Q.1  

a. Describe the output that will be generated by the following 'C' program.

```c
#include <stdio.h>
int main()
{
  int a[5] = {1,2,3,4,5};
  int *ptr = (int*)(&a+1);
  printf("%d %d" , *(a+1), *(ptr-1) );
  return 0;
}
```

b. Write a C program to add two numbers using pointers.

c. Distinguish between Automatic and Static variables

d. What is the following function computing? Assume x and n are positive integers.

```c
int  mystery ( int x , int n)
{
  int val;
  val =1;
  if (n>0)
  {
    if (n%2 == 1)
      val = val *x;
    val = val * mystery(x*x , n/2);
  }
  return val;
}
```

e. What will be the output of the following code segment? Explain.

```c
#include <stdio.h>
int main()
{
  int i=3;
  int j;
  j = sizeof(++i + ++i);
  printf(" i = %d
 j = %d", i , j);
  return 0;
}
```
f. Define a macro. Write a nested macro that gives the minimum of three values.

g. Differentiate between a compiler and an interpreter. (7 × 4)

Q.2  
a. What do you understand by stepwise refinement of the program? Compare Top-Down and Bottom-Up strategies to solve a problem. (6)

b. What is a recursive function? What is the advantage of using recursive function? Write two C programs that calculate factorial of a number using recursion and iteration? Compare two approaches. (12)

Q.3  
a. Write a function to remove duplicates from an ordered array. For example, if input is: a, a, c, d, q, r, s, u, w, w, w; then the output should be a, c, d, q, r, s, u, w. (9)

b. Write a function to sort the characters of the string passed to it as argument. (9)

Q.4  
a. Write a complete C program for reading an employees file containing {emp_number, name, salary, address}. Create an output file containing the names of those employees along with their salary and address whose salary is > 30,000. (9)

b. Distinguish between the following giving suitable example: 
   (i) Call by value and Call by reference
   (ii) Global and local variables.
   (iii) do..while and while loops (9)

Q.5  
a. Define a structure. How it is different from union? Explain the differences by giving suitable examples. (6)

b. What are preprocessor directives? List three types of them. What is the difference between the following directives: #include <filename> and #include “filename”? (6)

c. Write a function to delete a specified node from linked list. (6)

Q.6  
a. What is insertion sort? Write a program in C to sort the given list of integers using insertion sort. (6)

b. Differentiate between White Box and Black Box Testing. (6)

c. Explain Testing and debugging process briefly. (6)

Q.7  
a. Discuss the kind of errors those are likely to be present in a program. (6)

b. Explain the following functions giving a small C code snippet: 
   (i) feof() 
   (ii) ftell() 
   (iii) fseek() 
   (iv) ferror() 
   (v) malloc() (5)

c. Write a C program to multiply two matrices (maximum size of the two matrices is 20 × 20 each). (7)