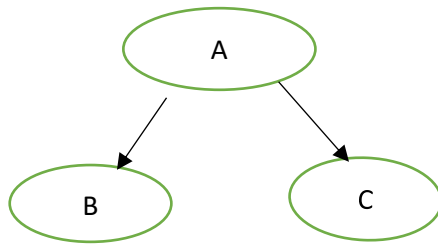
UNIT -IV

1. Define a tree

A tree is a collection of nodes. The collection can be empty; otherwise, a tree consists of a distinguished node r , called the root, and zero or more nonempty (sub) trees T_1, T_2, \dots, T_k , each of whose roots are connected by a directed edge from r .

2. Define root

This is the unique node in the tree to which further sub-trees are attached.



Here, A is the root.

3 . Define a binary tree

A binary tree is a finite set of nodes which is either empty or consists of a root and two disjoint binary trees called the left sub-tree and right sub-tree.

4.State the properties of a binary tree

- The maximum number of nodes on level n of a binary tree is 2^{n-1} , where $n \geq 1$.
- The maximum number of nodes in a binary tree of height n is $2^n - 1$, where $n \geq 1$.
- For any non-empty tree, $n_l = n_d + 1$ where n_l is the number of leaf nodes and n_d is the number of nodes of degree 2.

5 . What is meant by binary tree traversal?

Traversing a binary tree means moving through all the nodes in the binary tree, visiting each node in the tree only once.

6. What are the tasks performed during inorder traversal?

- Traverse the left sub-tree
- Process the root node
- Traverse the right sub-tree

7. Define a binary search tree

A binary search tree is a special binary tree, which is either empty or it should satisfy the following characteristics: Every node has a value and no two nodes should have the same value i.e) the values in the binary search tree are distinct

- The values in any left sub-tree is less than the value of its parent node
- The values in any right sub-tree is greater than the value of its parent node
- The left and right sub-trees of each node are again binary search trees

8. List out the disadvantages of using a linked list

- Searching a particular element in a list is difficult and time consuming
- A linked list will use more storage space than an array to store the same number of elements

9. List out the applications of a linked list

Some of the important applications of linked lists are manipulation of polynomials, sparse matrices, stacks and queues.

10. Define a Deque

Deque (Double-Ended Queue) is another form of a queue in which insertions and deletions are made at both the front and rear ends of the queue. There are two variations of a deque, namely, input restricted deque and output restricted deque. The input restricted deque allows insertion at one end (it can be either front or rear) only. The output restricted deque allows deletion at one end (it can be either front or rear)

UNIT -V

1. Define sorting

Sorting arranges the numerical and alphabetical data present in a list in a specific order or sequence. There are a number of sorting techniques available. The algorithms can be chosen based on the following factors – Size of the data structure – Algorithm efficiency – Programmer's knowledge of the technique.

2. Mention the types of sorting

- Internal sorting
- External sorting

3. Define bubble sort

Bubble sort is a simple sorting algorithm that works by repeatedly stepping through the list to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. The pass through the list is repeated until no swaps are needed, which indicates that the list is sorted. The algorithm gets its name from the way smaller elements "bubble" to the top of the list

4. What are the steps in quick sort?

The steps are:

- a. Pick an element, called a pivot, from the list.
- b. Reorder the list so that all elements with values less than the pivot come before the pivot, while all elements with values greater than the pivot come after it (equal values can go either way). After this partitioning, the pivot is in its final position. This is called the partition operation.
- c. Recursively apply the above steps to the sub-list of elements with smaller values and separately to the sub-list of elements with greater values.

5. What are the advantages of insertion sort

Advantages

- a. Simplest sorting technique and easy to implement
- b. It performs well in the case of smaller lists.
- c. It leverages the presence of any existing sort pattern in the list

Disadvantages

- Efficiency of $O(n^2)$ is not well suited for large sized lists
- It requires large number of elements to be shifted

6. Define searching

Searching refers to determining whether an element is present in a given list of elements or not. If the element is present, the search is considered as successful, otherwise it is considered as an unsuccessful search. The choice of a searching technique is based on the following factors

- a. Order of elements in the list i.e., random or sorted
- b. Size of the list

7. Mention the types of searching

The types are

- Linear search
- Binary search

8. What is meant by linear search?

Linear search or sequential search is a method for finding a particular value in a list that consists of checking every one of its elements, one at a time and in sequence, until the desired one is found.

9. What is open addressing?

Open addressing is also called closed hashing, which is an alternative to resolve the collisions with linked lists. In this hashing system, if a collision occurs, alternative cells are tried until an empty cell is found.

There are three strategies in open addressing:

- Linear probing
- Quadratic probing
- Double hashing

10. Define Hashing.

Hashing is the transformation of string of characters into a usually shorter fixed length value or key that represents the original string. Hashing is used to index and retrieve items in a database because it is faster to find the item using the short hashed key than to find it using the original value.