

Part I - Answer any 10 of the following - 2 marks each

1. In what order does one add and delete from a Queue?
2. When a variable is declared above the main() function, its scope is
3. Changes are made to a copy of a variable when a function is called using
4. $O(N^2)$ is the time complexity of a
5. To open a file in both read & write mode without losing existing file content, use
6. The second argument, generally referred to as argv, in main(int argc, char *argv[]) gives the on the command line
7. A 3x3 matrix can be implemented in C using arrays.
8. To retain the value of a variable in a recursive function across all calls, declare it as
9. The minimum key value of a MIN heap is stored in the
10. The format specifier for printing a string is
11. Use the keyword to declare a function / variable that is defined in a different source file.
12. Consider the statement, **const char *cptr = "I am a string";**
*(cptr+=10) will give character.

Part II - Answer any 12 of the following - 5 marks each

13. Write a function that receives a pointer to an array. It should sum the values in the array and return the sum as an integer value.
14. Write a Struct to encapsulate an integer, a float and a string of length 20. Declare a variable of this type and assign values to each element of the struct.
15. Write a Union to encapsulate the above struct, a character and a floating point value. Declare a variable and a pointer to it. Assign values to the elements using the pointer. What is the sizeof() of the Union, assuming int is two bytes.
16. Write a user-defined data type to create date storage using three separate unsigned integers. Use bit-fields to optimise space. Typedef the struct.

Indian Statistical Institute

17. I have numbers 17, 23, 1, 96, 100, 15, 2, 71, 28 on which I perform the following
 - a) push(), push(), push(), pop(), push(), push(), pop(), pop(), push(), push(), pop(). Show the stack after each operation.
 - b) what remains on the stack?
18. Write a function that creates a node in a doubly linked list. It takes an integer value as the data for the node and returns a pointer to the newly created node. (Hint: Use a well-known C standard library function to create the node)
19. Write a function with the following signature that computes the factorial of n recursively "**int fact(int n)**".
20. Write a recursive function with the signature "**void ssort(int *ss)**" that sorts the input array 'ss' using Selection Sort.
21. Show the necessary code to open a file in read mode. Read a line from the file and write it on stdout.
22. Write a function that returns the maximum of two values. Declare a pointer to this function and make the function call using this pointer.
23. Draw the Binary Search Tree for the following values 12-36-78-90-22-67-89-10-35-46-19-37. Write the search sequence to find the value 10 using (a) Breadth first search (b) Depth first search.
24. Give short single line / word answers for the following:
 - a) What is a Heap?
 - b) What is its use?
 - c) What data structure is used to implement it?
 - d) If a parent is stored at the ith value, where are the children stored ?
25. Write the necessary code to count the number of arguments on a program's command line.

Part III - Answer any two of the following - 10 marks each

26. Write a function with a variable length argument list that computes the average of any given set of numbers. The function should accept the numbers to be averaged as arguments. You will need to write all the steps necessary to implement a function with a variable length argument list.
27. Convert the following expressions into postfix form. Show the output string and stack values after reading each character of the infix expression.
 - a) $x + y$
 - b. $(x * y) - (a*b) - z$
 - c. Show the stack trace for $(x^y)^4 / (5*z) + 10$
 - d. Show the stack trace for $5 * 2 - 10 + 26 / 2$
 - e. Evaluate the resulting postfix expression and show the intermediate operands at each stage.
28. Show the step-wise sorting of the following numbers using Insertion sort. 4,3,9,2,6,1,8,0,7.