Question 1)

```
#include <iostream>
using namespace std;
int main() {
   int arr[5] = {1, 2, 3, 4, 5};
   int size = 5;
   int sum = 0;
   for (int i = 0; i < size; i++) {
      sum += arr[i];}
   int average = sum / size;
   cout << "The average is: " << average << endl;
return 0;}
```

```
The average is: 3


=== Code Execution Successful ===
```

Question 2)

```
#include <iostream>
using namespace std;
int main() {
   int arr[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
   int size = 10;
   int evenCount = 0;
   int oddCount = 0;
   for (int i = 0; i < size; i++) {
      if (arr[i] % 2 == 0) {
         evenCount++;
      } else {
         oddCount++;}}
   cout << "Number of even elements: " << evenCount
<< endl;
   cout << "Number of odd elements: " << oddCount << endl;
   return 0;}
```

```
Number of even elements: 5
Number of odd elements: 5


=== Code Execution Successful ===
```

Question 3)

```
#include <iostream>
using namespace std;
int main() {
   int arr[5] = {1, 2, 3, 4, 5};
   int size = 5;
   for (int i = 0; i < size / 2; i++) {
      int temp = arr[i];
      arr[i] = arr[size - i - 1];
      arr[size - i - 1] = temp;}
   for (int i = 0; i < size; i++) {
      cout << arr[i] << " ";}
   cout << endl;
   return 0;}
```

```
5 4 3 2 1


=== Code Execution Successful ===
```

Question 4)

```
#include <iostream>
using namespace std;
bool isSorted(int arr[], int size) {for (int i = 0; i < size - 1; i++) {
      if (arr[i] > arr[i + 1]) {
         return false;}}
   return true;}
int main() {
   int arr[5] = {1, 2, 3, 4, 5};
   int size = 5;
   if (isSorted(arr, size)) {
```

```
The array is sorted in ascending order


=== Code Execution Successful ===
```

```
    cout << "The array is sorted in ascending order." << endl;
  } else {
    cout << "The array is not sorted in ascending order." << endl;}
return 0;}
```

Question 5)

```
#include <iostream>
using namespace std;
int main(){
  int index=0;
  int arr1[5] = {1,2,3,4,5};
  int arr2[5] = {6,7,8,9,10};
  int arr[100];
  for(int i = 0; i<5; i++){
    arr[i] = arr1[i];
    index = i;}
  for(int j = 0; j<5; j++){
    arr[ index + j ] = arr2[j];}
  for(int k = 0; k<9; k++){
    cout<<arr[k];}}
```

```
1234678910

=== Code Execution Successful ===
```

Question 6)

```
#include <iostream>
using namespace std;
void insertElement(int arr[], int &n, int element, int position) {
  for (int i = n; i >= position; i--) {
    arr[i] = arr[i - 1];}
  arr[position - 1] = element;
  n++;}
void deleteElement(int arr[], int &n, int
position) {
  for (int i = position - 1; i < n - 1; i++) {
    arr[i] = arr[i + 1];}
  n--;}
int main() {
  int arr[100], n, element, position, choice;
  cout << "Enter the number of elements in
the array: ";
  cin >> n;
  cout << "Enter the elements of the
array:\n";
  for (int i = 0; i < n; i++) {
    cin >> arr[i];}
  cout << "Enter 1 to insert or 2 to delete: ";
  cin >> choice;
  if (choice == 1) {
    cout << "Enter the element to insert and its position: ";
    cin >> element >> position;
    insertElement(arr, n, element, position);
  } else if (choice == 2) {
    cout << "Enter the position to delete: ";
    cin >> position;
    deleteElement(arr, n, position);}
  cout << "Array after operation:\n";
  for (int i = 0; i < n; i++) {
    cout << arr[i] << " ";}
  return 0;}
```

```
Enter the number of elements in the array: 5
Enter the elements of the array:
1 2 3 4 5
Enter 1 to insert or 2 to delete: 2
Enter the position to delete: 2
Array after operation:
1 3 4 5

=== Code Execution Successful ===
```

Question 7)

```
#include <iostream>
using namespace std;
bool isPrime(int num) {
   if (num <= 1)
      return false;
   for (int i = 2; i * i <= num; i++) {
      if (num % i == 0)
         return false;}
   return true;}
int main() {
   int n;
   cout << "Enter the number of elements in the array: ";
   cin >> n;
   int arr[100];
   cout << "Enter the elements of the array:\n";
   for (int i = 0; i < n; i++) {
      cin >> arr[i];}
   cout << "Prime numbers in the array are:\n";
   for (int i = 0; i < n; i++) {
      if (isPrime(arr[i])) {
         cout << arr[i] << " ";}}
   return 0;}
```

```
Enter the number of elements in the array: 10
Enter the elements of the array:
4 5 6 3 2 4 9 7 124 53221
Prime numbers in the array are:
5 3 2 7

=== Code Execution Successful ===
```

Question 8)

```
#include <iostream>
using namespace std;
int main(){
   int arr[100], size, key, start = 0, flag = 0;
   cout<<"Enter the number of elements you want: ";
   cin>> size;
   cout<<"Enter the elements: ";
   for(int i=0; i < size; i++){
      cin>>arr[i];}
   int end = size-1;
   cout<<"Enter the element you want to search: ";
   cin>>key;
   while (start <= end) {
      int mid = (start + end) / 2;
      if (arr[mid] == key) {
         cout << "Element is present at index: " << mid;
         flag = 1;
         break;
      } else if (arr[mid] > key) {
         end = mid - 1;
      } else {
         start = mid + 1;  }}
   if(flag==0){
      cout<<"Element not found";}}
```

```
Enter the number of elements you want: 5
Enter the elements: 3 4 5 6 7
Enter the element you want to search: 4
Element is present at index: 1

=== Code Execution Successful ===
```

Question 9)

```
Enter the number of elements in the array: 5
Enter the elements of the array:
2 3 412 1 3
Element 2 occurs 1 times
Element 3 occurs 2 times
Element 412 occurs 1 times
Element 1 occurs 1 times


=== Code Execution Successful ===
```

```
#include <iostream>
using namespace std;
int main() {
   int n;
   cout << "Enter the number of elements in array: ";
   cin >> n;
   int arr[100];
   cout << "Enter the elements of the array:\n";
   for (int i = 0; i < n; i++) {
      cin >> arr[i];}
   for (int i = 0; i < n; i++) {
      int count = 1;
      if (arr[i] == -1) continue;        for (int j = i + 1; j < n;
j++) {
         if (arr[i] == arr[j]) {
            count++;
            arr[j] = -1; }}
      cout << "Element " << arr[i] << " occurs " << count << " times\n";}
   return 0;}
```

Question 10)

```
#include <iostream>
using namespace std;
int main() {
   int n1, n2;
   cout << "Enter the number of elements in the first array: ";
   cin >> n1;
   int arr1[100];
   cout << "Enter the elements of the first array:\n";
   for (int i = 0; i < n1; i++) {
      cin >> arr1[i];}
   cout << "Enter the number of elements in the second array: ";
   cin >> n2;
   int arr2[100];
   cout << "Enter the elements of the second array:\n";
   for (int i = 0; i < n2; i++) {
      cin >> arr2[i];}
   cout << "Common elements are:\n";
   for (int i = 0; i < n1; i++) {
      for (int j = 0; j < n2; j++) {
         if (arr1[i] == arr2[j]) {
            cout << arr1[i] << " ";
            break;}}}
   return 0;}
```

```
Enter the number of elements in the first array: 3
Enter the elements of the first array:
1 2 3
Enter the number of elements in the second array: 4
Enter the elements of the second array:
3 2 4 5
Common elements are:
2 3
```

Question 11)

```
#include <iostream>
using namespace std;
int main() {
   int n;
   cout << "Enter the number of elements in the array: ";
   cin >> n;
   int arr[100];
   cout << "Enter the elements of the array:\n";
```

```
  for (int i = 0; i < n; i++) {
    cin >> arr[i];}
  int count = 0;
  for (int i = 0; i < n; i++) {
    if (arr[i] != 0) {
      arr[count++] = arr[i]; }}
  while (count < n) {
    arr[count++] = 0;}
  cout << "Array after shifting zeros to the end:\n";
  for (int i = 0; i < n; i++) {
    cout << arr[i] << " ";}
  return 0;}
```

```
Enter the number of elements in the array: 6
Enter the elements of the array:
1 0 2 3 0 4
Array after shifting zeros to the end:
1 2 3 4 0 0
```

Question 12)

```
#include <iostream>
using namespace std;
bool isSubset(int arr1[], int size1, int arr2[], int size2) {
  for (int i = 0; i < size2; i++) {
    bool found = false;
    for (int j = 0; j < size1; j++) {
      if (arr2[i] == arr1[j]) {
        found = true;
        break;}}
    if (!found) {
      return false;}}
  return true;}
int main() {
  int n1, n2;
  cout << "Enter the number of
elements in the first array: ";
  cin >> n1;
  int arr1[100];
  cout << "Enter the elements of the first array:\n";
  for (int i = 0; i < n1; i++) {
    cin >> arr1[i];}
  cout << "Enter the number of elements in the second array: ";
  cin >> n2;
  int arr2[100];
  cout << "Enter the elements of the second array:\n";
  for (int i = 0; i < n2; i++) {
    cin >> arr2[i];}
  if (isSubset(arr1, n1, arr2, n2)) {
    cout << "The second array is a subset of the first array.\n";
  } else {
    cout << "The second array is not a subset of the first array.\n";}
  return 0;}
```

```
Enter the number of elements in the first array: 5
Enter the elements of the first array:
1 2 3 4 5
Enter the number of elements in the second array: 2
Enter the elements of the second array:
2 3
The second array is a subset of the first array.
```

Question 13)

```
#include <iostream>
using namespace std;
void reverse(int arr[], int start, int end) {
  while (start < end) {
    int temp = arr[start];
    arr[start] = arr[end];
    arr[end] = temp;
    start++;
    end--;}}
void rotateLeft(int arr[], int size, int n) {
```

```
  n = n % size;
  reverse(arr, 0, n - 1);
  reverse(arr, n, size - 1);
  reverse(arr, 0, size - 1);}
int main() {
  int size, n;
  cout << "Enter the number of
elements in the array: ";
  cin >> size;
  int arr[100];
  cout << "Enter the elements of the array:\n";
  for (int i = 0; i < size; i++) {
    cin >> arr[i];}
  cout << "Enter the number of positions to rotate the array left: ";
  cin >> n;
  rotateLeft(arr, size, n);
  cout << "Array after rotation:\n";
  for (int i = 0; i < size; i++) {
    cout << arr[i] << " ";}
  return 0;}
```

```
Enter the number of elements in the array: 4
Enter the elements of the array:
1 2 3 4
Enter the number of positions to rotate the array left: 2
Array after rotation:
3 4 1 2
```

Question 14)

```
#include <iostream>
using namespace std;
int main() {
  int size;
  cout << "Enter the number of elements in the array: ";
  cin >> size;
  int arr[100];
  cout << "Enter the elements of the array:\n";
  for (int i = 0; i < size; i++) {
    cin >> arr[i];}
  int sum = 0;
  for (int i = 0; i < size; i++) {
    sum += arr[i];}
  double mean = (double)sum / size;
  for (int i = 0; i < size - 1; i++) {
    for (int j = i + 1; j < size; j++) {
      if (arr[i] > arr[j]) {
        int temp = arr[i];
        arr[i] = arr[j];
        arr[j] = temp;}}}
  double median;
  if (size % 2 == 0) {
    median = (arr[size / 2 - 1] + arr[size / 2]) / 2.0;
  } else {
    median = arr[size / 2];}
  int frequency[100] = {0};
  int maxFrequency = 0;
  int mode = arr[0];
  for (int i = 0; i < size; i++) {
    frequency[arr[i]]++;}
  for (int i = 0; i < size; i++) {
    if (frequency[arr[i]] > maxFrequency) {
      maxFrequency = frequency[arr[i]];
      mode = arr[i];}}
  cout << "Mean: " << mean << endl;
  cout << "Median: " << median << endl;
```

```
Enter the number of elements in the array: 5
Enter the elements of the array:
1 2 3 3 4
Mean: 2.6
Median: 3
Mode: 3
```

```
  cout << "Mode: " << mode << endl;
  return 0;}
```

Question 15)

```
#include <iostream>
using namespace std;
int main() {
  int rows, cols, scalar;
  cout << "Enter the number of rows in the matrix: ";
  cin >> rows;
  cout << "Enter the number of columns in the matrix: ";
  cin >> cols;
  cout << "Enter the scalar value: ";
  cin >> scalar;
  int matrix[100][100];
  cout << "Enter the elements of the matrix:\n";
  for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
      cin >> matrix[i][j];}}
  cout << "Matrix after scalar multiplication:\n";
  for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
      cout << matrix[i][j] * scalar << " ";}
    cout << endl;}
  return 0;}
```

```
Enter the number of rows in the matrix: 3
Enter the number of columns in the matrix: 3
Enter the scalar value: 3
Enter the elements of the matrix:
1 2 3 4 5 6 7 8 9
Matrix after scalar multiplication:
3 6 9
12 15 18
21 24 27
```

Question 16)

```
#include <iostream>
using namespace std;
int main() {
  int rows, cols;
  cout << "Enter the number of rows and columns for the matrices: ";
  cin >> rows >> cols;
  int matrix1[100][100], matrix2[100][100], result[100][100];
  cout << "Enter the elements of the first matrix:\n";
  for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
      cin >> matrix1[i][j];}}
  cout << "Enter the elements of the second matrix:\n";
  for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
      cin >> matrix2[i][j];}}
  cout << "Matrix addition:\n";
  for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
      result[i][j] = matrix1[i][j] + matrix2[i][j];
      cout << result[i][j] << " ";}
    cout << endl;}
  cout << "Matrix subtraction:\n";
  for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
      result[i][j] = matrix1[i][j] - matrix2[i][j];
      cout << result[i][j] << " ";}
    cout << endl;}
  cout << "Enter the number of columns for the second matrix for multiplication: ";
  int cols2;
  cin >> cols2;
```

```
int matrix3[100][100];
cout << "Enter the elements of the second matrix for multiplication:\n";
for (int i = 0; i < cols; i++) {
   for (int j = 0; j < cols2; j++) {
      cin >> matrix3[i][j];}}
cout << "Matrix multiplication:\n";
for (int i = 0; i < rows; i++) {
   for (int j = 0; j < cols2; j++) {
      result[i][j] = 0;
      for (int k = 0; k < cols; k++) {
         result[i][j] += matrix1[i][k] * matrix3[k][j];}
      cout << result[i][j] << " ";}
   cout << endl;}
return 0;}
```

OUTPUT

```
Enter the number of rows and columns for the matrices: 3 3
Enter the elements of the first matrix:
1 2 3 4 5 6 7 8 9
Enter the elements of the second matrix:
9 8 7 6 5 4 3 2 1
Matrix addition:
10 10 10
10 10 10
10 10 10
Matrix subtraction:
-8 -6 -4
-2 0 2
4 6 8
Enter the number of columns for the second matrix for multiplication: 3
Enter the elements of the third matrix for multiplication:
1 2 3
4 5 6
7 8 9
Matrix multiplication:
30 36 42
66 81 96
102 126 150
```

Question 17)

```
#include <iostream>
using namespace std;
int main() {
   int rows, cols;
   cout << "Enter the number of rows and columns of the matrix: ";
   cin >> rows >> cols;
   int matrix[100][100], transpose[100][100];
   cout << "Enter the elements of the matrix:\n";
   for (int i = 0; i < rows; i++) {
      for (int j = 0; j < cols; j++) {
         cin >> matrix[i][j];}}
   for (int i = 0; i < rows; i++) {
      for (int j = 0; j < cols; j++) {
         transpose[j][i] = matrix[i][j];}}
   cout << "Transpose of the
matrix:\n";
   for (int i = 0; i < cols; i++) {
      for (int j = 0; j < rows; j++) {
         cout << transpose[i][j] << " ";}
      cout << endl;}
   return 0;}
```

```
Enter the number of rows and columns of the matrix: 3 3
Enter the elements of the matrix:
1 2 3 4 5 6 7 8 9
Transpose of the matrix:
1 4 7
2 5 8
3 6 9
```

Question 18)

```
#include <iostream>
using namespace std;
bool isSymmetric(int matrix[100][100], int size) {
   for (int i = 0; i < size; i++) {
      for (int j = 0; j < size; j++) {
         if (matrix[i][j] != matrix[j][i]) {
            return false;}}}
   return true;}
bool areEqual(int matrix1[100][100], int matrix2[100][100], int rows, int cols) {
   for (int i = 0; i < rows; i++) {
      for (int j = 0; j < cols; j++) {
         if (matrix1[i][j] != matrix2[i][j]) {
            return false;}}}
   return true;}
int main() {
   int rows, cols;
   cout << "Enter the number of rows and columns of the matrix: ";
   cin >> rows >> cols;
   int matrix1[100][100], matrix2[100][100];
   cout << "Enter the elements of the first matrix:\n";
   for (int i = 0; i < rows; i++) {
      for (int j = 0; j < cols; j++) {
         cin >> matrix1[i][j];}}
   cout << "Enter the elements of the second matrix:\n";
   for (int i = 0; i < rows; i++) {
      for (int j = 0; j < cols; j++) {
         cin >> matrix2[i][j];}}
   if (rows == cols) {
      if (isSymmetric(matrix1, rows)) {
         cout << "The first matrix is symmetric.\n";
      } else {
```

```
Enter the number of rows and columns of the matrix: 3 3
Enter the elements of the first matrix:
1 2 3 4 5 6 7 8 9
Enter the elements of the second matrix:
1 2 3 4 5 6 7 8 9
The first matrix is not symmetric.
The two matrices are equal.
```

```
        cout << "The first matrix is not symmetric.\n";}
    } else {
        cout << "The first matrix is not symmetric (not a square matrix).\n";}
    if (areEqual(matrix1, matrix2, rows, cols)) {
        cout << "The two matrices are equal.\n";
    } else {
        cout << "The two matrices are not equal.\n";}
    return 0;}
```

Question 19)

```
#include <iostream>
using namespace std;
int main() {
    int size;
    cout << "Enter the number of rows/columns of the square matrix: ";
    cin >> size;
    int matrix[100][100];
    int trace = 0;
    cout << "Enter the elements of the matrix:\n";
    for (int i = 0; i < size; i++) {
        for (int j = 0; j < size; j++) {
            cin >> matrix[i][j];}}
    for (int i = 0; i < size; i++) {
        trace += matrix[i][i];}
    cout << "Trace of the matrix: " << trace << endl;
    return 0;}
```

OUTPUT

```
Enter the number of rows/columns of the square matrix: 3 3
Enter the elements of the matrix:
1 2 3 4 5 6 7 8 9
Trace of the matrix: 15
```

Question 20)

```
#include <iostream>
using namespace std;

int main() {
    int matrix[2][2];
    int determinant;
    cout << "Enter the elements of the 2x2 matrix:\n";
    for (int i = 0; i < 2; i++) {
        for (int j = 0; j < 2; j++) {
            cin >> matrix[i][j];}}
    determinant = matrix[0][0] * matrix[1][1] - matrix[0][1] * matrix[1][0];
    cout << "Determinant of the matrix: " << determinant << endl;
    return 0;}
```

```
Enter the elements of the 2x2 matrix:
1 2 3 4
Determinant of the matrix: -2
```