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<u>**C- Programming Language**</u>

<u>**Week – 5**</u>
<u>**Programming Questions**</u>

Q. 1 Write a program to print the following patterns:
   a.   *****
        *****
        *****
        ***** Sol.
     #include
     <stdio.h>

     int main()
        { int i, j;
        for(i = 0; i < 4; i++) {
           for(j = 0; j < 5; j++)
              { printf("*");

```
        }
        printf("\n");
    }
    return 0;
}
```

```
Compile Result

*****
*****
*****
*****

[Process completed – press Enter]
```

b.   12345 12345
     12345
     12345
     12345

Sol. #include
<stdio.h>

```
int main()
    { int i, j;
    for(i = 1; i <= 4; i++)
        { for(j = 1; j <= 5; j++)
        { printf("%d", j); }
        printf("\n");
    }

    return 0;
}
```

```
Compile Result

12345
12345
12345
12345

[Process completed – press Enter]
```

c.   1
     12
     123
     1234

Sol. #include

```c
<stdio.h>

int main()
  { int i, j;

    for(i = 1; i <= 4; i++)
      { for(j = 1; j <= i; j++)
        { printf("%d", j); }
        printf("\n");
      }

    return 0;
  }
```

```
Compile Result

I
I2
I23
I234

[Process completed - press Enter]
```

d. 1
    22
    333
    4444
    Sol. #include
    <stdio.h>

```c
int main()
  { int i, j;

    for(i = 1; i <= 4; i++)
      { for(j = 1; j <= i; j++)
        { printf("%d", i); }
        printf("\n");
      }

    return 0;
  }
```

```
Compile Result

I
22
333
4444

[Process completed - press Enter]
```

e.
```
   *
**
***
**** 
```
Sol.
```c
#include <stdio.h>

int main()
   { int i, j;

      for(i = 1; i <= 4; i++)
         { for(j = 1; j <= i; j++)
         { printf("*"); }
         printf("\n");
      }
      return 0;
}
```

```
Compile Result

*
**
***
****

[Process completed - press Enter]
```

f.
```
   A
  AB
 ABC
ABCD
```
Sol.
```c
#include <stdio.h>

int main()
   { int i, j, k;
```

```c
    for(i = 1; i <= 4; i++) {
        for(j = 4; j > i; j--)
            { printf(" ");
        }
        for(k = 1; k <= i; k++) {
            printf("%c", 'A' + k - 1);
        }
        printf("\n");
    }

    return 0;
}
```
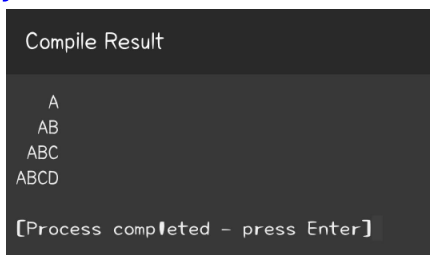
```
Compile Result

   A
  AB
 ABC
ABCD

[Process completed - press Enter]
```

g. 1
    2 3
    4 5 6
    7 8 9 10
    Sol.

```c
#include <stdio.h>
int main() {
    int i, j, num = 1;

    for(i = 1; i <= 4; i++)
        { for(j = 1; j <= i; j++) {
            printf("%d ", num);
            num++;
        }
        printf("\n");
    }

    return 0;
}
```

```
Compile Result

1
2 3
4 5 6
7 8 9 10

[Process completed - press Enter]
```

h. 1
   10
   101
   1010
   10101
   Sol. #include
   <stdio.h>

   int main()
      { int i, j;

      for(i = 1; i <= 5; i++)
         { for(j = 1; j <= i; j++)
         { if(j % 2 != 0)
         { printf("1");
            } else {
               printf("0");
            } }
         printf("\n")
         ;
      }
      return 0;
   }

```
Compile Result

1
10
101
1010
10101

[Process completed - press Enter]
```

i. 5
   5 4
   5 4 3

5 4 3 2
5 4 3 2 1
Sol. #include
<stdio.h>

```
int main()
   { int i, j;

   for(i = 5; i >= 1; i--)
      { for(j = 5; j >= i; j--) {
         printf("%d ", j);
      }
      printf("\n");
   }

   return 0;
}
```

```
Compile Result

5
5 4
5 4 3
5 4 3 2
5 4 3 2 |

[Process completed – press Enter]
```

j.   5 4 3 2 1
     5 4 3 2
     5 4 3
     5 4
     5
     Sol.
     #include <stdio.h>

```
int main()
   { int i, j;

   for(i = 5; i >= 1; i--) { for(j
      = 5; j >= 6 - i; j--) {
         printf("%d ", j);
      }
      printf("\n");
   }
```

```
        return 0;
    }
```

k. *****
    *   *
    *   *
    *   *
    ***** Sol.

```c
#include
<stdio.h>

int main()
  { int i, j;

  for(i = 1; i <= 5; i++) {
     for(j = 1; j <= 5; j++) {
        if(i == 1 || i == 5 || j == 1 || j == 5)
           { printf("*");
        } else {
           printf(" ");
        } }
     printf("\n")
     ;
  }
  return 0;
}
```

l.　.　*
　　**
　**
　***
　****
　*****
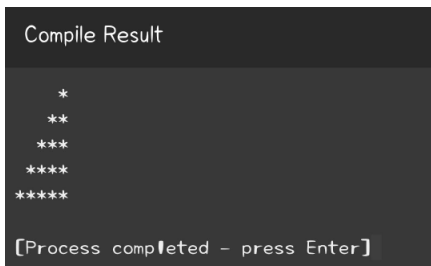
Sol.#include <stdio.h>

```c
int main() {
    int rows = 5;

    for (int i = 1; i <= rows; i++) { // Spaces for (int
        space = 1; space <= rows - i; space++)
        { printf(" ");
        }

        // Stars for (int j = 1; j
        <= i; j++) { printf("*"); }

        printf("\n");
    }

    return 0;
}
```

Compile Result

```
    *
   **
  ***
 ****
*****
```

[Process completed - press Enter]

m.　*
　**
　***
　****
　*****
　****
　***
　**
　*

Sol.#include <stdio.h>

```c
int main() {
    int rows = 5;
```

```c
// Upper part of the pattern
for (int i = 1; i <= rows; i++) {
    for (int j = 1; j <= i; j++)
    { printf("*"); }
    printf("\n");
}

// Lower part of the pattern
for (int i = rows - 1; i >= 1; i--)
{
    for (int j = 1; j <= i; j++)
    { printf("*"); }
    printf("\n");
}

return 0;
}
```

```
*
**
***
****
*****
****
***
**
*
[Process completed - press Enter]
```

n.   6 7 8
      9 3 4
       5
1 2
         0

```c
Sol. #include
<stdio.h>

int main() {
    int i, j, k = 6;

    for(i = 1; i <= 4; i++)
        { for(j = 1; j < i; j++)
        { printf(" ");
        }
        for(j = i; j <= 4; j++) {
            printf("%d ", k);
```
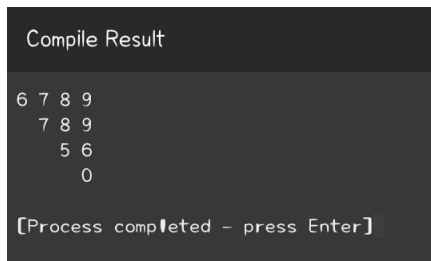
```
            k++;
         }
         k = k - 2*(i+1) + 1;
         printf("\n");
      }

      return 0;
   }
```

```
Compile Result

6 7 8 9
  7 8 9
    5 6
      0

[Process completed - press Enter]
```

C- Programming Language

Programming Question

Week - 6

Q. 1 Write a menu driven program to insert and delete elements of kth position to an array of size N.
Sol.-
#include <stdio.h>

```c
void insertElement(int arr[], int *n, int k, int element) {
   if (k < 1 || k > (*n) + 1) {
      printf("Invalid position for insertion.\n");
   } else { (*n)++; for (int i =
      *n; i > k; i--) { arr[i - 1]
      = arr[i - 2];
      }
      arr[k - 1] = element; printf("Element %d inserted at
      position %d.\n", element, k);
   }
}

void deleteElement(int arr[], int *n, int
   k) { if (k < 1 || k > *n) {
      printf("Invalid position for deletion.\n");
```

```c
    } else { int deletedElement =
        arr[k - 1]; for (int i = k - 1; i <
        *n - 1; i++) { arr[i] = arr[i + 1];
        }
        (*n)--;
        printf("Element %d deleted from position %d.\n", deletedElement, k);
    }
}

void printArray(int arr[], int
    n) { printf("Current array:
    "); for (int i = 0; i < n; i++)
    { printf("%d ", arr[i]);
    }
    printf("\n");
}

int main() {
    int N; printf("Enter the size of the
    array: "); scanf("%d", &N);

    int array[N]; printf("Enter the elements of the array
    separated by space: "); for (int i = 0; i < N; i++) {
        scanf("%d", &array[i]);
    }

    while (1) {
        printf("\nMenu:\n"); printf("1. Insert
        element at kth position\n"); printf("2.
        Delete element at kth position\n");
        printf("3. Print array\n"); printf("4.
        Exit\n");

        int choice;
        printf("Enter your choice (1-4): ");
        scanf("%d", &choice);

        int k, element;
        switch (choice) {
            case 1:
                printf("Enter the position to insert:
                "); scanf("%d", &k); printf("Enter
                the element to insert: ");
```

```c
            scanf("%d", &element);
            insertElement(array, &N, k,
            element); break;
        case 2:
            printf("Enter the position to delete:
            "); scanf("%d", &k);
            deleteElement(array, &N, k); break;
        case 3:
            printArray(array, N);
            break;
        case 4:
            printf("Exiting program.\n");
            return 0;
        default:
       printf("Invalid choice. Please enter a number between 1 and 4.\n");
        }
    }

    return 0;
}
```

```
Compile Result

Enter the size of the array: 8
Enter the elements of the array separa
ted by space: 1 2 3 4 5 6 7 8

Menu:
1. Insert element at kth position
2. Delete element at kth position
3. Print array
4. Exit
Enter your choice (1-4): 1
Enter the position to insert: 3
Enter the element to insert: 9
Element 9 inserted at position 3.

Menu:
1. Insert element at kth position
2. Delete element at kth position
3. Print array
4. Exit
Enter your choice (1-4): 2
Enter the position to delete: 6
Element 5 deleted from position 6.

Menu:
1. Insert element at kth position
2. Delete element at kth position
3. Print array
4. Exit
Enter your choice (1-4):
```
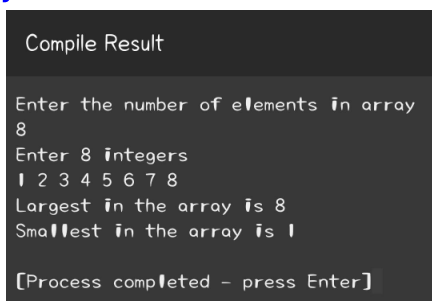
Q. 2   Write the program to print the biggest and smallest element in an array. Sol.-
#include <stdio.h>

```c
int main() {
    int array[100], n, i, smallest, largest;

    printf("Enter the number of elements in
    array\n"); scanf("%d", &n); printf("Enter %d
    integers\n", n);

    for (i = 0; i < n; i++)
        scanf("%d", &array[i]);
    smallest = largest = array[0];

    for (i = 1; i < n; i++) {
        if (array[i] > largest)
            largest = array[i];
        else if (array[i] < smallest)
            smallest = array[i];
    }

    printf("Largest in the array is %d\n", largest);
    printf("Smallest in the array is %d\n", smallest);

    return 0;
}
```

```
Compile Result

Enter the number of elements in array
8
Enter 8 integers
1 2 3 4 5 6 7 8
Largest in the array is 8
Smallest in the array is 1

[Process completed - press Enter]
```

Q. 3 Write the program to print the sum and average of an array.
Sol.-#include <stdio.h>

```c
int main() {
    int n, i, sum = 0;
    float average;
```

```c
    printf("Enter the number of elements in array\n");
    scanf("%d", &n);

    int array[n]; printf("Enter %d
    integers\n", n);

    for (i = 0; i < n; i++)
        { scanf("%d", &array[i]);
        sum += array[i];
    }

    average = (float)sum/n; printf("Sum

    of the array is %d\n", sum);

    printf("Average of the array is

     %.2f\n", average);


    return 0;
}
```

```
Compile Result

Enter the number of elements in array
7
Enter 7 integers
1 2 3 4 5 6 7
Sum of the array is 28
Average of the array is 4.00

[Process completed - press Enter]
```

Q. 4 Write the program to sort an array using bubble sort.
Sol.-
#include <stdio.h>

```c
void swap(int *xp, int *yp) {
    int temp = *xp;
    *xp = *yp;
    *yp = temp;
}

void bubbleSort(int arr[], int
```

```c
   n) { for(int i = 0; i < n-1; i++)
   { for (int j = 0; j < n-i-1; j++)
   { if (arr[j] > arr[j+1])
           swap(&arr[j], &arr[j+1]);
     }
   }
}

void printArray(int arr[], int size) {
   for (int i=0; i < size; i++)
      printf("%d ", arr[i]);
   printf("\n");
}

int main() {
   int arr[] = {64, 34, 25, 12, 22, 11, 90};
   int n = sizeof(arr)/sizeof(arr[0]);
   bubbleSort(arr, n); printf("Sorted
   array: \n"); printArray(arr, n);
   return 0;
}
```

```
Compile Result

Sorted array:
11 12 22 25 34 64 90

[Process completed - press Enter]
```

Q. 5Write the program to search an element using linear search as well as binary search.
Sol.-
// Linear Search
#include <stdio.h>

```c
int linearSearch(int array[], int n, int x) {
   for(int i = 0; i < n; i++)
     if(array[i] == x)
        return i;
   return -1;
}

// Binary Search
int binarySearch(int array[], int low, int high, int x) {
   if (high >= low) {
```

```c
        int mid = low + (high - low) / 2;

        if (array[mid] == x)
            return mid;

        if (array[mid] > x)
            return binarySearch(array, low, mid - 1, x);

        return binarySearch(array, mid + 1, high, x);
    }

    return -1;
}

int main() { int array[] = {2, 3,
    4, 10, 40}; int x = 10;

    // Using Linear Search
    int result = linearSearch(array, 5, x);
    (result == -1) ? printf("Element is not present in array\n")
            : printf("Element is present at index %d\n", result);

    // Using Binary Search
    int result2 = binarySearch(array, 0, 4, x);
    (result2 == -1) ? printf("Element is not present in array\n")
            : printf("Element is present at index %d\n",
    result2); return 0;
}
```

```
Compile Result

Element is present at index 3
Element is present at index 3

[Process completed - press Enter]
```

Q. 6Take an array of 20 integer inputs from user and print the following:

        a.number of positive numbers

        b.number of negative numbers

        c.number of odd numbers

d.number of even numbers

        e.number of 0.
Sol.-
#include <stdio.h>

int main() {
    int array[20];
    int pos = 0, neg = 0, odd = 0, even = 0, zero = 0;

    printf("Enter 20 integers:\n");

    for(int i = 0; i < 20; i++) {
        scanf("%d", &array[i]);

        // Check
        positive/negative/zero if
        (array[i] > 0) pos++; else if
        (array[i] < 0) neg++; else
        zero++;

        // Check odd/even if
        (array[i] % 2 == 0) even++;
        else odd++;
    }

    printf("Number of positive numbers: %d\n", pos);
    printf("Number of negative numbers: %d\n", neg);
    printf("Number of odd numbers: %d\n", odd);
    printf("Number of even numbers: %d\n", even);
    printf("Number of 0s: %d\n", zero);

    return 0;
}

```
Compile Result

Enter 20 integers:
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9
10 11 12 13
Number of positive numbers: 13
Number of negative numbers: 6
Number of odd numbers: 10
Number of even numbers: 10
Number of 0s: 1

[Process completed - press Enter]
```

7 Take an array of 10 elements. Split it into middle and store the elements in two different arrays. E.g.INITIAL array:

58, 24, 13, 15, 63, 9, 8, 81, 1, 78
After splitting:

58, 24, 13, 15, 63 9, 8, 81, 1, 78
Sol.-
```c
#include <stdio.h>

int main() {
    int array[10] = {58, 24, 13, 15, 63, 9, 8, 81, 1, 78};
    int array1[5], array2[5];

    // Split the array
    for(int i = 0; i < 5; i++)
    { array1[i] = array[i];
    array2[i] = array[i+5];
    }
    // Print the split arrays
    printf("First array after splitting:
\n"); for(int i = 0; i < 5; i++) {
        printf("%d ", array1[i]);
    }

    printf("\nSecond array after splitting: \n");
    for(int i = 0; i < 5; i++) {
        printf("%d ", array2[i]);
    }

    return 0;
```

}

8 Write the program to count frequency of each element in an array.
Sol.-
#include <stdio.h>

```c
int main() {
    int array[100], freq[100];
    int size, i, j, count;

    printf("Enter size of the array: ");
    scanf("%d", &size);

    printf("Enter elements in array: ");
    for(i = 0; i < size; i++) {
        scanf("%d", &array[i]);
        freq[i] = -1;
    }

    for(i = 0; i < size; i++){
        count = 1; for(j = i + 1; j <
        size; j++){ if(array[i] ==
        array[j]){
            count++;
            freq[j] = 0;
        }
    }

    if(freq[i] != 0){
        freq[i] = count;
    }
}

    printf("\nFrequency of all elements in array:
\n"); for(i = 0; i < size; i++){ if(freq[i] != 0){
        printf("%d occurs %d times\n", array[i], freq[i]);
    }
```

```
    }

    return 0;
}
```

C- Programming Language

Week – 7

Programming Questions

Q. 1 Write the program to print row major and column major matrix.
Sol.-
```c
#include <stdio.h>

int main() {
    int array[3][3] = {{1, 2, 3},
                {4, 5, 6},
                {7, 8, 9}};
    int i, j;

    // Print in row-major order
    printf("Row-major order: \n");
    for (i = 0; i < 3; i++) {
        for (j = 0; j < 3; j++) {
            printf("%d ", array[i][j]);
        }}

    printf("\n");

    // Print in column-major order
    printf("Column-major order: \n");
```

```c
    for (i = 0; i < 3; i++) {
        for (j = 0; j < 3; j++) {
            printf("%d ", array[j][i]);
        }
    }

    return 0;
}
```

```
Compile Result

Row-major order:
1 2 3 4 5 6 7 8 9
Column-major order:
1 4 7 2 5 8 3 6 9
[Process completed - press Enter]
```

Q. 2 Write the program to print sum of a whole matrix.
Sol.-
```c
#include <stdio.h>

int main(){
    int i, j, rows, columns, sum = 0;
    int matrix[10][10];

    printf("Enter the number of rows and columns of the

    matrix: "); scanf("%d%d", &rows, &columns);

    printf("\nEnter elements of the matrix: \n");

    for (i = 0; i < rows; i++){
      for (j = 0; j < columns;
        j++){ scanf("%d",
        &matrix[i][j]); sum = sum +
        matrix[i][j];
      }
    }

    printf("\nThe sum of all elements of the matrix is: %d",
    sum); return 0;
}
```

Q. 3 Write a program to add and multiply two 3x3 matrices. You can use 2D array to create a matrix.
Sol.-
```
#include <stdio.h>
int main() {
    int a[3][3] = {{1, 2, 3},
                {4, 5, 6},
                {7, 8, 9}}; int
    b[3][3] = {{10, 11, 12},
                {13, 14, 15},
                {16, 17, 18}}; int
    sum[3][3], product[3][3];
    int i, j, k;

    // Add matrices
    for (i=0; i<3; i++)
    {
        for (j=0; j<3; j++) {
            sum[i][j] = a[i][j] + b[i][j];
        }
    }

    // Multiply matrices for
    (i=0; i<3; i++) { for (j=0;
    j<3; j++) { product[i][j] =
    0; for (k=0; k<3; k++) {
        product[i][j] = product[i][j] + a[i][k] * b[k][j];
        }
    }
    }

    // Print sum matrix
    printf("Sum of matrices: \n");
```
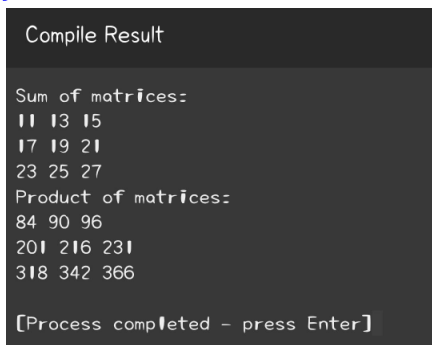
```c
    for (i=0; i<3; i++) {
        for (j=0; j<3; j++) {
            printf("%d ", sum[i][j]);
        }
        printf("\n");
    }

    // Print product matrix
    printf("Product of matrices: \n");
    for (i=0; i<3; i++) {
        for (j=0; j<3; j++) {
            printf("%d ", product[i][j]);
        }
        printf("\n");
    }

    return 0;
}
```

```
Compile Result

Sum of matrices:
11  13  15
17  19  21
23  25  27
Product of matrices:
84  90  96
201  216  231
318  342  366

[Process completed - press Enter]
```

Q. 4   Write the program to print sum of all diagonal elements, upper triangular matrix and lower triangular matrix.
Sol.-
#include <stdio.h>

int main() { int matrix[3][3]
    = {{1, 2, 3},
                {4, 5, 6},
                {7, 8, 9}};
    int i, j, sum = 0;

    // Sum of diagonal
    elements for(i=0; i<3; i++)
    { for(j=0; j<3; j++) { if(i == j)

```c
    {
            sum = sum + matrix[i][j];
        }
    }
}
printf("Sum of diagonal elements: %d\n", sum);

// Print upper triangular matrix
printf("Upper triangular matrix:
\n"); for(i=0; i<3; i++) { for(j=0; j<3;
j++) { if(i <= j) { printf("%d ",
matrix[i][j]);
        } else {
            printf("0 ");
        }
    }
    printf("\n");
}

// Print lower triangular matrix
printf("Lower triangular matrix: \n");
for(i=0; i<3; i++) {
    for(j=0; j<3; j++) {
        if(i >= j) { printf("%d ",
            matrix[i][j]);
        } else {
            printf("0 ");
        } }
    printf("\n");
}

return 0;
}
```

```
Compile Result

Sum of diagonal elements: 15
Upper triangular matrix:
1 2 3
0 5 6
0 0 9
Lower triangular matrix:
1 0 0
4 5 0
7 8 9

[Process completed - press Enter]
```

Q. 5 Write the program to find the frequency of odd and even elements in matrix.
Sol.-

```c
#include <stdio.h>

int main() {
    int matrix[3][3] = {{1, 2, 3},
                        {4, 5, 6},
                        {7, 8, 9}}; int i, j,
    oddCount = 0, evenCount = 0;

    // Count odd and even numbers
    for(i=0; i<3; i++) {
        for(j=0; j<3; j++) {
            if(matrix[i][j] % 2 == 0) {
                evenCount++;
            } else
                { oddCount++;
            }
        }
    }

    printf("Number of odd elements: %d\n", oddCount);
    printf("Number of even elements: %d\n", evenCount);

    return 0;
}
```

```
Compile Result

Number of odd elements: 5
Number of even elements: 4

[Process completed - press Enter]
```

Q. 6 Write the program to find sum of each row and sum of each column of matrix.
Sol.-

```c
#include <stdio.h>

int main() {
    int matrix[3][3] = {{1, 2, 3},
                        {4, 5, 6},
                        {7, 8, 9}};
    int i, j, rowSum,
```

```c
    colSum;

    // Sum of each row
    for(i=0; i<3; i++)
        { rowSum = 0;
        for(j=0; j<3; j++) {
            rowSum += matrix[i][j];
        }
        printf("Sum of row %d: %d\n", i+1, rowSum);
    }

    // Sum of each column
    for(i=0; i<3; i++)
        { colSum = 0;
        for(j=0; j<3; j++) {
            colSum += matrix[j][i];
        }
     printf("Sum of column %d: %d\n", i+1, colSum);
    }

    return 0;
}
```

```
Compile Result

Sum of row 1: 6
Sum of row 2: 15
Sum of row 3: 24
Sum of column 1: 12
Sum of column 2: 15
Sum of column 3: 18

[Process completed - press Enter]
```

Q. 7   Initialize a 2D array of 3*3 matrix. E.g.-

1	2	3
2	3	4
3	4	5

Sol.-
#include <stdio.h>

```c
int main() {
    int matrix[3][3] = {{1, 2, 3},
                        {2, 3, 4},
                        {3, 4, 5}};

    // Just to print the matrix
    for(int i=0; i<3; i++) {
        for(int j=0; j<3; j++) {
            printf("%d ", matrix[i][j]);
        }
        printf("\n");
    }

    return 0;
}
```
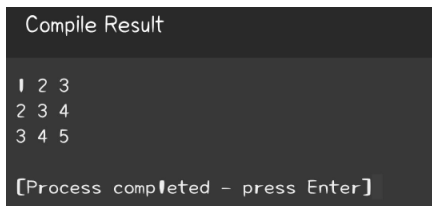
```
Compile Result

1 2 3
2 3 4
3 4 5

[Process completed - press Enter]
```

Q. 8   A square matrix, one having the same number of rows and columns, is called a diagonal matrix if it's only non-zero elements are on the diagonal from upper left to lower right. It is called upper triangular matrix if all elements bellow the diagonal are zeroes, and lower triangular matrix, if all the elements above the diagonal are zeroes. Write a program that reads a matrix and determines if it is one of the above mentioned three special matrices.

Sol.-

```c
#include<stdio.h>

int main(){

    int matrix[3][3] = {{1,0,0}, {0,2,0}, {0,0,3}};
    int i, j, diagonal = 1, upper = 1, lower = 1;

    for(i = 0; i < 3; i++){
        for(j = 0; j < 3; j++){

            if(i == j && matrix[i][j] == 0){
                diagonal = 0;
```

```c
            }

            if(i > j && matrix[i][j] != 0){
                upper = 0;
            }

            if(i < j && matrix[i][j] != 0){
                lower = 0;
            }

        }
    }

    if(diagonal == 1){
        printf("The matrix is a Diagonal matrix.\n");
    }
    else if(upper == 1){
        printf("The matrix is an Upper triangular matrix.\n");
    }
    else if(lower == 1){
        printf("The matrix is a Lower triangular matrix.\n");
    }
    else{
        printf("The matrix is not a special matrix.\n");
    }

    return 0;
}
```

```
Compile Result

The matrix is a Diagonal matrix.

[Process completed - press Enter]
```

Q. 9Write the program to check whether the matrix is sparse matrix or not.
Sol.-
```c
#include<stdio.h>

int main(){
    int matrix[3][3] = {{1,0,0}, {0,2,0}, {0,0,3}};
    int i, j, zeroCount = 0;
```

```c
    for(i = 0; i < 3;
      i++){ for(j = 0; j < 3;
      j++){
        if(matrix[i][j] == 0){
          zeroCount++;
        }
      }
    }

    if(zeroCount > ((3*3)/2)){
      printf("The given matrix is a sparse matrix.\n");
    }
    else{
      printf("The given matrix is not a sparse matrix.\n");
    }

    return 0;
}
```

```
Compile Result

The given matrix is a sparse matrix.

[Process completed - press Enter]
```

C- Programming Language

Week – 8

Programming Questions

Q. 1 Write a C program to create, initialize and use pointers.
Sol.#include<stdio.h>

```c
int main() {
    int num = 10; // Declare and initialize an

    integer int *ptr; // Declare an integer pointer

    ptr = &num; // Initialize pointer with address of

    num printf("Value of num: %d\n", num);

    printf("Address of num: %p\n", &num);

    printf("Value of pointer ptr: %p\n", ptr);

    printf("Value pointed to by ptr: %d\n", *ptr);

    return 0;
}
```

```
Compile Result

Value of num: 10
Address of num: 0x7ffb169598
Value of pointer ptr: 0x7ffb169598
Value pointed to by ptr: 10

[Process completed - press Enter]
```

Q. 2 Write a C program to add two numbers using pointers.
Sol.#include<stdio.h>

```c
int main() {
    int num1 = 5, num2 = 15, sum;
    int *ptr1, *ptr2;

    ptr1 = &num1; // Pointer to num1

    ptr2 = &num2; // Pointer to num2

    sum = *ptr1 + *ptr2; // Add two

    numbers printf("Sum = %d", sum);

    return 0;
}
```

```
Compile Result

Sum = 20
[Process completed - press Enter]
```

Q. 3 Write a C program to swap two numbers using pointers.
Sol.-

```c
#include <stdio.h>

void swap(int* n1, int* n2) {
    int temp;
    temp = *n1;
    *n1 = *n2;
    *n2 = temp;
}

int main() {
    int num1 = 10, num2 = 20;

    printf("Before swapping: num1 = %d, num2 = %d\n", num1,
    num2); swap(&num1, &num2); printf("After swapping: num1
    = %d, num2 = %d\n", num1, num2);

    return 0;
}
```

Q. 4 Write a C program to input and print array elements using pointer.
Sol.-
```c
#include <stdio.h>

int main() {
    int arr[5]; int *ptr = arr; //
    Pointer to the array
    int i;

    printf("Enter array elements: \n");
    for(i = 0; i < 5; i++) {
        scanf("%d", ptr);
        ptr++;
    }

    ptr = arr; // Reset pointer to start of array

    printf("Array elements are:
    \n"); for(i = 0; i < 5; i++)
    { printf("%d ", *ptr); ptr++;
    }

    return 0;
}
```

Q. 5 Write a C program to copy one array to another using pointer.
Sol.-
```c
#include <stdio.h>

int main() { int arr1[5] = {1,
```

```c
2, 3, 4, 5}; int arr2[5]; int
*ptr1 = arr1; int *ptr2 =
arr2;
int i;

// Copy arr1 to arr2
for(i = 0; i < 5; i++) {
    *(ptr2 + i) = *(ptr1 + i);
}

// Print arr2 elements
printf("Elements of arr2 are: \n");
for(i = 0; i < 5; i++) {
    printf("%d ", *(ptr2 + i));
}

return 0;
}
```

Compile Result

Elements of arr2 are:
1 2 3 4 5
[Process completed - press Enter]

Q. 6 Write a C program to swap two arrays using pointers.
Sol.-

```c
#include <stdio.h>

void swap_arrays(int *arr1, int *arr2, int n) {
    int i, temp;

    for (i = 0; i < n; i++) {
        temp = *(arr1 + i);
        *(arr1 + i) = *(arr2 + i);
        *(arr2 + i) = temp;
    }
}

int main() {
    int arr1[] = {1, 2, 3, 4, 5}; int arr2[]
    = {6, 7, 8, 9, 10}; int n =
    sizeof(arr1) / sizeof(arr1[0]); int i;
```
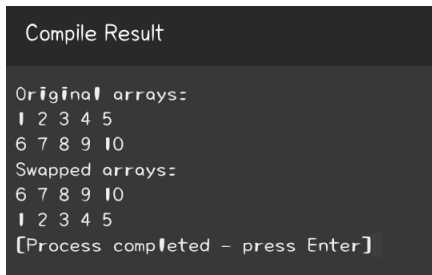
```c
    printf("Original arrays:\n"); for (i = 0;
    i < n; i++) printf("%d ", arr1[i]);
    printf("\n");
    for (i = 0; i < n; i++) printf("%d ", arr2[i]);
    printf("\n");

    swap_arrays(arr1, arr2, n);
    printf("Swapped arrays:\n"); for (i =
    0; i < n; i++) printf("%d ", arr1[i]);
    printf("\n");
    for (i = 0; i < n; i++) printf("%d ", arr2[i]);

    return 0;
}
```

```
Compile Result

Original arrays:
1 2 3 4 5
6 7 8 9 10
Swapped arrays:
6 7 8 9 10
1 2 3 4 5
[Process completed - press Enter]
```

Q. 7 Write a C program to reverse an array using pointers.
Sol.-
```c
#include <stdio.h>

void reverse_array(int *arr, int n) {
    int *start_ptr = arr; int
    *end_ptr = arr + n - 1;
    int temp;

    while (end_ptr > start_ptr)
      { temp = *start_ptr;
      *start_ptr = *end_ptr;
      *end_ptr = temp;
      start_ptr++; end_ptr--;
   }
}

int main() {
    int arr[] = {1, 2, 3, 4, 5}; int n =
    sizeof(arr) / sizeof(arr[0]); int
```

```c
    i;

    printf("Original array:\n");
    for (i = 0; i < n; i++)
    { printf("%d ", arr[i]);
    }

    reverse_array(arr, n);
    printf("\nReversed
    array:\n"); for (i = 0; i < n;
    i++) { printf("%d ", arr[i]);
    }

    return 0;
}
```

```
Compile Result

Original array:
1 2 3 4 5
Reversed array:
5 4 3 2 1
[Process completed - press Enter]
```

Q. 8 Write a C program to add two matrix using pointers.
Sol.-
```c
#include <stdio.h> #define SIZE

3 // Size of the matrix

void add_matrices(int *m1, int *m2, int *result, int
    size) { int i;
    for (i = 0; i < size * size; i++) {
        *(result + i) = *(m1 + i) + *(m2 + i);
    }
}

int main() {
    int m1[SIZE][SIZE] = {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}; int
    m2[SIZE][SIZE] = {{10, 11, 12}, {13, 14, 15}, {16, 17, 18}}; int
    result[SIZE][SIZE]; int i, j; add_matrices((int *)m1, (int
    *)m2, (int *)result, SIZE);
```
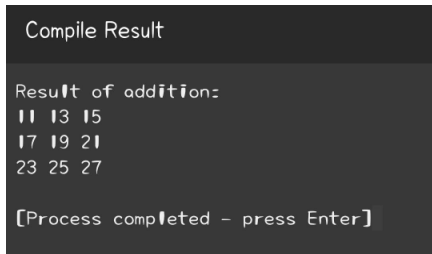
```c
    printf("Result of
    addition:\n"); for (i = 0; i <
    SIZE; i++) { for (j = 0; j <
    SIZE; j++) {
        printf("%d ", result[i][j]);
    }
    printf("\n");
    }
    return 0;
}
```

```
Compile Result

Result of addition:
11  13  15
17  19  21
23  25  27

[Process completed - press Enter]
```

Q. 9 Write a C program to multiply two matrix using pointers.
Sol.-

```c
#include <stdio.h>

#define SIZE 3 // Size of the matrices

void multiply_matrices(int *m1, int *m2, int *result, int size)
{
    int i, j, k; for (i = 0; i <
    size; i++) {
        for (j = 0; j < size; j++)
            { *(result + i*size + j) = 0;
            for (k = 0; k < size; k++) {
        *(result + i*size + j) += *(m1 + i*size + k) * *(m2 + k*size + j);
            }
        }
    }
}

int main() {
    int m1[SIZE][SIZE] = {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}; int
    m2[SIZE][SIZE] = {{10, 11, 12}, {13, 14, 15}, {16, 17, 18}}; int
    result[SIZE][SIZE]; int i, j; multiply_matrices((int *)m1,
    (int *)m2, (int *)result, SIZE);
```

```c
    printf("Result of
    multiplication:\n"); for (i = 0; i <
    SIZE; i++) {
        for (j = 0; j < SIZE; j++) {
            printf("%d ", result[i][j]);
        }
        printf("\n");
    }
    return 0;
}
```

Compile Result

```
Result of multiplication:
84 90 96
201 216 231
318 342 366

[Process completed - press Enter]
```

C- Programming Language

Week – 9

Programming Questions

Q. 1   Write a C program to Search string.
Sol.-
#include <stdio.h>
#include <string.h>

```c
int main() { char string[100],
    search[50]; int position;

    printf("Enter a string:\n");
    gets(string);

    printf("Enter the string to

    search:\n"); gets(search); char*

    ptr = strstr(string, search);

    if(ptr) {
        position = ptr - string; printf("Found at
        position: %d\n", position + 1);
    } else { printf("Not
        found.\n");
    }

    return 0;
}
```



```
Compile Result

Enter a string:
1
Enter the string to search:
2
Not found.

[Process completed – press Enter]
```

Q. 2   Write a C program to Reverse words in string.
Sol.-

```c
#include <stdio.h>
#include <string.h>

void reverse(char *begin, char *end) {
   char temp;

   while (begin < end)
     { temp = *begin;
      *begin++ = *end;
       *end-- = temp;
   }
}

void reverseWords(char *sentence) {
   char *word_begin = sentence;
   char *temp = sentence;

   while (*temp) {
      temp++; if
      (*temp == '\0') {
         reverse(word_begin, temp - 1);
      } else if (*temp == ' ')
         { reverse(word_begin, temp - 1);
         word_begin = temp + 1;
      }
   }

   reverse(sentence, temp - 1);
}

int main() {
   char sentence[100];

   printf("Enter a sentence: ");

   gets(sentence);

   reverseWords(sentence);

   printf("Reversed String: %s",
```

sentence); return 0;

}

Q. 3 Write a C program to count vowels, consonants, etc.
Sol.-

```c
#include <stdio.h>

int main()
   { char
   str[100];
   int vowels = 0, consonants = 0, digits = 0, spaces =
   0; int i = 0;

   printf("Enter a string:\n");
   gets(str);

   while(str[i] != '\0') { if((str[i] >= 'a' && str[i] <= 'z') || (str[i] >= 'A' && str[i] <= 'Z')) { if(str[i]
      == 'a' || str[i] == 'e' || str[i] == 'i' || str[i] == 'o' || str[i] == 'u' || str[i] == 'A' || str[i] == 'E'
|| str[i] == 'I' || str[i] == 'O' || str[i] == 'U')
            { vowels++;
         } else
            { consonants++;
         }
      } else if(str[i] >= '0' && str[i] <= '9')
         { digits++;
      } else if(str[i] == ' ')
         { spaces++;
      }

      i++;
   }

   printf("Vowels: %d\n", vowels);
   printf("Consonants: %d\n",
   consonants); printf("Digits: %d\n",
   digits); printf("Spaces: %d\n", spaces);
```

```c
    return 0;
}
```

Q. 4 Create a program to separate characters in a given string?
Sol.-

```c
#include <stdio.h>
#include <string.h>

int main()
{ char
str[100]; int
i;

printf("Enter a string: ");
gets(str);

for(i = 0; str[i] != '\0'; i++)
    { printf("%c ", str[i]);
}

return 0;
}
```

Q. 5 Write a program to take two strings from user and concatenate them also add a space between them using strcat() function.

Sample input: JAI
GLA

Sample output: JAI GLA
Sol.-
```c
#include <stdio.h>
#include <string.h>
int main() {
    char str1[50], str2[50];

    printf("Enter the first string: ");
    gets(str1);

    printf("Enter the second string: ");
    gets(str2);

    strcat(str1, " "); strcat(str1, str2);

    printf("\nThe concatenated string is: %s",

    str1);

    return 0;
}
```


Compile Result

Enter the first string: jai
Enter the second string: gla

The concatenated string is: jai gla
[Process completed – press Enter]

Q. 6 Write a C program to take a string from user and make it toggle its case i.e.

lower case to upper case and upper case to lower case.

Sample Input: HElLo wOrlD

Sample output: heLlO WoRLd
Sol.-
```c
#include <stdio.h>

int main() {
    char str[100];
    int i;

    printf("Enter a string: ");
```

```c
    gets(str);

    for(i = 0; str[i] != '\0'; i++) {
        if(str[i] >= 'A' && str[i] <= 'Z') {
            str[i] = str[i] + 32;
        }
        else if(str[i] >= 'a' && str[i] <= 'z')
            { str[i] = str[i] - 32;
        }
    }

    printf("Case toggled string: %s", str);

    return 0;
}
```

```
Compile Result

Enter a string: HEllO wOrLD
Case toggled string: heLLo WoRld
[Process completed - press Enter]
```

Q. 7   Write a C program to take two strings as input from user and check they are identical or not without using string functions.

Sample input: **Jai Gla**

Jai Gla

Sample output: Identical
Sol.-
#include <stdio.h>

int main() { char
    str1[100], str2[100]; int
    i, flag = 0;

    printf("Enter the first string: ");
    gets(str1);

    printf("Enter the second string: ");
    gets(str2);
```

```c
    for(i = 0; str1[i] != '\0' || str2[i] != '\0'; i++)
        { if(str1[i] != str2[i]) { printf("Not
        Identical\n"); flag = 1; break;
        }
    }
    if(flag == 0) {
        printf("Identical\n");
    }

    return 0;
}
```

```
Compile Result

Enter the first string: jai
Enter the second string: jai
Identical

[Process completed - press Enter]
```

Q. 8   Write a C program to take a list of a student's names from user by asking number of students and sort them alphabetical order.

Sample Input:

Bhisham

Jayant

Abhishek

Dhruv

Sample Output:

Abhishek

Bhisham

Dhruv

Jayant

Sol.-

```c
#include <stdio.h>
#include <string.h>
int main() { int i, j, n; char
    str[25][50], temp[50];

    printf("How many students? ");
    scanf("%d", &n);

    printf("Enter names of the students: ");
    for(i=0; i<n; i++) {
        scanf("%s", str[i]);
    }

    for(i=0; i<n-1; i++){
        for(j=i+1; j<n; j++){
            if(strcmp(str[i], str[j]) > 0) {
                strcpy(temp, str[i]);
                strcpy(str[i], str[j]);
                strcpy(str[j], temp);
            }
        }
    }

    printf("Names in Alphabetical Order: \n");
    for(i=0; i<n; i++) {
        printf("%s\n", str[i]);
    }

    return 0;
}
```

```
Compile Result

How many students? 4
Enter names of the students: Shoaib
Ayush
Puneet
Saurabh
Names in Alphabetical Order:
Ayush
Puneet
Saurabh
Shoaib

[Process completed - press Enter]
```

C- Programming Language

Week – 10

Programming Questions

Q. 1 Write a C program to find length of string using pointers.
Sol.
```c
#include<stdio.h>

int string_length(char* ptr) {
    int length = 0;
    while(*ptr != '\0') {
        length++;
        ptr++;
    }
    return length;
}

int main() {
    char str[50];

    printf("Enter a string: "); gets(str);

    printf("Length of the string: %d",

    string_length(str));

    return 0;
}
```

```
Compile Result

Enter a string: Programimg
Length of the string: 10
[Process completed - press Enter]
```

Q. 2 Write a C program to copy one string to another using pointer.
Sol.-
```c
#include <stdio.h> void copy_string(char
```

```c
*target, char *source) { while(*source)

{ *target = *source; source++; target++;

    }
    *target = '\0';
}

int main() {
    char source[100], target[100];

    printf("Enter source string: ");

    fgets(source, sizeof(source), stdin);

    copy_string(target, source);

    printf("Target string: %s", target);

    return 0;
}
```

```
Compile Result

Enter source string: Computer
Target string: Computer

[Process completed - press Enter]
```

Q. 3 Write a C program to concatenate two strings using pointers.
Sol.#include<stdio.h
>

```c
void concatenate(char* target, char* source) {
    while(*target) {
        target++;
    }

    while(*source)
        { *target =
        *source; target++;
        source++;
    }
    *target = '\0';
}
```

```
int main() {
    char source[100], target[100];

    printf("Enter first string: ");
    gets(target);

    printf("Enter second string: "); gets(source);

    concatenate(target, source); printf("String

    after concatenation: %s", target);

    return 0;
}
```



```
Compile Result

Enter first string: com
Enter second string: puter
String after concatenation: computer
[Process completed - press Enter]
```

Q. 4 Write a C program to compare two strings using pointers.
Sol.-
#include <stdio.h>

```
int compare_strings(char *str1, char *str2) {
    while(*str1 && (*str1 == *str2))
    {
        str1++;
        str2++;
    }
    return *str1 - *str2;
}

int main() {
    char str1[100], str2[100];

    printf("Enter first string: ");
    gets(str1);

    printf("Enter second string: ");

    gets(str2); int result =
```

```c
    compare_strings(str1, str2); if(result
    == 0) {
        printf("Strings are equal.");
    }
    else {
        printf("Strings are not equal.");
    }

    return 0;
}
```

Q. 5 WAP to find largest among three numbers using pointer

```c
Sol.#include
<stdio.h>

void find_largest(int *n1, int *n2, int *n3) {
    if(*n1 > *n2) {
        if(*n1 > *n3) {
            printf("The largest number is: %d", *n1);
        } else { printf("The largest number is:
            %d", *n3);
        }
    } else { if(*n2 >
        *n3) {
            printf("The largest number is: %d", *n2);
        } else { printf("The largest number is:
            %d", *n3);
        }
    }
}

int main() {
    int n1, n2, n3;

    printf("Enter first number: ");
```

```c
    scanf("%d", &n1);

    printf("Enter second number: ");
    scanf("%d", &n2);
    printf("Enter third number: ");

    scanf("%d", &n3);

    find_largest(&n1, &n2, &n3);

    return 0;
}
```

Compile Result

```
Enter first number: 34
Enter second number: 25
Enter third number: 67
The largest number is: 67
[Process completed - press Enter]
```

Q. 6 WAP to find largest among three numbers using pointer.
Sol.-

```c
#include <stdio.h>

void find_largest(int *n1, int *n2, int *n3) {
    if(*n1 > *n2) {
        if(*n1 > *n3) {
            printf("The largest number is: %d", *n1);
        } else { printf("The largest number is:
            %d", *n3);
        }
    } else { if(*n2 >
        *n3) {
            printf("The largest number is: %d", *n2);
        } else { printf("The largest number is:
            %d", *n3);
        }
    }
}

int main() {
    int n1, n2, n3;
```

```c
    printf("Enter first number: ");
    scanf("%d", &n1);

    printf("Enter second number:

    "); scanf("%d", &n2);

    printf("Enter third number: ");

    scanf("%d", &n3);

    find_largest(&n1, &n2, &n3);

    return 0;
}
```

```
Compile Result

Enter first number: 55
Enter second number: 67
Enter third number: 99
The largest number is: 99
[Process completed - press Enter]
```

Q. 7 WAP to find factorial of a number using pointer.
Sol.-
#include <stdio.h>

```c
void factorial(int *num, int *fact) {
    *fact = 1; for(int i = 1; i <=
    *num; i++) { *fact *= i;
    }
}

int main()
    { int num;
    int fact =
    1;

    printf("Enter a number: "); scanf("%d",

    &num); factorial(&num, &fact);

    printf("Factorial of %d = %d", num,

    fact);

    return 0;
```

```
}
```

Q. 8 Write a program to print largest even number present in an array using pointer to an array.

Sol.-

```c
#include <stdio.h>

void largest_even(int *arr, int n) {
    int largest = -1; for(int i = 0; i < n; i++) { if
    (*(arr+i) % 2 == 0 && *(arr+i) > largest)
    { largest = *(arr+i);
        }
    }
    if (largest != -1)
        printf("The largest even number is: %d", largest);
    else
        printf("No even number found");
}

int main() { int
    arr[100], n, i;

    printf("Enter the number of elements you want in array:
    "); scanf("%d", &n);

    printf("Enter elements in array :
    "); for(i = 0; i < n; i++)
    { scanf("%d", &arr[i]);
    }

    largest_even(arr, n);

    return 0;
}
```

Q. 9 WAP to find sum of elements of an array using array of pointer.
Sol.-

```
#include <stdio.h>
int main() { int arr[5] = {1,
    2, 3, 4, 5}; int *ptr[5];
    int sum = 0, i;

    for(i = 0; i < 5; i++){
ptr[i] = &arr[i]; // Assign the address of each of array element.
    }

    for(i = 0; i < 5; i++){
        sum += *ptr[i]; // Add the value at address stored in
        pointer.
    }

    printf("The sum of the array elements is: %d", sum);

    return 0;
}
```

Q. 10 WAP to compute simple interest using pointers.
Sol.-

```
#include <stdio.h>

void calculate_simple_interest(float *p, float *r, float *t,
    float *si) { *si = (*p * *r * *t) / 100;
}

int main() {
    float p, r, t, si;
```

```
printf("Enter principal amount: ");
scanf("%f", &p); printf("Enter rate of
interest: "); scanf("%f", &r);
printf("Enter time in years: ");
scanf("%f", &t);
calculate_simple_interest(&p, &r, &t,
&si); printf("The Simple Interest is:
 %.2f", si); return 0;
}
```

```
Compile Result

Enter principal amount: 1000
Enter rate of interest: 5
Enter time in years: 2
The Simple Interest is: 100.00
[Process completed - press Enter]
```

Q. 11 Write a program to print largest even number present in an array using pointer to an array.
Sol.-

```c
#include <stdio.h>

int find_largest_even(int *arr, int n) {
    int max_even = -1; for(int i = 0; i < n; i++)
    { if(arr[i] % 2 == 0 && arr[i] > max_even)
    {
        max_even = arr[i];
      }
    }
    return max_even;
}

int main() { int arr[5] = {2, 4, 1, 3, 5}; int
    max_even = find_largest_even(arr, 5);
    if(max_even != -1) {
        printf("The largest even number is: %d", max_even);
    } else { printf("No even number found in
        the array.");
    }
    return 0;
}
```

C- Programming Language

Week – 11

Programming Questions

Q. 1 Write a C function to return the maximum of three integers.
Sol.-
#include <stdio.h>

```c
int max_of_three(int a, int b, int c) {
    int max = a;
    if (b > max)
    {
        max = b;
    }
    if (c > max) {
        max = c;
    }
    return max;
}

int main() {
    int a = 3, b = 5, c = 7; int max =
    max_of_three(a, b, c); printf("The
    maximum value is: %d", max); return
    0;
}
```

Q. 2 Write a C function to check if a given number is prime or not.
Sol.-

```c
#include <stdio.h>

int is_prime(int num) {
    if(num <= 1)
        return 0;
    if(num <= 3)
        return 1;
        if(num % 2 ==
        0 || num % 3
        == 0) return 0;
    for(int i = 5; i * i <= num; i = i + 6)
        if(num % i == 0 || num % (i + 2) == 0)
            return 0;
    return 1;
}

int main() {
    int num = 17;
    if(is_prime(num))
        printf("%d is a prime number.", num);
    else
        printf("%d is not a prime number.", num);
    return 0;
}
```

Compile Result

17 is a prime number.
[Process completed - press Enter]

Q. 3Write a C function to compute the factorial of a non-negative integer.
Sol.-

```c
#include <stdio.h>

int factorial(int n) {
    if(n == 0)
        return 1;
    else
        return n * factorial(n-1);
}

int main() {
```

```c
    int num = 5;
    printf("The factorial of %d is: %d", num, factorial(num));
    return 0;
}
```

```
Compile Result

The factorial of 5 is: 120
[Process completed - press Enter]
```

Q. 4Write a C function to swap the values of two integers in actual arguments.
Sol.-
```c
#include <stdio.h>

void swap(int* a, int* b) {
    int temp = *a;
    *a = *b;
    *b = temp;
}

int main() {
    int a = 5, b = 10; printf("Before swapping: a =
     %d, b = %d\n", a, b); swap(&a, &b);
    printf("After swapping: a = %d, b = %d\n", a, b);
    return 0;
}
```

```
Compile Result

Before swapping: a = 5, b = 10
After swapping: a = 10, b = 5

[Process completed - press Enter]
```

Q. 5Write a C function to compute the sum and average of an array of integers.
Sol.-
```c
#include <stdio.h>

void sum_and_average(int arr[], int n, int* sum, float* avg) {
    *sum = 0; for(int i = 0;
    i < n; i++) { *sum +=
    arr[i];
    }
```

```c
    *avg = (float)(*sum) / n;
}

int main() {
    int arr[] = {1, 2, 3, 4, 5}; int n = sizeof(arr) /
    sizeof(arr[0]); int sum = 0; float avg = 0.0f;
    sum_and_average(arr, n, &sum, &avg);
    printf("Sum = %d, Average = %.2f", sum,
    avg); return 0;
}
```

```
Compile Result

Sum = 15, Average = 3.00
[Process completed - press Enter]
```

Q. 6   Write a C function to find the GCD (Greatest Common Divisor) of two nonnegative integers using Euclid's algorithm.
Sol.-
#include <stdio.h>

```c
int gcd(int a, int b) {
    if(b == 0)
        return a;
    else
        return gcd(b, a % b);
}

int main() {
    int num1 = 60, num2 = 48; printf("The GCD of %d and %d is: %d",
    num1, num2, gcd(num1, num2)); return 0;
}
```

```
Compile Result

The GCD of 60 and 48 is: 12
[Process completed - press Enter]
```

Q. 7   Write a C function to check if a given string is a valid palindrome, considering

only alphanumeric characters and ignoring cases.
Sol.-

```c
#include <stdio.h>
#include <string.h>
#include <ctype.h>

int isPalindrome(char* str) {
    int start = 0, end = strlen(str) - 1;

    while (start < end) {
        if (!isalnum(str[start])) {
            start++;
        } else if (!isalnum(str[end]))
            { end--;
        } else if (tolower(str[start]) != tolower(str[end]))
            { return 0;
        } else
            { start++;
            end--;
        }
    }
    return 1;
}

int main() {
    char str[] = "A man, a plan, a canal: Panama";

    if(isPalindrome(str)) {
        printf("The string is a palindrome\n");
    } else { printf("The string is not a
        palindrome\n");
    }
    return 0;
}
```

```
Compile Result

The string is a palindrome

[Process completed - press Enter]
```

Q. 8 Write a C function to calculate the sum and difference of two complex numbers.

Sol.-
```c
#include <stdio.h>

typedef struct
complex { float real;
float imag; } complex;

complex addComplex(complex n1, complex n2) {
    complex temp; temp.real =
    n1.real + n2.real; temp.imag =
    n1.imag + n2.imag; return
    temp;
}
complex subtractComplex(complex n1, complex n2) {
    complex temp; temp.real =
    n1.real - n2.real; temp.imag =
    n1.imag - n2.imag; return
    temp;
}

int main() {
    complex n1 = {1.0, 2.0}, n2 = {3.0, 4.0}, result;

    result = addComplex(n1, n2); printf("Sum = %.1f +
     %.1fi\n", result.real, result.imag);

    result = subtractComplex(n1, n2); printf("Difference =
     %.1f + %.1fi", result.real, result.imag);

    return 0;
}
```

```
Compile Result

Sum = 4.0 + 6.0i
Difference = -2.0 + -2.0i
[Process completed - press Enter]
```

H.O.T.S Questions

Q. 9 Write a C function to find the second largest and second smallest elements in an array of integers.

```c
Sol.-
#include <stdio.h>
#define SIZE 10
#define MAX 10000

void findSecondLargestSmallest(int arr[], int
    arrSize) { int i, first, second;

    if (arrSize < 2) { printf("
        Invalid Input ");
        return;
    }

    first = second = MAX;
    for (i = 0; i < arrSize; i++)
        { if (arr[i] < first)
        { second = first; first =
        arr[i];
        }
        else if (arr[i] < second && arr[i] != first)
            second = arr[i];
    }

    printf("The smallest element is %d and second smallest element is %d\n", first, second);

    first = second = -MAX;
    for (i = 0; i < arrSize; i++)
    { if (arr[i] > first)
    { second = first; first =
    arr[i];
        }
        else if (arr[i] > second && arr[i] != first)
            second = arr[i];
    }

    printf("The largest element is %d and second largest element is %d", first, second);
}

int main() {
    int numbers[SIZE], i;

    printf("Enter 10 numbers:\n");
```

```c
    for(i = 0; i < SIZE; i++) {
        scanf("%d", &numbers[i]);
    }

    findSecondLargestSmallest(numbers, SIZE);

    return 0;
}
```

```
Compile Result

Enter 10 numbers:
1 2 3 4 5 6 7 8 9 10
The smallest element is 1 and second s
mallest element is 2
The largest element is 10 and second l
argest element is 9
[Process completed - press Enter]
```

Q. 10 Write a C function to find the number of occurrences of each unique element in an array.
Sol.-
```c
#include <stdio.h>
#define MAX_SIZE 100

void findElementCount(int arr[], int len) {
    int count[MAX_SIZE] = {0};

    for(int i = 0; i < len; i++)
        { count[arr[i]]++;
    }

    for(int i = 0; i < len; i++) { if(count[arr[i]] != 0)
        { printf("%d occurs %d times\n", arr[i],
        count[arr[i]]); count[arr[i]] = 0;
        }
    }
}

int main() {
    int numbers[MAX_SIZE], num, i;

    printf("Enter number of elements to be stored in the
    array: "); scanf("%d", &num);

    printf("Enter elements in array :
```

```c
    \n"); for(i = 0; i < num; i++)
    { scanf("%d", &numbers[i]);
    }

    findElementCount(numbers, num);

    return 0;
}
```

```
Compile Result

Enter number of elements to be stored
in the array: 8
Enter elements in array :
1 1 3 4 5 6 4 3
1 occurs 2 times
3 occurs 2 times
4 occurs 2 times
5 occurs 1 times
6 occurs 1 times

[Process completed - press Enter]
```