OOP

A Key to Programming Exercises of Object-Oriented Programming using C++

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IT Series

KEY TO

Object-Oriented Programming

using

C++

2nd Edition

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IT Series Publications

Published by: IT Series Publications
Mob: (+92) 0321 661 56 56

Price: Rs. **100/-**

Can be had from:

Kitab Markaz
Aminpur Bazar,
Faisalabad, Pakistan.
Ph: +92-041-2642707

Imtiaz Book Depot
Urdu Bazar,
Lahore, Pakistan.
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Preface

The book **"Key to Object-Oriented Programming using C++"** is written to provide the exercise solutions of the book **"Object-Oriented Programming using C++"**. All exercises are solved for the students so that they may use it as a reference and get help in understanding complex questions. However, the students are advised to try to solve the exercises by themselves before using this book in order to improve their programming skills.

Readers are welcome to send suggestions for improvements of the book by sending email to us at **comments@itseries.edu.pk**. You can also visit **www.itseries.com.pk** for any interaction and latest information about the book.

Authors

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CHAPTER 4

INPUT AND OUTPUT

Q.1. Write a program that prints a text of 4 lines consisting of characters, integer values and floating-point values using cout statement.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int marks = 786;
  float avg = 89.75;
  char grade = 'A';
  clrscr();
  cout<<"I am Usman Khalil: "<<endl;
  cout<<"My total marks are: "<<marks<<endl;
  cout<<"My average is: "<< avg<<endl;
  cout<<"My grade is: "<< grade;
  getch();
}
```

Q.2. Write a program that inputs radius of sphere from user. It calculates its volume and surface area using the formula Area = $4\pi R^2$ and circumference = $4/3\pi R^3$ where π=3.14.

```
#include <iostream.h>
#include<iomanip.h>
#include <conio.h>
void main()
{
  float r, area, cir;
  clrscr();
  cout<<"Enter radius: ";
  cin>>r;
  area = 4.0 * 3.14 * r * r;
  cir = (4.0/3.0) * 3.14 * r * r * r;
  cout<<"Area is:"<<setprecision(2)<< area<<endl;
  cout<<"Circumference is:"<<setprecision(2)<<cir;
  getch();
}
```

Q.3. Write a program to find out the area of triangle when three sides a, b and c of the triangle are given. Use appropriate statements to input the values of a, b and c from the keyboard. Formula for the area of triangle is as follows:

$$\text{Area} = \sqrt{s\,(s-a)\,(s-b)(s-c)}$$

where $s = (a + b + c) / 2$.

```
#include <iostream.h>
#include <math.h>
#include<conio.h>
void main()
{
  float a, b, c;
  double s, area;
  clrscr();
  cout<<"Enter side A: ";
  cin>>a;
  cout<<"Enter side B: ";
  cin>>b;
  cout<<"Enter side C: ";
  cin>>c;
  s = (a + b + c) / 2.0;
  area = sqrt(s * (s - a) * (s - b) * (s - c));
  cout<<"Area of triangle is:"<<area;
  getch();
}
```

Q.4. Write a program that inputs miles from the user and convert miles into kilometers. One mile is equal to 1.609 kilometer.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  float kilo;
  int miles;
  clrscr();
  cout<<"Enter miles: ";
  cin>>miles;
  kilo = 1.609 * miles;
  cout<<miles<<" miles: "<<kilo<<" kilometers";
  getch();
}
```

Q.5. Write a program that inputs 4 numbers and calculates the sum, average, and product of all the numbers.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int a, b, c, d, sum, product;
  float avg;
  clrscr();
  cout<<"Enter 4 numbers:";
  cin>>a>>b>>c>>d;
  sum = a + b + c + d;
  product = a * b * c * d;
  avg = sum / 4.0;
  cout<<"Sum of all numbers: "<< sum<<endl;
  cout<<"Product of all numbers: "<<product<<endl;
  cout<<"Average of all numbers: "<<avg<<endl;;
  getch();
}
```

Q.6. Write a program that inputs age in years and displays age in days and months.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int age, months, days;
  clrscr();
  cout<<"Enter age in years:";
  cin>>age;
  months = age * 12;
  days = age * 365;
  cout<<"Age in months:"<<months<<endl;
  cout<<"Age in days: "<<days;
  getch();
}
```

Q.7. Write a program that inputs a number from user and displays its square and cube.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, s, c;
  clrscr();
```

```
    cout<<"Enter a number:";
    cin>>n;
    s = n * n;
    c = n * n * n;
    cout<<"Square is: "<< s<<endl;
    cout<<"Cube is: "<< c<<endl;
    getch();
}
```

Q.8. Write a program that inputs total pages of a book, number of pages a person reads in one day and number of days a person has read the book. It displays number of pages that have been read and number of pages remaining.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int pages, pagesDaily, days, remaining, completed;
  clrscr();
  cout<<"Enter total pages of book: ";
  cin>>pages;
  cout<<"How many pages you read daily? ";
  cin>>pagesDaily;
  cout<<"How many days you read the book? ";
  cin>>days;
  completed = days * pagesDaily;
  remaining = pages – completed;
  cout<<"You have read "<<completed<<" pages."<<endl;
  cout<<"Remaining pages are "<< remaining;
  getch();
}
```

Q.9. A car can travel 5.3 miles in 1 liter. Write a program that inputs petrol in liters and displays how much distance the car can cover using the available petrol.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  float distance, liters;
  clrscr();
  cout<<"Enter petrol in liters: ";
  cin>>liters;
  distance = liters * 5.3;
  cout<<"Car can cover "<<distance<<" miles in "<<liters<<" liters.";
  getch();
}
```

Q.10. Write a program that inputs total number of student in a class and fee per student. It displays total fee collected from the class.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int fee, students;
  long total;
  clrscr();
  cout<<"Enter total students: ";
  cin>>students;
  cout<<"Enter fee per student: ";
  cin>>fee;
  total = students * fee;
  cout<<"Total fee = "<< total;
  getch();
}
```

Q.11. Write a program that inputs temperature from the user in Fahrenheit and converts it into Celsius degree using formula C = 5/9 (F – 32).

```
#include <iostream.h>
#include <conio.h>
void main()
{
  float cel, faren;
  clrscr();
  cout<<"Enter temperature in farenheit: ";
  cin>>faren;
  cel = 5.0 / 9.0 * ( faren – 32);
  cout<<"Temperature in celcius is "<<cel;
  getch();
}
```

Q.12. Write a program that inputs a 3-digit number and displays its digits in separate three lines. For example if the user enters 123, the program displays the output as follows:

```
1
2
3
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, a, b, c;
  clrscr();
```

```
    cout<<"Enter a 3-digit number: ";
    cin>>n;
    a = n / 100;
    n = n % 100;
    b = n / 10;
    c = n % 10;
    cout<< a<<endl;
    cout<< b<<endl;
    cout<<c<<endl;
    getch();
}
```

Q.13. Write a program to show following output using one cout statement:

```
1    2    3    4    5
6    7    8    9    10
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  cout<<"1 2 3 4 5 \n6 7 8 9 10";
  getch();
}
```

Q.14. Write a program to calculate the volume (V) of a cube by taking measures from the user. (Formula: V = length * width * height)

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>
void main()
{
  clrscr();
  float len, wid, ht  v;
  cout<<"Enter length: ";
  cin>>len;
  cout<<"Enter width: ";
  cin>>wid;
  cout<<"Enter height: ";
  cin>>ht;
  v = len * wid * ht;
  cout<<"Volume of cube: "<<setprecision(2)<<v;
  getch();
}
```

Q.15. Write a program that inputs the x, y coordinates for two points and computes the distance between two points using the formula:

$$\text{Distance} = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

```
#include <iostream.h>
#include<conio.h>
#include<iomanip.h>
#include <math.h>
void main()
{
  clrscr();
  cout << "Enter first point x1 and y1: ";
  double x1, y1;
  cin >> x1 >> y1;
  cout << "Enter second x2 and y2: ";
  double x2, y2;
  cin >> x2 >> y2;
  double distance = pow((x1 - x2) * (x1 - x2) + (y1 - y2) * (y1 - y2), 0.5);
  cout <<"Distance of two points is: "<<setprecision(2)<< distance;
  getch();
}
```

Q.16. Write a program to swap the values of three variables with using fourth variable.

```
#include<iostream.h>
#include<conio.h>
#include<stdio.h>
void main()
{
  clrscr();
  int x, y, z;
  cout<< "\n Enter 3 numbers : ";
  cin>> x >> y >> z ;
  cout<<"\n Old values :\n";
  cout << "x = " << x << " y = " << y << "z = " << z ;
  x = x+y+z;
  y = x - (y+z);
  z = x - (y+z);
  x = x - (y + z);
  cout<<"\n New values :\n";
  cout << "x = " << x << " y = " << y << "z = " << z ;
  getch();
}
```

Q.17. Write a program that calculates the arc of length of a convex lens by taking radius of arc and angle made by arc.
(Formula: length = radius * angle)

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  float length, radius, angle;
  cout<<"Enter radius: ";
  cin>>radius;
  cout<<"Enter angle: ";
  cin>>angle;
  length = radius * angle;
  cout<<"Length = "<<length;
  getch();
}
```

Q.18. Write a program that inputs pounds from the user and converts it into kilograms.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  double pounds, kilograms;
  cout << "Enter the number of pounds: ";
  cin >> pounds;
  kilograms = pounds/2.205;
  cout << pounds << " pounds = " << kilograms << " kilograms \n";
  getch();
}
```

Q.19. Write a program that computes the area of a sector of a circle when theta is the angle in radians between the radii.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  double theta, r, area;
  cout << "Enter length of radii and angle in radians between them: ";
  cin >> r >> theta;
  area = (r*r*theta)/2.0;
  cout << "The area of sector is " << area << endl;
  getch();
}
```

Q.20. Write a program that reads a positive number and then computes the logarithm of that value to the base 2.

```
#include <iostream.h>
#include<conio.h>
#include <math.h>
void main()
{
  double  n, ans;
  cout << "Enter a positive number:  ";
  cin >> n;
  ans = log(n)/log(2.0);
  cout << "The logarithm of " << n << " to the base 2 is " << ans<<endl;
  getch();
}
```

Q.21. Write a program to enter a letter and display the next two letters.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  char charac;
  cout << "Enter your letter : " << endl;
  cin>>charac;
  cout << "The 2 letters are : " << endl;
  cout << (char)(charac+1) << endl;
  cout << (char)(charac+2) << endl;
  getch();
}
```

Q.22. Write a program that inputs five-digit integer through the keyboard and calculates the sum of its digits.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int number, last_digit, next_digit, total;
  cout<<"Enter the number whose sum of digits is to be calculated: ";
  cin>>number;
  last_digit = number%10;
  total = last_digit;
  next_digit = (number/10) % 10;
  total = total + next_digit;
  next_ digit = (number/100) % 10;
```

```
    total = total + next_digit;
    next_digit = (number/1000) %10;
    total = total + next_digit;
    next_digit = (number/10000) %10;
    total = total + next_digit;
    cout<<"The sum of the digits of the entered number is:"<<total;
    getch();
}
```

Q.23. Write a program that inputs Basic Salary and calculates 35% dearness allowance, 25% house rent and then displays the gross salary.

```
#include<iostream.h>
#include<conio.h>
void main ()
{
  clrscr();
  int basic;
  float gross;
  cout<<"Enter your Basic Salary: ";
  cin>>basic;
  gross = basic+(0.35*basic)+(0.25*basic);
  cout<<"Your Gross Salary is:"<<gross;
  getch();
}
```

Q.24. Write a program that inputs two times in hh:mm:ss format, adds both times and displays the total time.

```
#include <iostream.h>
#include<conio.h>
#include <iomanip.h>
void main()
{
  clrscr();
  int t1, t2, t, m1, m2, m, s1, s2, s;
  cout << "Enter the two times in the format tt mm ss" << endl;
  cin >> t1 >> m1 >> s1 >> t2 >> m2 >> s2;
  s = s1+s2;
  m = m1 + m2 + s/60;
  t = t1 + t2 + m/60;
  s = s % 60;
  m = m % 60;
  cout << "The total time is"<< ' ' << setw(2) << setfill('0') << t;
  cout<< ' ' << setw(2) << setfill('0') << m;
  cout<< ' ' << setw(2) << setfill('0') << s << endl;
  getch();
}
```

Q.25. Write a program that inputs principal amount, rate of interest and total time. It calculates the compound interest and displays it. The formula for compound interest is: p (1 + r / 100) ^ t – p where p is the principal amount, r is the rate and t is the time.

```
#include<iostream.h>
#include<conio.h>
#include<math.h>
void main()
{
  double p, r, t, i, am;
  cout<< " Enter principal amount, rate and time ?";
  cin>> p >> r >> t;
  am = p * pow((1.0 + r / 100), t);
  i = am - p;
  cout << "\n The compound interest amount = Rs. " << i;
  getch();
}
```

Q.26. Write a program that inputs a number and displays its corresponding ASCII code.

```
#include<iostream.h>
#include<conio.h>
#include <stdlib.h>
void main()
{
  clrscr();
  int number;
  char letter;
  cout<<"Enter  a number : ";
  cin >> number;
  cout<<"The number is : \""<<char(number)<<"\" in ASCII"<<endl;
  getch();
}
```

Q.27. Write a program that displays the following output:

Number	Square	Cube
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>
void main()
{
  int a;
  clrscr();
  cout<<setw(10)<<"Number";
  cout<<setw(10)<<"Square";
  cout<<setw(10)<<"Cube"<<endl;
  cout<<setw(10)<<1<<setw(10)<<1*1<<setw(10)<<1*1*1<<endl;
  cout<<setw(10)<<2<<setw(10)<<2*2<<setw(10)<<2*2*2<<endl;
  cout<<setw(10)<<3<<setw(10)<<3*3<<setw(10)<<3*3*3<<endl;
  cout<<setw(10)<<4<<setw(10)<<4*4<<setw(10)<<4*4*4<<endl;
  cout<<setw(10)<<5<<setw(10)<<5*5<<setw(10)<<5*5*5<<endl;
  getch();
}
```

Q.28. Write a program that inputs marks obtained by a student in five subjects. It then calculates and displays total marks and percentage.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int s1, s2, s3, s4, s5, total;
  float avg;
  cout<<"Enter marks in English: ";
  cin>>s1;
  cout<<"Enter marks in Math: ";
  cin>>s2;
  cout<<"Enter marks in Chemistry: ";
  cin>>s3;
  cout<<"Enter marks in Physics: ";
  cin>>s4;
  cout<<"Enter marks in Biology: ";
  cin>>s5;
  total = s1 + s2 + s3 + s4 + s5;
  avg = float(total) / 5.0;
  cout<<"Total marks: "<<total<<endl;
  cout<<"Average marks: "<<avg<<endl;
  getch();
}
```

CHAPTER 5

CONTROL STRUCTURES

Q.1. Write a program that accepts a character and determines whether it is a lowercase letter. If the entered character is a lowercase letter, display the message "Entered character is a lowercase letter", otherwise display the message "Entered character is not a lowercase letter".

```
#include <iostream.h>
#include <conio.h>
void main()
{
  char letter;
  clrscr();
  cout<<"Enter a character : ";
  cin>>letter;
  if (letter>= 'a' && letter<= 'z')
    cout<<"Entered character is a lowercase letter \n";
  else
    cout<<"Entered character is not a lowercase letter \n";
  getch();
}
```

Q.2. Senior salesperson is paid Rs. 400 a week, and a junior salesperson is paid Rs. 275 a week. Write a program that accepts as input a salesperson's status in the character variable *status*. If *status* is 's' or 'S', the senior person's salary should be displayed; if status is 'j' or 'J', the junior person's salary should be displayed, otherwise display error message.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  char status;
  int senior=400, junior=275;
  clrscr();
  cout<< " 'J' --> junior person's salary \n ";
  cout<< " Enter status > ";
  cin>>status;
  if (status== 'S' || status== 's')
    cout<< "Senior person salary is Rs."<<senior;
  else if (status== 'J' || status== 'j')
    cout<< "Junior person salary is Rs. "<<junior;
```

```
    else
      cout<< "You should select senior or junior, try again!";
    getch();
}
```

Q.3. Write a program to get three numbers from user for integer variables a, b and c. If a is not zero, find out whether it is the common divisor of b and c.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int a, b, c;
  clrscr();
  cout<<"Enter the value of a , b and c:";
  cin>>a>>b>>c;
  if(a==0)
  {
    cout<<"divisor cannot be 0"<<endl;
  }
  else
  {
    if(b%a==0&&c%a==0)
      cout<<a<<" is a common divisor of "<<b<<" and "<<c<<endl;
    else
      cout<<a<<" is not a common divisor of "<<b<<" and "<<c<<endl;
  }
  getch();
}
```

Q.4. Write a program that contains an if statement that may be used to compute the area of a square (area = side * side) or a triangle (area = ½ * base * height) after prompting the user to type the first character of the figure name (S or T).

```
#include <iostream.h>
#include <conio.h>
void main()
{
  char op;
  int side, base, height;
  float area;
  clrscr();
  cout<<"Enter choice (S for Square, T for Triangle:)";
  cin>>op;
```

```
    if(op == 'S')
    {
      cout<<"Enter side: ";
      cin>>side;
      area = side * side;
      cout<<"Area ="<< area;
    }
    else if(op == 'T')
    {
      cout<<"Enter base:";
      cin>>base;
      cout<<"Enter height:";
      cin>>height;
      area = base * height * 0.5;
      cout<<"Area = "<< area;
    }
    getch();
}
```

Q.5. Write a program that gets the number and a letter. If the letter is 'f', the program should treat the number entered as temperature in degrees Fahrenheit and convert it to the temperature in degree Celsius and print a suitable message. If the letter is 'c', the program should consider the number as Celsius temperature and convert it to Fahrenheit temperature and print a suitable message. The program should display error message and then exit if the user enters any other letter.

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>
void main()
{
  float temp, temp2;
  char choice;
  clrscr();
  cout<<"Enter temperature: ";
  cin>>temp;
  cout<<"Enter choice: ";
  cin>>choice;
  if(choice == 'f')
  {
    temp2 = 5.0 / 9.0 * (temp – 32);
    cout<<"Temperature in Celcius is "<<temp2<<endl;
  }
  else if(choice == 'c')
  {
    temp2 = 9.0 / 5.0 * temp + 32;
    cout<<"Temperature in Fahrenheit is "<<temp2;
  }
```

```
  else
    cout<<"Invalid choice.";
  getch();
}
```

Q.6. Write a program that accepts the code number as an input and display the correct disk drive manufacture as follows:

Code	disk drive manufacture
1	Western Digital
2	3M Corporation
3	Maxell Corporation
4	Sony Corporation
5	Verbatim Corporation

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int code;
  clrscr();
  cout<<"============== \n";
  cout<<"Code Numbers\n";
  cout<<"============== \n";
  cout<<"1 for Western Digital \n";
  cout<<"2 for 3M Corporation \n";
  cout<<"3 for Maxil Corporation \n";
  cout<<"4 for Sony Corporation \n";
  cout<<"5 for Verbatim Corporation \n";
  cout<<"\nEnter any code: ";
  cin>>code;
  switch(code)
  {
    case 1:
      cout<<" Western Digital ";
      break;
    case 2:
      cout<<"3M Corporation ";
      break;
    case 3:
      cout<<"Maxil Corporation ";
      break;
    case 4:
      cout<<"Sony Corporation ";
      break;
    case 5:
      cout<<"Verbatim Corporation ";
      break;
  }
```

```
    getch();
}
```

Q.7. Write a program that uses the following categories of movies:

A	for Adventure movies
C	for Comedy movies
F	for Family movies
H	for Horror movies
S	for Science Fiction movies

The program inputs code for movie type and displays its category. For example if the user enters H, it displays "Horror Movies". The program should also display a menu of movie categories.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  char ch;
  clrscr();
  cout<<"================= \n";
  cout<<"Movies Categories \n";
  cout<<"================= \n";
  cout<<"A for Adventure \n";
  cout<<"C for Comedy \n";
  cout<<"F for Family \n";
  cout<<"H for Horror \n";
  cout<<"S for Science Fiction \n";
  cout<<"\nEnter code of movie category: ";
  cin>>ch;
  switch(ch)
  {
    case 'A':
      cout<<"Your selection is Adventure Movies";
      break;
    case 'C':
      cout<<"Your selection is Comedy Movies";
      break;
    case 'F':
      cout<<"Your selection is Family Movies";
      break;
    case 'H':
      cout<<"Your selection is Horror Movies";
      break;
    case 'S':
      cout<<"Your selection is Science Fiction Movies";
      break;
```

```
    default:
      cout<<"Invalid category";
  }
  getch();
}
```

Q.8. Write a program that inputs a value and type of conversion. The program should then output the value after conversion. The program should include the following conversions:

1 inch = 2.54 centimeters
1 gallon = 3.785 liters
1 mile = 1.609 kilometers
1 pound = .4536 kilograms

Make sure that program accepts only valid choices for type of conversion to perform.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  float value;
  char con;
  clrscr();
  cout<<"Enter conversion type: \n";
  cout<<"C for Centimeters \n";
  cout<<"L for Liters \n";
  cout<<"K for Kilometers \n";
  cout<<"G for Kilograms \n";
  cin>>con;
  cout<<"Enter a value: ";
  cin>>value;
  switch(con)
  {
    case 'C':
    case 'c':
      cout<<"Value"<<value * 2.54;
      break;
    case 'L':
    case 'l':
      cout<<"Value: "<< value * 3.785;
      break;
    case 'K':
    case 'k':
      cout<<"Value: "<< value * 1.609;
      break;
```

```
    case 'G':
    case 'g':
      cout<<"Value: "<<value * .4536;
      break;
    default:
      cout<<"Invalid conversion type!";
  }
  getch();
}
```

Q.9. A year is a leap year if it is divisible by four, except that any year divisible by 100 is a leap year only if it is divisible by 400. Write a program that inputs a year such as 1996, 1800 and 2010 and display "Leap year" if it is a leap year otherwise displays "Not a leap year".

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int year;
  clrscr();
  cout<<"Enter a year:";
  cin>>year;
  if(year%4==0)
    cout<<"Leap year.";
  else if(year%100==0 && year%400==0)
    cout<<"Leap year.";
  else
    cout<<"Not a leap year.";
  getch();
}
```

Q.10. Write a program that inputs temperature and displays a message as follows:

Temperature	Message
Greater than 35	Hot day
Between 25 and 35 (inclusive)	Pleasant day
Less than 25	Cool day

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int t;
  clrscr();
  cout<<"Enter temperature: ";
  cin>>t;
```

```
    if(t > 35)
      cout<<"Hot day.";
    else if(t >= 25)
      cout<<"Pleasant day.";
    else
      cout<<"Cool day.";
    getch();
}
```

Q.11. Write a program that inputs obtained marks of a student, calculates the percentage (assuming total marks are 1100) and displays grade according to the following rules:

Percentage	Grade
More than or equal to 80	A+
Between 70 (inclusive) and 80	A
Between 60 (inclusive) and 70	B
Between 50 (inclusive) and 60	C
Between 40 (inclusive) and 50	D
Between 33 (inclusive) and 40	E
Less than 33	F

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int m;
  char g;
  float a;
  clrscr();
  cout<<"Enter marks: ";
  cin>>m;
  a = m * 100.0 / 1100.0;
  if(a >= 80)
    cout<<"A+";
  else if(a >= 70)
    cout<<"A";
  else if(a >= 60)
    cout<<"B";
  else if(a >= 50)
    cout<<"C";
  else if(a >= 40)
    cout<<"D";
  else if(a >= 33)
    cout<<"E";
  else
    cout<<"F";
  getch();
}
```

Q.12. Write a program that converts MILITARY time to STANDARD time.

```
#include<iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int h;
  double m;
  cout<<"Enter 24 hours military hours: ";
  cin>>h;
  cout<<"Enter 24 hours military minutes: ";
  cin>>m;
  if(h>12 && h<24)
  {
    h = h - 12;
    cout<<"Standard Time: "<<h<<":"<<m<<" PM"<<endl;
  }
  else if(h==24)
  {
    h = h - 12;
    cout<<"Standard Time: "<<h<<":"<<m<<" AM"<<endl;
  }
  else if(h==12)
    cout<<"Standard Time: "<<h<<":"<<m<<" PM"<<endl;
  else
    cout<<"Standard Time: "<<h<<":"<<m<<" AM"<<endl;
  getch();
}
```

Q.13. Write a program that will take three values a, b and c and print the roots, if real, of the quadratic equation $ax^2 + bx + c = 0$. Sample input 1: (a=1, b=1, c=-6 the output should be "Roots of the equation are 2 and -3"). Sample input 2 (if the input is a=1, b=0, c=9, the output should be "Sorry the roots are not real.")

```
#include<iostream.h>
#include<conio.h>
#include<math.h>
void main()
{
  clrscr();
  int a, b, c, d, e;
  double f, x1, x2;
  cout<<"Enter value of a: ";
  cin>>a;
  cout<<"Enter value of b: ";
  cin>>b;
```

```
    cout<<"Enter value of c: ";
    cin>>c;
    d = b * b - 4 * a * c;
    e = 2 * a;
    if (a == 0)
      cout<<"Not a quadratic equation. A cannot be zero."<<endl;
    else if (d < 0)
      cout<<" Sorry the roots are not real."<<endl;
    else
    {
      f = pow(d, 0.5);
      x1 = (-b + f) / e;
      x2 = (-b - f) / e;
      cout<<"The roots of equation are: "<<x1<<", "<<x2<<endl;
    }
    getch();
}
```

Q.14. Write a program that inputs the salary of an employee from the user. It deducts the income tax from the salary on the following basis :

- 20% income tax if the salary is above Rs. 30000.
- 15% income tax if the salary is between Rs. 20000 and Rs. 30000.
- 10% income tax if the salary is below Rs. 20000.

The program finally displays salary, income tax and the net salary.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int itrate;
  float salary,itax,nsalary=0;
  cout << "Enter the salary : ";
  cin>>salary;
  if(salary>30000)
  {
    itax=salary*20/100;
    itrate=20;
  }
  else if(salary>=20000)
  {
    itax=salary*15/100;
    itrate=15;
  }
  else
```

```
    {
      itax=salary*10/100;
      itrate=10;
    }
    nsalary=salary-itax;
    cout << "Salary = RS" << salary << endl;
    cout << "Your income tax @ " << itrate << "% = Rs. " << itax << endl;
    cout << "Your net salary = Rs. " << nsalary << endl;
    getch();
}
```

Q.15. Write a program that inputs year and month. It displays the number of days in the month of the year entered by the user. For example, if the user enters 2010 in year and 3 in month, the program should display "March 2010 has 31 days".

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int year, month, numberOfDaysInMonth = 0;
  cout << "Enter a year: ";
  cin >> year;
  cout << "Enter a month in the year (e.g., 1 for Jan): ";
  cin >> month;
  switch (month)
  {
    case 1:
      cout << "January " << year;
      numberOfDaysInMonth = 31;
      break;
    case 2:
      cout << "Feburary " << year;
      if (year % 400 == 0 || (year % 4 == 0 && year % 100 != 0))
        numberOfDaysInMonth = 29;
      else
        numberOfDaysInMonth = 28;
      break;
    case 3:
      cout << "March " << year;
      numberOfDaysInMonth = 31;
      break;
    case 4:
      cout << "April " << year;
      numberOfDaysInMonth = 30;
      break;
```

```
        case 5:
          cout << "May " << year;
          numberOfDaysInMonth = 31;
          break;
        case 6:
          cout << "June " << year;
          numberOfDaysInMonth = 30;
          break;
        case 7:
          cout << "July " << year;
          numberOfDaysInMonth = 31;
          break;
        case 8:
          cout << "August " << year;
          numberOfDaysInMonth = 31;
          break;
        case 9:
          cout << "September " << year;
          numberOfDaysInMonth = 30;
          break;
        case 10:
          cout << "October " << year;
          numberOfDaysInMonth = 31;
          break;
        case 11:
          cout << "November " << year;
          numberOfDaysInMonth = 30;
          break;
        case 12:
          cout << "December " << year;
          numberOfDaysInMonth = 31;
          break;
      }
      cout << " has " << numberOfDaysInMonth << " days";
      getch();
    }
```

Q.16. Write a program that displays the following menu for a parking area:

- M = Motorcycle
- C = Car
- B = Bus

The program inputs the type of vehicle and number of days to park the vehicle. It finally displays total charges for parking according to following:

- Motorcycle Rs. 10 per day
- Car Rs. 20 per day
- Bus Rs. 30 per day

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int days;
  char p;
  clrscr();
  cout<<"M = Motorcycle \n";
  cout<<"C = Car \n";
  cout<<"B = Bus \n";
  cout<<"Enter parking choice: ";
  cin>>p;
  cout<<"How many days to park? ";
  cin>>days;
  switch(p)
  {
    case 'M':
    case 'm':
      cout<<"Parking charges: Rs. "<<days * 10;
      break;
    case 'C':
    case 'c':
      cout<<"Parking charges: Rs. "<<days * 20;
       break;
    case 'B':
    case 'b':
      cout<<"Parking charges: Rs. "<<days * 30;
       break;
    default:
      cout<<"Invalid parking choice!";
  }
  getch();
}
```

Q.17. Write a program that inputs a value and type of conversion. The program should then display the output after conversion. The program should include the following conversions:

- 1 cm = .394 inches
- 1 liter = .264 gallons
- 1 kilometer = .622 miles
- 1 kilogram = 2.2 pounds

Make sure that the program accepts only valid choices for the type of conversion.

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
void main()
{
   float Value;
   char Conversion;
   clrscr();
   cout<<"Enter the Value"<<endl;
   cin>>Value;
   cout<<"Enter the type of Conversion"<<endl;
   cout<<"I] Inches"<<endl;
   cout<<"G] Gallons"<<endl;
   cout<<"M] Miles"<<endl;
   cout<<"P] Pounds"<<endl;
   cin>>Conversion;
   switch(Conversion)
   {
     case 'I':
     case 'i':
       cout<<Value*.394<<endl;
       break;
     case 'G':
     case 'g':
       cout<<Value*.264<<endl;
       break;
     case 'M':
     case 'm':
       cout<<Value*.622<<endl;
       break;
     case 'P':
     case 'p':
       cout<<Value*2.2<<endl;
       break;
     default:
       cout<<"Illegal Input"<<endl;
       break;
   }
   getch();
}
```

CHAPTER 6

LOOPING STRUCTURES

Q.1. Write a program to display the following format using **while** loop:

```
----------
a        b
----------
1        5
2        4
3        3
4        2
5        1
----------
```

```
#include<iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int i = 1, j = 5;
  cout<<"----------\n";
  cout<<("a \tb \n");
  cout<<("----------\n");
  while (i <= 5)
  {
    cout<<i<<"\t"<<j<<endl;
    i++;
    j--;
  }
  cout<<("----------");
  getch();
}
```

Q.2. Write a program to display the following format using **while** loop:

```
----------
num      sum
----------
1        1
2        3
3        6
4        10
5        15
----------
```

```
#include<iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int num = 1, sum = 0;
  cout<<("-----------\n");
  cout<<("num\tsum\n");
  cout<<("-----------\n");
  while (num <= 5)
  {
    sum = sum + num;
    cout<<num<<"\t"<<sum<<"\n";
    num++;
  }
  cout<<("-----------");
  getch();
}
```

Q.3. Write a program that displays the sum of the following series using do-while loop.

1 + 1/4 + 1/8 + ... + 1/100

```
#include <iostream.h>
#include <conio.h>
void main()
{
  float c, r;
  clrscr();
  c = 4.0;
  r = 1.0;
  do
  {
    r = r + 1.0/c;
    c = c + 4;
  }
  while(c<=100);
  cout<<"Result is"<<r;
  getch();
}
```

Q.4. Write a program to display alphabets from A to Z using for loop.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  char ch;
```

```
    clrscr();
    for(ch='A'; ch<='Z'; ch++)
      cout<<ch;
    getch();
  }
```

Q.5. Write a program to find the largest, smallest, and average of n whole numbers. You can assume that "n" has already been set by the user.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int largest, smallest, value;
  int n = 10;
  float total;
  cout <<"Please enter a whole number: ";
  cin >>value;
  largest = smallest = total = value;
  for (int j = 0; j < n ; ++j)
  {
    cout <<"Please enter another whole number: ";
    cin >> value;
    total += value;
    if (value > largest)
      largest = value;
    if (value < smallest)
      smallest = value;
  }
  cout <<"The largest value is: " <<largest <<endl;
  cout <<"The smallest value is: " <<smallest <<endl;
  cout <<"The average is: " <<total/n <<endl;
  getch();
}
```

Q.6. Write a program that will ask the user a question with four possible answers. The question should be asked 20 times. After all the input is gathered, the program should output the number of times each answer was selected.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int Answer1=0, Answer2=0, Answer3=0, Answer4=0;
  int Answer, Counter, Value;
  clrscr();
```

```
for(Counter = 0; Counter < 20; Counter++)
{
  cout<<"Enter either 1,2,3, or 4"<<endl;
  cin>>Value;
  switch(Value)
  {
    case 1:
      Answer1++;
      break;
    case 2:
      Answer2++;
      break;
    case 3:
      Answer3++;
      break;
    case 4:
      Answer4++;
      break;
    default:
      cout<<"Incorrect choice"<<endl;
    Counter--;
  }
}
cout<<"Number of Answer 1's = "<<Answer1<<endl;
cout<<"Number of Answer 2's = "<<Answer2<<endl;
cout<<"Number of Answer 3's = "<<Answer3<<endl;
cout<<"Number of Answer 4's = "<<Answer4<<endl;
getch();
}
```

Q.7. Write a program that inputs a series of 20 numbers and displays the minimum value.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int Min, Counter, Value;
  cout<<"Enter a Number"<<endl;
  cin>>Min;
  for(Counter = 0; Counter < 19; Counter++)
  {
    cout<<"Enter a Number"<<endl;
    cin>>Value;
    if (Value < Min)
      Min = Value;
  }
```

```
    cout<<Min<<endl;
    getch();
}
```

Q.8. Write a program that inputs a number from the user and displays Fibonacci series up to the number entered.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int a, b, next, limit;
  cout<<"Enter the limit upto which fibonnaci terms requried:";
  cin>>limit;
  a = 0;
  b = 1;
  cout<<"Fibonacci terms upto limit are: "<<endl;
  cout<<a<<"\t"<<b;
  next = a + b;
  while(next <= limit)
  {
    next = a + b;
    cout<<"\t"<<next;
    a=b;
    b=next;
    next=a+b;
  }
  getch();
}
```

Q.9. Write a program that inputs a number from the user and displays all Armstrong numbers up to the number entered.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int num,n,r,sum,limit;
  cout<<"Enter the limit up to which Armstrong numbers are required:";
  cin>>limit;
  for(num=1;num<=limit;num++)
  {
    n=num;
    sum=0;
```

```
    while(n!=0)
    {
      r=n%10;
      sum=sum+(r*r*r);
      n/=10;
    }
    if(sum==num)
      cout<<num<<"\t";
  }
  getch();
}
```

Q.10. Write a program that inputs a number from the user and displays all perfect numbers up to the number entered.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int i, num, mid, sum, limit;
  cout<<"Enter the limit upto perfect numbers are required :";
  cin>>limit;
  if (limit<6)
    cout<<"No perfect number up to"<<limit;
  else
  {
    cout<<"Perfect numbers upto to "<<limit<<"are:\n";
    for(num=6; num<=limit; num++)
    {
      sum=0;
      mid=num/2;
      for(i=1;i<=mid;i++)
      {
        if((num%i)==0)
          sum=sum+i;
      }
      if (sum==num)
        cout<<num<<"\t";
    }
  }
  getch();
}
```

Q.11. Write a program that inputs the number of students in the class. It then inputs the marks of these students and displays the highest and second highest marks.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int marks,numberOfStudents;
  double marks1 = -1;
  double marks2 = -2;
  cout << "Enter the number of students: ";
  cin >> numberOfStudents;
  for (int i = 0; i < numberOfStudents; i++)
  {
    cout << "Enter a student marks: ";
    cin >> marks;
    if (marks > marks1)
    {
      marks2 = marks1;
      marks1 = marks;
    }
    else if (marks > marks2)
      marks2 = marks;
  }
  cout << "Highest marks is " << marks1 << endl;
  cout << "Second highest marks is " << marks2 << endl;
  getch();
}
```

Q.12. Write a program that calculates and prints the average of several integers. Assume that the last value read is sentinel 9999. A typical input sequence might be 10 8 6 7 2 9999 indicating that average of all values preceding 9999 is required.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int c, num;
  double sum = 0.0, avg = 0.0;
  num = 1;
  c = 0;
  while (num != 9999)
  {
    cout<<"Enter a number: ";
    cin>>num;
    if (num == 9999)
      break;
    sum += num;
```

```
    c++;
  }
  avg = sum / c;
  cout<<"Average = "<<avg;
  getch();
}
```

Q.13. Write a program that inputs a number from the user and displays all prime numbers which are less than the input number using any loop.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int n, c, num, p;
  clrscr();
  cout<<"Enter an integer: ";
  cin>>num;
  cout<<"List of prime numbers is as follows: "<<endl;
  for(n=1; n<=num; n++)
  {
    p = 1;
    for(c=2; c<=n/2; c++)
    if(n%c==0)
    {
      p = 0;
      break;
    }
    if(p==1)
      cout<<n<<"\t";
  }
  getch();
}
```

Q.14. Write a program that inputs a number from the user and displays its factorial. It asks the user whether he wants to calculate another factorial or not. If the user inputs 1, it again inputs number and calculates factorial. If user inputs 0, program terminates.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int i, f, n;
  int op = 1;
  clrscr();
```

```
    while(op==1)
    {
      cout<<"Enter a number: ";
      cin>>n;
      f = 1;
      for(i=n; i>=1; i--)
        f = f * i;
      cout<<"Factorial of "<<n<<" is "<<f;
      cout<<"\nDo you want to enter again? (Enter 0 for No 1 for Yes)";
      cin>>op;
    }
    getch();
}
```

Q.15. Write a program that inputs an integer and displays whether it is a prime number or not.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, p, j;
  clrscr();
  cout<<"Enter a number: ";
  cin>>n;
  p = 1;
  for(j=2; j<n; j++)
    if(n%j==0)
    {
      p = 0;
      break;
    }
    if(p==1)
      cout<<" The number is prime."<<n;
  else
      cout<<"The number is not prime"<<n;
  getch();
}
```

Q.16. Write a program that continuously inputs positive integer values from the user. The user enters a zero to show that he has no more values to enter. The program should finally display the second largest number entered.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int num, first, second;
```

```
  clrscr();
  first = second = num = 0;
  do
  {
    if(num > first)
    {
      second = first;
      first = num;
    }
    else if(num > second)
      second = num;
    cout<<"Enter a number (0 to exit): ";
    cin>>num;
  }
  while(num != 0);
  cout<<"Second largest number: "<<second;
  getch();
}
```

Q.17. Write a program that takes n numbers as input. It displays total positive and negative numbers.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int num, pos, neg;
  clrscr();
  pos = neg = 0;
  do
  {
    cout<<"Enter a number: ";
    cin>>num;
    if(num > 0)
      pos++;
    else if(num < 0)
      neg++;
  }
  while(num != 0);
  cout<<"Total positive numbers: "<<pos<<endl;
  cout<<"Total negative numbers: "<<neg<<endl;
  getch();
}
```

Q.18. Write a program to calculate and display sum of the following series using **for** loop:

$x + x^2 + x^3 \ldots x^n$

```
#include <iostream.h>
#include <conio.h>
#include <math.h>
void main()
{
  int x, n, i;
  long sum;
  sum = 0;
  clrscr();
  cout<<"Enter value of x: ";
  cin>>x;
  cout<<"Enter value of n: ";
  cin>>n;
  for(i=1; i<=n; i++)
    sum = sum + pow(x, i);
  cout<<"Sum = "<< sum;
  getch();
}
```

Q.19. Write a program to calculate and display sum of the following series using **for** loop:

$1! + 2! + 3! + 4! + 5!$

Where the symbol "!" represents the factorial of the number.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int i, j;
  long f, sum;
  sum = 0;
  clrscr();
  for(i=1; i<=5; i++)
  {
    f = 1;
    for(j=i; j>=1; j--)
      f = f * j;
    sum = sum + f;
  }
  cout<<"Sum = "<< sum;
  getch();
}
```

Q.20. Write a program to calculate and display the sum of the following series using **for** loop:

$1 + 2x + 3x^2 + 4x^3 + 5x^4$

```
#include <iostream.h>
#include <conio.h>
#include <math.h>
void main()
{
  int x, n, i, res;
  long sum;
  sum = 1;
  clrscr();
  cout<<"Enter value of x: ";
  cin>>x;
  for(i=1; i<=4; i++)
  {
    res = (i+1) * pow(x, i);
    sum = sum + res;
  }
  cout<<"Sum = "<< sum;
  getch();
}
```

Q.21. Write a program to calculate and display the sum of the following series using **for** loop:

1/2 + 2/3 + 3/4 + ... + 99/100

```
#include<iostream.h>
#include<conio.h>
void main()
{
  int i;
  double sum = 0;
  clrscr();
  for (i = 1; i <= 99; i++)
    sum = sum + (i * 1.0 / (i + 1));
  cout<<"Sum is"<<sum;
  getch();
}
```

Q.22. Write a program to print the following sequence:

64 32 16 8 4 2

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int c;
```

```
    for (c=64; c>=2; c/=2)
      cout<<c<<"\t";
    getch();
}
```

Q.23. Write a program to print the following sequence:

1 3 9 27 81 ... 200

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int c;
  for (c=1; c<=200; c*=3)
    cout<<c<<"\t";
  getch();
}
```

Q.24. Write a program to print the following sequence:

8 12 17 24 28 33 40 ...

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int num, inc;
  clrscr();
  num = 8;
  inc = 4;
  while(num<=100)
  {
    cout<<num<<"\t";
    num = num + inc;
    if(inc==4)
      inc = 5;
    else if(inc==5)
      inc = 7;
    else
      inc = 4;
  }
  getch();
}
```

Q.25. Write a program to add the first seven terms of the following series using **for** loop:

1/1! + 2/2! + 3/3! ...

```
#include <iostream.h>
#include<conio.h>
void main()
{
  double sum, num, f, n;
  clrscr();
  for(num=1; num<=7; num++)
  {
    f = 1;
    for(n=1; n<=num; n++)
      f = f * n;
    sum = sum + num/f;
  }
  cout<<"Sum of series: "<<sum;
  getch();
}
```

Q.26. Write a program that sums the sequence of integers assuming that first integer read specifies the number of values remaining to be entered. The program should read one value per input statement. A typical input sequence might be 5 100 200 150 300 500. The first integer 5 indicates that subsequent five values are to be summed.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int c, n, num, sum = 0;
  cout<<"Enter a number: ";
  cin>>n;
  for (c=1; c<=n; c++)
  {
    cout<<"Enter a number: ";
    cin>>num;
    sum += num;
  }
  cout<<"Sum = "<<sum;
  getch();
}
```

Q.27. A person invests $1000.00 in a saving account yielding 5% interest. Assuming all interest is left deposit in the account, calculate and print the amount of money in the accounts at the end of each year for ten years. Formula: $(a = p(1+r)^n)$ where p is the original amount invested, r is the annual interest rate, n is the number of years and a is the amount on deposit at the end of nth years.

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>
#include <math.h>
void main()
{
  float p, r, a;
  int y;
  clrscr();
  p = 1000;
  r = 0.05;
  cout.setf(ios::fixed, ios::floatfield);
  cout<<setprecision(2);
  for(y=1; y<=10; y++)
  {
    a = p * pow(1+r, y);
    cout<<"Amount at the end of Year "<<y<<": "<<a<<endl;
  }
  getch();
}
```

Q.28. Write a program to calculate the sum of the first n odd integers.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, num, sum, c;
  clrscr();
  sum = 0;
  num = 1;
  cout<<"How many odd integers to add? ";
  cin>>n;
  for(c=1; c<=n; c++)
  {
    sum = sum + num;
    num = num + 2;
  }
  cout<<"Sum of first "<<n<<" odd integers: "<<sum;
  getch();
}
```

Q.29. Write a program that could find whether the number entered through keyboard is odd or even and should also tell that whether it is prime or not. The program should keep on taking the value till the user ends and before termination should find the total number of odds, evens and primes entered.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int num, odd, even, c, p;
  char op = 'y';
  clrscr();
  odd = even = prime = 0;
  while(op!='n' && op!='N')
  {
    cout<<"Enter a number: ";
    cin>>num;
    if(num%2==0)
    {
      cout<<"Number is even. ";
      even++;
    }
    else
    {
      cout<<"Number is odd. ";
      odd++;
    }
    p = 1;
    for(c=2; c<=num/2; c++)
    if(num%c==0)
    {
      p = 0;
      break;
    }
    if(p==1)
    {
      cout<<"It is a prime number."<<endl;
      prime++;
    }
    else
      cout<<"It is a composite number."<<endl;
    cout<<"Enter 'N' to terminate? ";
    cin>>op;
  }
  cout<<"Total prime numbers: "<<prime<<endl;
  cout<<"Total even numbers: "<<even<<endl;
  cout<<"Total odd numbers: "<<odd<<endl;
  getch();
}
```

Q.30. Write a loop that will calculate the sum of every third integer, beginning with i = 2 (i.e., calculate the sum 2 + 5 + 8 + 11 + ...) for all values of i that are less than 100. Write the loop in each of the following ways:

(1) Using a for loop
(2) Using a while loop
(3) Using a do while loop

(1) Using for loop

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, sum;
  clrscr();
  sum = 0;
  for(n=2; n<100; n=n+3)
    sum += n;
  cout<<"Sum = "<<sum<<endl;
  getch();
}
```

(2) Using while loop

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, sum;
  clrscr();
  sum = 0;
  n = 2;
  while(n<100)
  {
    sum += n;
    n = n + 3;
  }
  cout<<"Sum = "<<sum<<endl;
  getch();
}
```

(3) Using do while loop

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, sum;
```

```
    clrscr();
    sum = 0;
    n = 2;
    do
    {
      sum += n;
      n = n + 3;
    }
    while(n<100);
    cout<<"Sum = "<<sum<<endl;
    getch();
}
```

Q.31. Write a program to add first nine terms of following series using for and while loop:

1/3! + 5/4! + 9/5! + ... where ! indicates factorial.

(1) Using for loop

```
#include <iostream.h>
#include<conio.h>
void main()
{
  double sum, num, f, n, d;
  clrscr();
  d = 1;
  for(num=3; num<=11; num++)
  {
    f = 1;
    for(n=1; n<=num; n++)
      f = f * n;
    sum = sum + d/f;
    d = d + 4;
  }
  cout<<"Sum of series: "<<sum;
  getch();
}
```

(2) Using while loop

```
#include <iostream.h>
#include<conio.h>
void main()
{
  double sum, num, f, n, d;
  clrscr();
  d = 1;
  num = 3;
```

```
    while(num<=11)
    {
      f = 1;
      n = 1;
      while(n<=num)
      {
        f = f * n;
        n++;
      }
      sum = sum + d/f;
      d = d + 4;
      num++;
    }
    cout<<"Sum of series: "<<sum;
    getch();
}
```

Q.32. Write a program to calculate sum of the following series using for and do while loop:

$1/3 + 3/5 + 5/7 + \ldots + 97/99$

(1) Using for Loop

```
#include<iostream.h>
#include<conio.h>
void main()
{
  double sum, n, r;
  clrscr();
  sum = 0;
  for(n=1; n<=97; n=n+2)
    sum = sum + n / (n+2);
  cout<<"Sum of series: "<<sum;
  getch();
}
```

(2) Using do while loop

```
#include<iostream.h>
#include<conio.h>
void main()
{
  double sum, n, r;
  clrscr();
  sum = 0;
  n = 1;
```

```
    do
    {
      sum = sum + n / (n+2);
      n = n + 2;
    }
    while(n<=97);
    cout<<"Sum of series: "<<sum;
    getch();
}
```

Q.33. Write a program to generate all possible combinations of 1, 2, 3 and 4.

```
#include<iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int i, j, k, l;
  for (i=1; i<=4; i++)
  {
    for (j=1; j<=4; j++)
    {
      for (k=1; k<=4; k++)
      {
        for (l=1; l<=4; l++)
          cout<<i<<j<<k<<l<<"\t";
      }
    }
  }
  getch();
}
```

Q.34. Write a program that inputs the starting and ending numbers and displays all prime number ending with digit 7 between the given range in descending order.

```
#include<iostream.h>
#include<conio.h>
#include<process.h>
void main()
{
  int start, end , flag = 0,i,j, r ;
  clrscr();
  cout<<" \n Enter the number to start with :";
  cin>> start;
  cout<<" \n Enter the number to end with :";
  cin>>end;
```

```
    if(start>end)
    {
      cout<<"\n Invalid Input.";
      getch();
      exit(1);
    }
    clrscr();
    cout<<"\n The Series :\n ";
    for(i = end ; i>=start ; i--)
    {
      flag = 0;
      for(j = 2; j<= i-1;j++)
      {
        r = i%j;
        if(r == 0)
          flag = 1;
      }
      if(flag == 0)
      {
        if(i%10 == 7)
          cout<< i << " ";
      }
    }
    getch();
}
```

Q.35. Write a program that displays all prime numbers between 100 and 500 that are also palindrome.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int flag,rev,n,j,k;
  clrscr();
  cout<< "\n Palindrome prime numbers between 100 to 500 are :\n";
  for(n = 100 ; n<=500 ; n ++ )
  {
    flag = 0;
    for(j= 2; j<= n-1;j++)
    {
      if(n%j == 0)
      {
        flag = 1;
        break;
      }
    }
    rev = 0;
```

```
    if(flag == 0)
    {
      for(k = n; k >=1 ; k = k/10)
        rev = rev*10 + k%10;
      if(rev == n)
      cout<< n << " " ;
    }
  }
  getch();
}
```

Q.36. Write a program to display following output using nested **for** loop:

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

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n, m;
  clrscr();
  for(n=1; n<=5; n++)
  {
    for(m=1; m<=5; m++)
      if(n==1 || m==1 || n==5 || m==5)
        cout<<"*";
      else
        cout<<" ";
    cout<<endl;
  }
  getch();
}
```

Q.37. Write a program to print the following output using loop:

```
                    1
                  1 2
                1 2 3
              1 2 3 4
            1 2 3 4 5
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int i, j, s;
  clrscr();
  for(i=1; i<=5; i++)
  {
    for(s=1; s<=5-i; s++)
      cout<<"\t";
    for(j=1; j<=i; j++)
      cout<<"\t"<<j;
    cout<<"\n";
  }
  getch();
}
```

Q.38. Write a program to print the following output using loop:

```
1   2       3       4       5
1   2       3       4
1   2       3
1   2
1
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int i, j, s;
  clrscr();
  for(i=5; i>=1; i--)
  {
    for(j=1; j<=i; j++)
    cout<<"\t"<<j;
    cout<<"\n";
  }
  getch();
}
```

Q.39. Write a program to print the following output using loop:

```
1
1   2
1   2       3
1   2       3       4
1   2       3       4       5
```

```
#include <iostream.h>
#include <conio.h>
#include<iomanip.h>
void main()
{
  int i, j;
  clrscr();
  for(i=1; i<=5; i++)
  {
    for(j=1; j<=i; j++)
      cout<<setw(5)<<j;
    cout<<endl;
  }
  getch();
}
```

Q.40. Write a program that uses nested for loops to display multiplication table as follows:

1	2	3	4	5
2	4	6	8	10
3	6	9	12	15
4	8	12	16	20
5	10	15	20	25

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int m, n;
  clrscr();
  m = 1;
  while(m<=5)
  {
    n = 1;
    while(n<=5)
    {
      cout<<"\t"<<m*n;
      n++;
    }
    cout<<"\n";
    m++;
  }
  getch();
}
```

Q.41. Write a program that uses nested loops to display the following lines:

```
1 2 4 6
2 2 4 6
3 2 4 6
4 2 4 6
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  for (int i = 1; i <= 4; ++i)
  {
    cout << i;
    for (int j = 2; j <= 6; j += 2)
      cout << " " << j;
    cout << endl;
  }
  getch();
}
```

Q.42. Write a program to print the following output using loop:

```
#####*#####
####*#*####
###*###*###
##*#####*##
#*#########*#
*###########*
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int row, pound, star;
  int nrows = 6;
  clrscr();
  for(row=1; row<=nrows; row++)
  {
    for(pound=1; pound<=nrows-row; pound++)
      cout << "#";
    for(star=1; star<=2*row-1; star++)
      if(star == 1 || star == 2*row-1)
        cout << "*";
      else
        cout << "#";
```

```
    for(pound=1; pound<=nrows-row; pound++)
      cout << "#";
    cout << endl ;
  }
  getch();
}
```

Q.43. Write a program to print the following output using loop:

```
BBBBBBBBB
. BBBBBBB
. . BBBBB
. . . BBB
. . . . B
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int i,j,k;
  clrscr();
  for (k = 5; k > 0; k = k - 1)
  {
    for (i = 1; i <= 5 - k; i = i + 1)
      cout<<".";
    for (j = 1; j <= 2 * k - 1; j = j + 1)
      cout<<"B";
    cout<<"\n";
  }
  getch();
}
```

Q.44. Write a program that inputs the height of a triangle and displays it using loop. For example, if the user enters height as 5, the program should print the following:

```
& & & & & & & & &
  & & & & & & &
    & & & & &
      & & &
        &
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n,i,sp,k,j;
  clrscr();
  cout<<"\n Enter height of a triangle : ";
  cin>>n;
  for(i = n, sp = 0; i >0 ; i --, sp++)
  {
    for(k=0; k<=sp; k++)
      cout<<" "<<" ";
    for(j = 1; j <  2*i ;  j++)
    {
      cout << "&" << " ";
    }
    cout<<"\n";
  }
  getch();
}
```

Q.45. Write a program that displays a diamond of asterisks using loop.

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

```
#include<iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int row, space,asterisk;
  for (row = 1; row <= 5; row++ )
  {
    for (space = 1; space <= 5 - row; space++ )
      cout << ' ';
```

```
    for ( asterisk = 1; asterisk <= 2 * row - 1; asterisk++ )
      cout << '*';
    cout << '\n';
  }
  for (row = 4; row >= 1; row-- )
  {
    for ( space = 1; space <= 5 - row; space++ )
      cout << ' ';
    for ( asterisk = 1; asterisk <= 2 * row - 1; asterisk++ )
      cout << '*';
    cout << '\n';
  }
  getch();
}
```

Q.46. Write a program to generate the following pyramid of digits using nested loop:

```
                    1
                  232
                34543
              4567654
            567898765
          67890109876
        7890123210987
      890123454321098
    90123456765432109
  0123456789876543210
```

```
#include <iostream.h>
#include<conio.h>
void main()
{
  clrscr();
  int mid, i, j;
  for(i=1;i<=10;i++)
  {
    cout<<"   ";
    mid=(2*i)-1;
    for(j=1;j<=(10-i);j++)
      cout<<' ';
    for(j=i;j<=mid;j++)
      cout<<(j%10);
    for(j=(mid-1);j>=i;j--)
      cout<<(j%10);
    cout<<endl;
```

```
    }
    getch();
}
```

Q.47. Write a program that inputs the height of triangle and displays a triangle of alphabets. For example, if the user enters 5, it displays the following:

```
A
A B
A B C
A B C D
A B C D E
```

```
#include<iostream.h>
#include<conio.h>
void main()
{
  char ch='A';
  int n,i,j;
  clrscr();
  cout<< "\n Enter the height of the triangle: ";
  cin>> n;
  for(i=1; i<= n ; i++)
  {
    ch = 'A';
    for(j= 1;j<=i;j++)
    {
      cout<< ch<< " ";
      ch++;
    }
    cout<< "\n";
  }
  getch();
}
```

Q.48. Write a program to display the following output using while loop:

```
1
3 5
7 9 11
13 15 17 19
21 23 25 27 29
31 33 35 37 39 41
43 45 47 49 51 53 55
```

```
#include<iostream.h>
#include<conio.h>
void main()
{
  int n, m, val;
  clrscr();
  n = 1;
  val = 1;
  while(n<=7)
  {
    m = 1;
    while(m<=n)
    {
      cout<<val<<" ";
      m++;
      val = val + 2;
    }
    cout<<endl;
    n++;
  }
  getch();
}
```

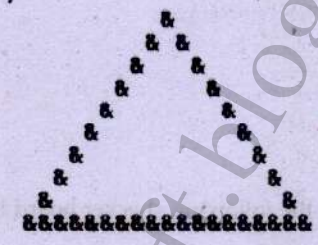
Q.49. Write a program to display the following output using loop:

```
1 2 3 4 5 6 7 6 5 4 3 2 1
1 2 3 4 5 6   6 5 4 3 2 1
1 2 3 4 5       5 4 3 2 1
1 2 3 4           4 3 2 1
1 2 3               3 2 1
1 2                   2 1
1                       1
```

```
#include<iostream.h>
#include<conio.h>
void main()
{
  int n, m, x, y, s;
  clrscr();
  s = 0;
  for(n=7; n>=1; n--)
  {
    for(m=1; m<=n; m++)
      cout<<m;
```

```
    for(y=0; y<s; y++)
      cout<<" ";
    for(x=m-1; x>=1; x--)
      if(x!=7)
        cout<<x;
    if(n==7)
      s++;
    else
      s = s + 2;
    cout<<endl;
  }
  getch();
}
```

Q.50. Write a program that inputs the height of triangle and displays a triangle of ampersand as follows:



```
#include <iostream.h>
#include <conio.h>
void main()
{
  int n;
  cout<<"\n Enter height :";
  cin>>n;
  for(int r = 1, sp = n-1 ; r<= n ; r++, sp--)
  {
    for (int k = 0; k<=sp ; k++)
      cout<< " " ;
    for(int c = 1; c < 2*r ; c++)
    {
      if(c==1 || c == 2*r - 1 || r == n )
        cout << "&";
      else
        cout<< " " ;
    }
    cout<< endl;
  }
  getch();
}
```

Q.51. Write a program to display the following output using loop:

```
0
0 1
0 1 2
0 1 2 3
0 1 2 3 4
0 1 2 3 4 5
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int i, j;
  clrscr();
  for(i=0; i<=5; i++)
  {
    for(j=0; j<=i; j++)
      cout<<j<<" ";
    cout<<endl;
  }
  getch();
}
```

Q.52. Write a program that generates the following checker board by using loop.

```
  - - - - - - - - -
- - - - - - - - -
  - - - - - - - - -
- - - - - - - - -
  - - - - - - - - -
- - - - - - - - -
  - - - - - - - - -
- - - - - - - - -
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int row = 8;
  int side;
  clrscr();
  while ( row-- > 0 )
  {
    side = 8;
```

```
        if ( row % 2 != 0 )
          cout << ' ';
        while ( side-- > 0 )
          cout << " -";
        cout << endl;
      }
      getch();
    }
```

CHAPTER 7

ARRAYS

Q.1. Write a program that inputs ten integers in an array and counts all prime numbers entered by the user. The program finally displays total number of primes in array.

```
#include <iostream.h>
#include<conio.h>
void main()
{
  int c, num[10], p, i, count;
  count = 0;
  clrscr();
  cout<<"Enter ten integers: ";
  for(i=0; i<10; i++)
  {
    p = 1;
    cin>>num[i];
    for(c=2; c<=num[i]/2; c++)
    if(num[i]%c==0)
    {
      p = 0;
      break;
    }
    if(p==1)
      count++;
  }
  cout<<"Total prime numbers in array: "<<count;
  getch();
}
```

Q.2. Write a program that uses two arrays to store the roll number and marks of student. It inputs roll numbers and marks of five students and stores them in corresponding elements of the arrays. (For example, if roll number 1 is stored in rno[0] then his marks must be stored in marks[0] and so on.) The program finally displays the roll number and marks of the student with highest marks.

```
#include <iostream.h>
#include<conio.h>
void main()
{
```

```
    int rollno[5], marks[5], max, i;
    clrscr();
    for(i=0; i<5; i++)
    {
      cout<<"Enter roll no of student "<<i+1<<": ";
      cin>>rollno[i];
      cout<<"Enter marks of student "<<i+1<<": ";
      cin>>marks[i];
    }
    max = 0;
    for(i=1; i<5; i++)
      if(marks[i] > marks[max])
        max = i;
    cout<<"The details of student with highest marks: "<<endl;
    cout<<"Roll No: "<<rollno[max]<<endl;
    cout<<"Marks: "<<marks[max];
    getch();
}
```

Q.3. Write a program that uses four arrays *numbers*, *squares*, *cubes* and *sums* each consisting of 10 elements. The *numbers* array stores values of its indexes, *squares* array stores the squares of its indexes, the *cubes* array stores the cubes of its indexes and *sums* array stores the sum of corresponding indexes of three arrays. The program should display the values of sums array and the total of all values in sums array.

```
#include <iostream.h>
#include <conio.h>
void main ()
{
  const int size = 10;
  int numbers[size], squares[size];
  int cubes[size], sums[size], i, total;
  clrscr();
  for (i = 0; i < size; i++)
  {
    numbers[i] = i;
    squares[i] = i * i;
    cubes[i] = i * i * i;
    sums[i] = numbers[i] + squares[i] + cubes[i];
  }
  total = 0;
  for (i = 0; i < size; i++)
  {
    cout << "Sum of " << i << ", " << i << " squared, and "
       << i << " cubed is: " << sums[i] << endl;
    total = total + sums[i];
  }
```

```
    cout << "Grand total: " << total << endl;
    getch();
}
```

Q.4. Write a program that inputs the names and monthly salaries of 10 employees. The program checks annual salary of each person. If annual salary is greater than or equal to Rs 2,50000/- then it prints name, salary and a message 'Tax to be paid' else it prints name, salary and a message 'No tax'.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  char nam[10][30];
  int sal[10], i;
  clrscr();
  for(i = 0; i< 10; i++)
  {
    cout<<"Enter the name of an employee: ";
    cin>>nam[i];
    cout<<"Enter the salary: ";
    cin>>sal[i];
  }
  cout<<"Name" << "\t\t" << "Salary" << endl;
  for(i = 0; i< 10; i++)
  {
  if(sal[i]*12 >= 250000)
    cout<<nam[i] << "\t\t"<< sal[i] << " Tax to be paid!"<< "\n" ;
  else
    cout<< nam[i] << "\t\t"<< sal[i] << " No tax"<< "\n" ;
  }
  getch();
}
```

Q.5. Write a program that inputs ten integers in an array. It displays the number of occurrences of each number in the array as follows:

```
    3 is stored 4 times in the array.
    1 is stored 1 times in the array.
```

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int arr[10], i, j, n, c;
  clrscr();
```

```
    for(i=0; i<10; i++)
    {
      cout<<"Enter an integer: ";
      cin>>arr[i];
    }
    for(i=0; i<10; i++)
    {
      if(arr[i] == -1)
        continue;
      n = arr[i];
      c = 1;
      for(j=i+1; j<10; j++)
      {
        if(arr[j]==n)
        {
          c++;
          arr[j] = -1;
        }
      }
      cout<<n<<" is stored "<<c<<" times in the array."<<endl;
    }
    getch();
}
```

Q.6. Write a program that inputs marks of ten students. The program displays number of students in each grade. The criteria is as follows:

80 or above	A
60 to 79	B
40 to 59	C
Below 40	F

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int marks[10], i, a, b, c, f;
  clrscr();
  a = b = c = f = 0;
  for(i=0; i<10; i++)
  {
    cout<<"Enter marks of student "<<i+1<<": ";
    cin>>marks[i];
    if(marks[i] >= 80)
      a++;
    else if(marks[i] >= 60)
      b++;
```

```
    else if(marks[i] >= 40)
      c++;
    else
      f++;
  }
  cout<<endl<<a<<" students are in grade A. "<<endl;
  cout<<endl<<b<<" students are in grade B. "<<endl;
  cout<<endl<<c<<" students are in grade C. "<<endl;
  cout<<endl<<f<<" students are in grade F. "<<endl;
  getch();
}
```

Q.7. Write a program that uses three arrays Mango, Orange and Banana to store the number of fruits purchased by customer. The program inputs the number of mangos, oranges and bananas to be purchased by customer and stores them in corresponding arrays. The program finally displays the total bill of each customer according to the following prices:

Rs. 20 per mango
Rs. 10 per orange
Rs. 5 per banana

The output should appear as follows:

Customer No.	Mangoes	Oranges	Bananas	Total Bill
1	5	10	12	Rs. 260

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int mango[5], orange[5], banana[5], i, bill;
  clrscr();
  for(i=0; i<5; i++)
  {
    cout<<"Enter purchase detail of customer "<<i+1<<": "<<endl;
    cout<<"Number of mangoes: ";
    cin>>mango[i];
    cout<<"Number of oranges: ";
    cin>>orange[i];
    cout<<"Number of bananas: ";
    cin>>banana[i];
  }
  cout<<endl<<"-------------------------------------------------------"<<endl;
  cout<<endl<<"Customer No\tMangoes\tOranges\t "<<endl;
  cout<<endl<<"Bananas\tTotal Bill"<<endl;
  cout<<endl<<"-------------------------------------------------------"<<endl;
```

```
    for(i=0; i<5; i++)
    {
      bill = mango[i] * 20 + orange[i] * 10 + banana[i] * 5;
      cout<<i+1<<"\t\t"<<mango[i]<<"\t"<<orange[i]<<"\t";
      cout<<banana[i]<<"\t"<<bill<<endl;
    }
    getch();
}
```

Q.8. Write a program that inputs ten floating point numbers in an array. It displays the values which are greater than average value of the array.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  float arr[10], avg, tot = 0.0;
  int i;
  clrscr();
  for(i=0; i<10; i++)
  {
    cout<<"Enter a floating point number: ";
    cin>>arr[i];
    tot = tot + arr[i];
  }
  avg = tot / 10.0;
  cout<<"The values greater than "<<avg<<" are as follows: "<<endl;
  for(i=0; i<10; i++)
    if(arr[i] > avg)
      cout<<arr[i]<<endl;
  getch();
}
```

Q.9. Write a program that uses a two dimensional array to initialize the scores of students. The students are arranged in five rows with five students in each row. The program inputs the row number and student number in that row and then displays the score of the student.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  int row, std, score[5][5] = { {50,45,32,68,91},{27,52,81,77,50},
                                {15,62,79,48,33},{96,71,56,82,61},
                                {49,71,52,39,60} };
  clrscr();
  cout<<"Enter row number: ";
  cin>>row;
```

```
    cout<<"Enter student number: ";
    cin>>std;
    if(row<1 || row>5 || std<1 || std>5)
      cout<<"Invalid input.";
    else
      cout<<"Score of the student: "<<score[row-1][std-1];
    getch();
}
```

CHAPTER 8

STRUCTURES

Q.1. Write a program that declares a structure to store the distance covered by a player along with the minutes and seconds taken to cover the distance. The program should input the records of two players and then display the record of the winner.

```
#include <iostream.h>
#include <conio.h>
struct Player
{
  int dis;
  int min;
  int sec;
};

void main()
{
  Player p1, p2;
  float time1, time2;
  clrscr();
  cout<<"Enter distance covered by first palyer: ";
  cin>>p1.dis;
  cout<<"Enter minutes & seconds: ";
  cin>>p1.min>>p1.sec;
  cout<<"Enter distance covered by second palyer: ";
  cin>>p2.dis;
  cout<<"Enter minutes & seconds: ";
  cin>>p2.min>>p2.sec;
  time1 = (p1.min*60+p1.sec) / p1.dis;
  time2 = (p2.min*60+p2.sec) / p2.dis;
  cout<<"The record of winner player:"<<endl;
  if(time1 < time2)
  {
    cout<<"Player 1 distance: "<<p1.dis<<" miles in ";
    cout<<p1.min<<" minutes, "<<p1.sec<<" seconds."<<endl;
  }
  else
  {
    cout<<"Player 2 distance: "<<p2.dis<<" miles in ";
    cout<<p2.min<<" minutes, "<<p2.sec<<" seconds."<<endl;
  }
```

```
  getch();
}
```

Q.2. Write a program that declares a structure to store the code number, salary and grade of an employee. The program defines two structure variables, inputs records of two employees and then displays the record of the employee with more salary.

```
#include <iostream.h>
#include <conio.h>

struct Emp
{
  int code, sal, grade;
};

void main()
{
  Emp e1, e2;
  clrscr();
  cout<<"Enter code, salary & grade of first employee: ";
  cin>>e1.code>>e1.sal>>e1.grade;
  cout<<"Enter code, salary & grade of second employee: ";
  cin>>e2.code>>e2.sal>>e2.grade;
  cout<<"The employee with more salary: "<<endl;
  if(e1.sal > e2.sal)
  {
    cout<<"Code: "<<e1.code<<endl;
    cout<<"Salary: "<<e1.sal<<endl;
    cout<<"Grade: "<<e1.grade<<endl;
  }
  else
  {
    cout<<"Code: "<<e2.code<<endl;
    cout<<"Salary: "<<e2.sal<<endl;
    cout<<"Grade: "<<e2.grade<<endl;
  }
  getch();
}
```

Q.3. Write a program that declares a structure to store income, tax rate and tax of a person. The program defines an array of structure to store the record of five persons. It inputs income and tax rate of five persons and then displays the tax payable.

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>
```

```
struct TaxPayer
{
  double taxRate, income, taxes;
};

void main()
{
  TaxPayer citizen[5];
  int i;
  clrscr();
  cout<<"Enter annual income and tax rate for 5 tax payers: \n\n";
  for(i=0; i<5; i++)
  {
    cout<<"Enter annual income of tax payer # "<<i+1<<": ";
    cin>>citizen[i].income;
    cout<<"Enter tax rate for tax payer # "<<i+1<<": ";
    cin>>citizen[i].taxRate;
    citizen[i].taxes = citizen[i].income * citizen[i].taxRate / 100;
  }
  cout<<"\nTaxes due for this year: \n\n";
  for(i=0; i<5; i++)
    cout<<"Tax Payer # "<<i+1<<": "<<"Rs. "<<citizen[i].taxes<<endl;
  getch();
}
```

Q.4. Write a program that declares a structure Book to store BookID, book name and price. It declares another structure Order that contains OrderID and an array of Book of length 5. The program should define a variable of type Order and input the values from the user. The program finally displays the values.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>

struct Book
{
  int bid;
  char name[30];
  float price;
};

struct Order
{
  int oid;
  Book bk[5];
};
```

```
void main()
{
  Order or;
  int i;
  clrscr();
  cout<<"Enter order ID: ";
  cin>>or.oid;
  cout<<"Enter details of five books in order: "<<endl;
  for(i=0; i<5; i++)
  {
    cout<<"Book ID? ";
    cin>>or.bk[i].bid;
    cout<<"Book name? ";
    gets(or.bk[i].name);
    cout<<"Book price? ";
    cin>>or.bk[i].price;
  }
  cout<<"\nOrder details is as follows:"<<endl;
  cout<<"Order ID: "<<or.oid<<endl;
  cout<<"\nBook ID\tBook Name\tPrice"<<endl;
  for(i=0; i<5; i++)
  {
    cout<<or.bk[i].bid<<"\t"<<or.bk[i].name;
    cout<<"\t\t"<<or.bk[i].price<<endl;
  }
  getch();
}
```

CHAPTER 9

FUNCTIONS

Q.1. Write a function that inputs a decimal number and converts it to binary digits.

```
#include <iostream.h>
#include <conio.h>

void decToBin(int num, int base);

void main()
{
  int decimalNum;
  int base;
  clrscr();
  base = 2;
  cout<<"Enter number in decimal: ";
  cin>>decimalNum;
  cout<<endl;
  cout<<"Decimal "<<decimalNum<<" = ";
  decToBin(decimalNum, base);
  cout<<" binary"<<endl;
  getch();
}

void decToBin(int num, int base)
{
  if(num > 0)
  {
    decToBin(num/base, base);
    cout<<num % base;
  }
}
```

Q.2. Write a function that converts binary number to decimal number.

```
#include <iostream.h>
#include <math.h>
#include <conio.h>

void binToDec(int binaryNumber, int& decimal, int& weight);
```

```
void main()
{
  int decNum, bitWeight, binNum;
  clrscr();
  decNum = 0;
  bitWeight = 0;
  cout<<"Enter number in binary: ";
  cin>>binNum;
  cout<<endl;
  binToDec(binNum, decNum, bitWeight);
  cout<<"Binary "<<binNum<<" = "<<decNum<<" decimal"<<endl;
  getch();
}

void binToDec(int binaryNumber, int& decimal, int& weight)
{
  int bit;
  if(binaryNumber > 0)
  {
    bit = binaryNumber % 10;
    decimal = decimal + bit * (pow(2, weight));
    binaryNumber = binaryNumber / 10;
    weight++;
    binToDec(binaryNumber, decimal, weight);
  }
}
```

Q.3. Write a program that counts number of zeros, odd, and even numbers.

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>

const int N = 20;
void initialize(int& zCount, int& oCount, int& eCount);
void getNumber(int& num);
void classifyNumber(int num, int& zCount, int& oCount, int& eCount);
void printResults(int zCount, int oCount, int eCount);

void main()
{
  int counter, number, zeros, odds, evens;
  clrscr();
  initialize(zeros, odds, evens);
  cout<<"Please enter "<<N<<" integers."<<endl;
  for (counter = 1; counter <= N; counter++)
  {
    getNumber(number);
    classifyNumber(number,zeros,odds,evens);
  }
```

```
  cout<<endl;
  printResults(zeros,odds,evens);
  getch();
}
void initialize(int& zCount, int& oCount, int& eCount)
{
  zCount = 0;
  oCount = 0;
  eCount = 0;
}
void getNumber(int& num)
{
  cin>>num;
}
void classifyNumber(int num, int& zCount, int& oCount, int& eCount)
{
  switch(num % 2)
  {
    case 0: eCount++;
     if(num == 0)
       zCount++;
     break;
    case 1:
    case -1:
     oCount++;
  }
}
void printResults(int zCount, int oCount, int eCount)
{
   cout<<eCount<<" evens including "<<zCount<<" zeros"<<endl;
   cout<<"Total number of odds are: "<<oCount<<endl;
}
```

Q.4. Write a function that inputs number of lines and prints a triangle of stars according to the given number of lines.

```
#include <iostream.h>
#include <conio.h>
void printStars(int blnk, int stars);

void main()
{
  int lines, counter, blanks;
  clrscr();
  cout<<"Enter number of star lines to print (1 to 20): ";
  cin>>lines;
```

```
    while(lines <= 0 || lines > 20)
    {
      cout<<"Number of star lines should be between 1 and 20"<<endl;
      cout<<"Enter number of star lines to print (1 to 20): ";
      cin>>lines;
    }
    cout<<endl<<endl;
    blanks = 30;
    for(counter = 1; counter <= lines; counter++)
    {
      printStars(blanks, counter);
      blanks--;
    }
    getch();
}

void printStars(int blnk, int stars)
{
  int count;
  for(count = 1; count <= blnk; count++)
    cout<<" ";
  for(count = 1; count <= stars; count++)
    cout<<" *";
  cout<<endl;
}
```

Q.5. Write a program that enters a number from the user and displays Fibonacci numbers from 1 to given number using function.

```
#include <iostream.h>
#include <conio.h>

void fib(int n);

void main()
{
  int num;
  clrscr();
  cout<<"Enter a number: ";
  cin>>num;
  fib(num);
  getch();
}

void fib(int n)
{
  int a, b, c, i;
  a = 1;
  b = 1;
```

```
    cout<<a<<" "<<b<<" ";
    c = a + b;
    while(c<=n)
    {
      cout<<c<<" ";
      a = b;
      b = c;
      c = a + b;
    }
}
```

Q.6. Write a program that accepts two integers. Create a function that tells whether or not the first integer is a multiple of the second.

```
#include <iostream.h>
#include <conio.h>

int multiple ( int , int );

void main()
{
  int num1 , num2 , result ;
  char more = 'y' ;
  clrscr();
  while ( more == 'y' )
  {
    cout<<"Enter a pair of integers: ";
    cin>>num1>>num2 ;
    result = multiple ( num1 , num2 );
    if ( result == 1 )
      cout<<num1<<" is multiple of "<<num2<<endl;
    else
      cout<<num1<<" is not multiple of "<<num2<<endl;
    cout<<"Do you want enter another? ";
    cin>>more;
  }
}

int multiple (int a , int b)
{
  if (a % b == 0)
    return 1 ;
  else
    return 0;
}
```

Q.7. Write a program that inputs two numbers in main function and passes them to a function. The function displays first number raised to the power of second number. For example, if the user enters 2 and 4, it displays 16.

```
#include <iostream.h>
#include <conio.h>

int power(int, int);

void main()
{
  int a, b, result=0;
  clrscr();
  cout<<"\nEnter base and exponent: ";
  cin>>a>>b;
  result = power(a, b);
  cout<<a<<" raised to power "<<b<<" is "<<result;
  getch();
}

int power(int base, int exponent)
{
  int result=1, count ;
  for ( count = 1; count <= exponent ; count ++)
    result *= base;
  return result;
}
```

Q.8. Write a program that uses a function EQ() to find whether four integers a,b,c,d passed to the function satisfy the equation $a^3+b^3+c^3 = d^3$ or not. The function returns 0 if the above equation is satisfied and returns –1 otherwise.

```
#include <iostream.h>
#include <conio.h>

int satis(int a, int b, int c, int d)
{
  if( a*a*a + b*b*b + c*c*c == d*d*d)
    return 0;
  else
    return -1;
}

void main()
{
  int x, y, z, w, s;
  clrscr();
  cout<< "\n Enter 4 integers: ";
  cin>>x>>y>>z>>w;
  s = satis(x, y, z, w);
  if(s == 0)
    cout<< "\n The equation is satisfied";
  else
    cout<< "\n The equation is NOT satisfied";
```

```
    getch();
}
```

Q.9. Write a program that prompts the user to enter a number and reverse it. Write a function Reverse() to reverse the number. For example, if the user enters 2765, the function should reverse it so that it becomes 5672. The function should accept the number as an input parameter and return the reverse number.

```
#include <iostream.h>
#include <conio.h>
int Reverse(int n)
{
  int t, r = 0;
  for(t=n; t!=0; t=t/10)
    r = 10 * r + t % 10;
  return r;
}
void main()
{
  int num, rev;
  clrscr();
  cout<<"Enter an integer: ";
  cin>>num;
  rev = Reverse(num);
  cout<<"The number in reverse is "<<rev;
  getch();
}
```

Q.10. Write a program that inputs a number in main() function and passes it to a function. The function displays whether number is prime or not.

```
#include <iostream.h>
#include<conio.h>
void prime(int n)
{
  int c, p = 1;
  for(c=2; c<=n/2; c++)
    if(n%c==0)
    {
      p = 0;
      break;
    }
  if(p==1)
    cout<<n<<" is a prime number.";
  else
    cout<<n<<" is not a prime number.";
}
```

```
void main()
{
  int num;
  clrscr();
  cout<<"Enter an integer: ";
  cin>>num;
  prime(num);
  getch();
}
```

Q.11. Write a function LCM() that receives two integer arguments and returns LCM.

```
#include <iostream.h>
#include<conio.h>

int lcm(int x, int y)
{
  int r, s, i;
  if(x<y)
    s = x;
  else
    s = y;
  for(i=1; i<=s; i++)
    if(x%i==0 && y%i==0)
      r = i;
  return r;
}

void main()
{
  int a, b, res;
  clrscr();
  cout<<"Enter two integers: ";
  cin>>a>>b;
  res = lcm(a, b);
  cout<<"Least common multiplier is "<<res;
  getch();
}
```

Q.12. Write a program that calls two functions Draw_Horizontal and Draw_Vertical to construct a rectangle. Also write functions Draw_Horizontal to draw two parallel horizontal lines and the function Draw_Vertical to draw two vertical lines.

```
#include <iostream.h>
#include <conio.h>

void Draw_Horizontal();
void Draw_Vertical();
```

```
void main()
{
  clrscr();
  Draw_Horizontal();
  Draw_Vertical();
  Draw_Horizontal();
  getch();
}

void Draw_Horizontal()
{
  int i;
  for(i=1; i<=25; i++)
    cout<<"*";
  cout<<"\n";
}

void Draw_Vertical()
{
  int j;
  for(j=1; j<=5; j++)
    cout<<"*                *\n";
}
```

Q.13. Write a function that returns the smallest of three floating point numbers.

```
#include <iostream.h>
#include <conio.h>

float func(float x, float y, float z)
{
 if(( x < y ) && ( x < z ))
   return x ;
 else if (( y < x ) && ( y < z ))
   return y;
 else
   return z ;
}

void main()
{
 float a, b, c, small;
 clrscr() ;
 cout<<"\nEnter any three floating numbers: ";
 cin >> a >> b >> c ;
 small = func ( a , b , c );
 cout<<"The smallest of the three is: "<<small;
 getch();
}
```

Q.14. Write a program that inputs five numbers and passes them to a function one at a time. The function returns **true** if the integer is even and false otherwise.

```
#include <iostream.h>
#include <conio.h>

int fun(int n)
{
 if(n%2==0)
   return 1;
 else
   return 0;
}

void main()
{
  int n, i;
  clrscr();
  for(i=1; i<=5; i++)
  {
    cout<<"Enter a number: ";
    cin>>n;
    if(fun(n)==1)
      cout<<n<<" is even."<<endl;
    else
      cout<<n<<" is odd."<<endl;
  }
  getch();
}
```

Q.15. Write a program that prompts the user for Cartesian coordinates of two points x1, y1 and x2, y2 and displays the distance between them. Write a function Distance() with four input parameters to compute the distance. The function uses the following formula to compute distance and return result to calling function.

```
#include <iostream.h>
#include <conio.h>
#include <iomanip.h>
#include <math.h>

float Distance(int,int,int,int);

void main()
{
  int x1, y1, x2, y2;
  float result;
  clrscr();
```

```
    cout<<"Enter the value of x1: ";
    cin>>x1;
    cout<<"Enter the value of y1: ";
    cin>>y1;
    cout<<"Enter the value of x2: ";
    cin>>x2;
    cout<<"Enter the value of y2: ";
    cin>>y2;
    result = Distance(x1,y1,x2,y2);
    cout<<"Distance between two point: "<<setprecision(2)<<result;
    getch();
}

float Distance(int a1, int b1, int a2, int b2)
{
    float r;
    r = sqrt(pow((a2 - a1),2) + pow((b2-b1),2));
    return r;
}
```

Q.16. Write a program that declares a function accepting two parameters. The first parameter is a floating pointer number and the second parameter is an integer. The program should multiply the floating-point number by itself the number of times indicated by the integer. The function should return the result to the main function. The main function should ask the user for the floating point number and integer. It should then call the function and store the result in a variable. Finally the main function should display the returned.

```
#include <iostream.h>
#include <conio.h>

float Cal(float num1, int num2)
{
    float total=1;
    while(num2-- > 0)
        total *= num1;
    return total;
}

void main()
{
    float val, res;
    int mul;
    clrscr();
    cout<<"Enter the value: ";
    cin>>val;
    cout<<"Enter the multiplier: ";
    cin>>mul;
```

```
    res = Cal(val, mul);
    cout<<"The result is "<<res<<endl;
    getch();
}
```

Q.17. Write a function that accepts a salary and returns the tax according to following rules:

No tax for first Rs.1000
5% for second Rs.1000
4% for third Rs.1000
3% for remain untaxed salary

For example, if the salary is Rs.4000, then the tax is Rs.120.

```
#include <iostream.h>
#include <conio.h>

float Tax(long s)
{
  float t;
  if(s <= 1000)
    t = 0;
  else if(s > 1000 && s <= 2000)
  {
    s = s - 1000;
    t = s * 5 / 100;
  }
  else if(s > 2000 & s <= 3000)
  {
    t = 1000 * 5 / 100;
    s = s - 2000;
    t = t + (s * 4 / 100);
  }
  else
  {
    t = 1000 * 5 / 100;
    t = t + (1000 * 4 / 100);
    s = s - 3000;
    t = t + (s * 3 / 100);
  }
  return t;
}

void main()
{
  long sal;
  float tax;
  clrscr();
```

```
    cout<<"Enter salary: ";
    cin>>sal;
    tax = Tax(sal);
    cout<<"The tax on salary "<<sal<<" is Rs. "<<tax<<endl;
    getch();
}
```

Q.18. Write a program that calculates greatest common divisor (gcd) of two numbers using recursive function.

```
#include <iostream.h>
#include <conio.h>

unsigned gcd(unsigned int, unsigned int );

void main()
{
  unsigned x, y;
  clrscr();
  cout<<"Enter two integers: ";
  cin>>x>>y;
  cout<<"GCD of "<<x<<" and "<<y<<" is "<<gcd(x, y)<<endl;
  getch();
}

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

Q.19. Write a program that calculates Fibonacci series of a number using recursive function. For example, if the user enters 8, it displays 21 which is the 8th number in the Fibonacci series.

```
#include<iostream.h>
#include"conio.h"

int fabo(int);

void main()
{
  int result=0, c;
  clrscr();
  cout<<"Enter a number for the series: ";
  cin>>c;
```

```
  result = fabo(c);
  cout<<"The Fibonacci series is: "<<result;
  getch();
}

int fabo(int n)
{
  if(n==1)
    return 1;
  else if(n==2)
    return 1;
  else
    return fabo(n-1) + fabo(n-2);
}
```

Q.20. Write a program that calculates and displays the sum of the following series using function:

$$x - (x \wedge 2) / 2! + (x \wedge 3) / 3! - (x \wedge 4) / 4! \ldots + (x \wedge 16) / 16!$$

```
#include <iostream.h>
#include <conio.h>
#include <math.h>

double Cal(int n);
long Fac(int m);
void main()
{
  int x;
  double res;
  clrscr();
  cout<<"Enter an integer. ";
  cin>>x;
  res = Cal(x);
  cout<<"Sum of series is "<<res;
  getch();
}

double Cal(int n)
{
  int c;
  double sum;
  sum = n;
  for(c=2; c<=16; c++)
  {
    if (c%2==0)
      sum = sum - pow(n, c) / Fac(c);
    else
      sum = sum + pow(n, c) / Fac(c);
  }
```

```
  return sum;
}

long Fac(int m)
{
  long f = 1;
  int n;
  for(n=m; n>=1; n--)
    f = f * n;
  return f;
}
```

Q.21. Write a function AVG which calculates and displays the average of a player. Call this function in main function. The program inputs the runs given and balls delivered in main function. The average may be calculated by the formula:

Average = (Total runs given * 60) / (Total number of balls delivered)

```
#include <iostream.h>
#include <conio.h>

float AVG(int r, int b)
{
  float a;
  a = r * 60 / b;
  return a;
}

void main()
{
  int run, ball;
  clrscr();
  cout<<"Enter total runs given: ";
  cin>>run;
  cout<<"Enter number of balls delivered: ";
  cin>>ball;
  cout<<"Player's average: "<<AVG(run, ball);
  getch();
}
```

Q.22. Write a program inputs an integer and passes it to a function. The function should return the number of digits in the integer. For example, if the integer is 35 the function should return 2, if it is 3572 the function should return 4.

```
#include <iostream.h>
#include <conio.h>
```

```
int digits(int n)
{
  int t, r = 0;
  for(t=n; t!=0; t=t/10)
    r++;
  return r;
}

void main()
{
  int num, d;
  clrscr();
  cout<<"Enter an integer: ";
  cin>>num;
  d = digits(num);
  cout<<"The number "<<num<<" contains "<<d<<" digits.";
  getch();
}
```

Q.23. Write a program that inputs five integers in a one-dimensional array and passes the array to a function. The function finds the maximum value in the array and returns to main function where it is displayed.

```
#include <iostream.h>
#include <conio.h>

int Max(int a[])
{
  int m, c;
  m = a[0];
  for(c=1; c<5; c++)
    if(a[c] > m)
      m = a[c];
  return m;
}

void main()
{
  int arr[5], max, i;
  clrscr();
  for(i=0; i<5; i++)
  {
    cout<<"Enter an integer: ";
    cin>>arr[i];
  }
  max = Max(arr);
  cout<<"The maximum number in array is "<<max;
  getch();
}
```

Q.24. Write a program that gets two numbers, one should be passed by value and the other should be passed by reference and then check the original variables whether their values have been changed or not.

```
#include <iostream.h>
#include <conio.h>

void fun(int x, int &y)
{
  x = x * 2;
  y = y * 2;
}

void main()
{
  int a, b;
  clrscr();
  cout<<"Enter value for a: ";
  cin>>a;
  cout<<"Enter value for b: ";
  cin>>b;
  cout<<"The value of a before function call: "<<a<<endl;
  cout<<"The value of b before function call: "<<b<<endl;
  fun(a, b);
  cout<<"The value of a after function call: "<<a<<endl;
  cout<<"The value of b after function call: "<<b<<endl;
  getch();
}
```

Q.25. Write a program that inputs a positive integer and passes it to a function that displays the prime factors of this number. For example, prime factors of 24 are 2, 2, 2, 3 and prime factors of 35 are 5 and 7.

```
#include <iostream.h>
#include <conio.h>

void factor(int n)
{
  int i, f;
  f = 2;
  cout<<"Prime factors of "<<n<<" are ";
  while(f <= n)
    if(n%f==0)
    {
      n = n / f;
      cout<<f<<" ";
    }
    else
      f++;
}
```

```
void main()
{
  int num;
  clrscr();
  cout<<"Enter a positive integer: ";
  cin>>num;
  factor(num);
  getch();
}
```

Q.26. Write a function that takes two times as two integer arguments of hours and minutes. It returns number of minutes between two times.

```
#include <iostream.h>
#include <conio.h>

struct Time
{
  int hour, minute;
};
int fun(Time t1, Time t2)
{
  int min1, min2;
  min1 = t1.hour * 60 + t1.minute;
  min2 = t2.hour * 60 + t2.minute;
  if(min1 > min2)
    return min1 - min2;
  else
    return min2 - min1;
}

void main()
{
  Time one, two;
  clrscr();
  cout<<"Enter first time: "<<endl;
  cout<<"Hours: ";
  cin>>one.hour;
  cout<<"Minutes: ";
  cin>>one.minute;
  cout<<"Enter second time: "<<endl;
  cout<<"Hours: ";
  cin>>two.hour;
  cout<<"Minutes: ";
  cin>>two.minute;
  cout<<"Difference between times is "<<fun(one, two)<<" minutes.";
  getch();
}
```

Q.27. Write a program to generate a Pascal's triangle using function as follows:

```
        1
      1   1
    1   2   1
  1   3   3   1
1   4   6   4   1
```

```
#include <iostream.h>
#include <conio.h>

void pas(int n)
{
  int x, y, z, c, s;
  cout<<endl;
  s = n;
  for(y=0; y<n; y++)
  {
    c = 1;
    for(z=1; z<=s; z++)
      cout<<" ";
    for(x = 0; x <= y; x++)
    {
      cout<<c<<" ";
      c = c * (y - x) / (x + 1);
    }
    s--;
    cout<<endl;
  }
}

void main()
{
  int num;
  clrscr();
  cout<<"Enter a number: ";
  cin>>num;
  pas(num);
  getch();
}
```

Q.28. Write a program to use two functions Large() and Sum(). The Large() function gets two integer arguments by reference and sets the larger number to its square. The Sum() function gets an integer argument by value and returns the sum of the individual digits of the number. The main() function inputs two integers from user and prints the sum of individual digits and square of larger number.

```
#include <iostream.h>
#include <conio.h>

void Large(int &x, int &y)
{
  if(x > y)
    x = x * x;
  else
    y = y * y;
}

int Sum(int n)
{
  int rem, s = 0;
  while(n!=0)
  {
    rem = n % 10;
    s = s + rem;
    n = n / 10;
  }
  return s;
}

void main()
{
  int a, b, large;
  clrscr();
  cout<<"Enter two numbers: ";
  cin>>a>>b;
  cout<<"Sum of individual digits of "<<a<<": "<<Sum(a)<<endl;
  cout<<"Sum of individual digits of "<<b<<": "<<Sum(b)<<endl;
  cout<<"The square of large number is: ";
  if(a > b)
  {
    Large(a, b);
    cout<<a<<endl;
  }
  else
  {
    Large(a, b);
    cout<<b<<endl;
  }
  getch();
}
```

Q.29. Write a program that inputs five integers in a one-dimensional array and passes the array to a function. The function finds the minimum value in the array and returns to main function where it is displayed.

```
#include <iostream.h>
#include <conio.h>

int Mini(int n[])
{
  int m, i;
  m = n[0];
  for(i=1; i<5; i++)
    if(n[i] < m)
      m = n[i];
  return m;
}

void main()
{
  int arr[5], c, min;
  clrscr();
  for(c=0; c<5; c++)
  {
    cout<<"Enter an integer: ";
    cin>>arr[c];
  }
  min = Mini(arr);
  cout<<"Minimum number in array: "<<min;
  getch();
}
```

Q.30. Write a program that inputs the name and population of two cities in structure variables and passes them to a function. The function displays the record of the city that has less population.

```
#include <iostream.h>
#include <conio.h>

struct City
{
  char name[30];
  unsigned long pop;
};

void Fun(City a, City b)
{
  if(a.pop < b.pop)
  {
    cout<<"The city with less population is "<<a.name<<endl;
    cout<<"Its population is: "<<a.pop;
  }
  else
  {
    cout<<"The city with less population is "<<b.name<<endl;
```

```
    cout<<"It's population is: "<<b.pop;
  }
}

void main()
{
  City x, y;
  clrscr();
  cout<<"Enter name of first city: ";
  cin>>x.name;
  cout<<"Enter its population: ";
  cin>>x.pop;
  cout<<"Enter name of second city: ";
  cin>>y.name;
  cout<<"Enter its population: ";
  cin>>y.pop;
  Fun(x, y);
  getch();
}
```

Q.31. Write a program that inputs a float array having 10 elements. The program uses reverse() function to reverse this array. The main() function displays the original and reversed array.

```
#include <iostream.h>
#include <conio.h>

void reverse(float a[])
{
  float t[10];
  int i;
  for(i=0; i<10; i++)
    t[4-i] = a[i];
  for(i=0; i<10; i++)
    a[i] = t[i];
}

void main()
{
  float arr[10];
  int j;
  clrscr();
  for(j=0; j<10; j++)
  {
    cout<<"Enter floating point number: ";
    cin>>arr[j];
  }
  cout<<"Original array: ";
```

```
    for(j=0; j<10; j++)
      cout<<arr[j]<<" ";
    reverse(arr);
    cout<<"\nReversed array: ";
    for(j=0; j<10; j++)
      cout<<arr[j]<<" ";
    getch();
}
```

Q.32. Write a function Change() that accepts an array of integers and its size as parameters. It divides all array elements by 5 that are divisible by 5 and multiplies other array elements by 2.

```
#include <iostream.h>
#include <conio.h>

void Change(int a[], int n)
{
  int i;
  for(i=0; i<n; i++)
    if(a[i]%5==0)
      a[i] = a[i] / 5;
    else
      a[i] = a[i] * 2;
}

void main()
{
  int arr[5], j;
  clrscr();
  for(j=0; j<5; j++)
  {
    cout<<"Enter an integer: ";
    cin>>arr[j];
  }
  cout<<"Original array: ";
  for(j=0; j<5; j++)
    cout<<arr[j]<<" ";
  Change(arr, 5);
  cout<<"\nChanged array: ";
  for(j=0; j<5; j++)
    cout<<arr[j]<<" ";
  getch();
}
```

Q.33. Write a program that inputs five integers in two arrays each. It declares a function that accepts four parameters. The first parameter is the first array, second parameter is the second array, third parameter is the third array and fourth parameter is the length of the arrays. The

function adds the corresponding values of first two arrays and stores the result in the corresponding element of third array. The main function finally displays the values of all arrays. **Note:** The length of all three arrays must be same.

```
#include <iostream.h>
#include <conio.h>

void Add(int a[], int b[], int c[], int s)
{
  int i;
  for(i=0; i<s; i++)
    c[i] = a[i] + b[i];
}
void main()
{
  int x[5], y[5], z[5], j;
  clrscr();
  cout<<"Enter five values in 1st array: ";
  for(j=0; j<5; j++)
    cin>>x[j];
  cout<<"Enter five values in 2nd array: ";
  for(j=0; j<5; j++)
    cin>>y[j];
  Add(x, y, z, 5);
  cout<<"1st array: ";
  for(j=0; j<5; j++)
    cout<<x[j]<<" ";
  cout<<"\n2nd array: ";
  for(j=0; j<5; j++)
    cout<<y[j]<<" ";
  cout<<"\n3rd array: ";
  for(j=0; j<5; j++)
    cout<<z[j]<<" ";
  getch();
}
```

Q.34. Write a program that inputs values in a 2-D array of 5 columns and 5 rows. It displays these values using a function display(). It passes the array to a function times2() that doubles the values stored in all elements of array. The program then again displays the changed values of the array using display() function.

```
#include <iostream.h>
#include <conio.h>

void display(int a[5][5])
{
  int m, n;
```

```
    cout<<"The vlaues in array: "<<endl;
    for(m=0; m<5; m++)
    {
      for(n=0; n<5; n++)
        cout<<a[m][n]<<" ";
      cout<<endl;
    }
}

void times2(int a[5][5])
{
  int m, n;
  for(m=0; m<5; m++)
    for(n=0; n<5; n++)
      a[m][n] = a[m][n] * 2;
  cout<<endl;
}

void main()
{
  int arr[5][5], i, j;
  clrscr();
  cout<<"Enter values in 5x5 array: ";
  for(i=0; i<5; i++)
    for(j=0; j<5; j++)
      cin>>arr[i][j];
  display(arr);
  times2(arr);
  display(arr);
  getch();
}
```

Q.35. Write an inline function MAX(double x, double y), which returns the maximum value of x and y. Test the function by reading values from the keyboard.

```
#include <iostream.h>
#include <conio.h>

inline double MAX(double x, double y)
{
  return x > y ? x : y;
}

void main()
{
  double a, b;
  clrscr();
```

```
    cout<<"Enter two floating point values: ";
    cin>>a>>b;
    cout<<"Maximum value is: "<<MAX(a, b);
    getch();
}
```

Q.36. Write a program that inputs radius of circle and uses an inline function Area() to calculate and return the area of circle.

```
#include <iostream.h>
#include <conio.h>

inline float Area(float r)
{
  return 3.14 * r * r;
}

void main()
{
  float rad;
  clrscr();
  cout<<"Enter radius: ";
  cin>>rad;
  cout<<"Area of circle: "<<Area(rad);
  getch();
}
```

CHAPTER 11

POINTERS

Q.1. Write a program that sorts an array of integers using pointers.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int arr[5], i, j, temp, *p, *q;
  for(i=0; i<5; i++)
  {
    cout<<"Enter an integer: ";
    cin>>arr[i];
  }
  p = arr;
  for(i=0; i<4; i++)
  {
    q = p + 1;
    for(j=i+1; j<5; j++)
    {
      if(*q < *p)
      {
        temp = *p;
        *p = *q;
        *q = temp;
      }
      q++;
    }
    p++;
  }
  cout<<"Sorted array: ";
  for(i=0; i<5; i++)
    cout<<arr[i]<<" ";
  getch();
}
```

Q.2. Write a program that inputs two integers and passes them to a function using pointers. The function swaps the values of both integers. The main() function should display the values before and after calling the function.

```
#include <iostream.h>
#include <conio.h>
```

```
void swap(int*,int*);

void main()
{
  clrscr();
  int a, b;
  cout<<"Enter two integers: ";
  cin>>a>>b;
  cout<<"Values before swapping: \n";
  cout<<"a = "<<a<<endl;
  cout<<"b = "<<b<<endl;
  swap(&a, &b);
  cout<<"Values after swapping: \n";
  cout<<"a = "<<a<<endl;
  cout<<"b = "<<b<<endl;
  getch();
}

void swap(int *x, int *y)
{
  int t;
  t = *x;
  *x = *y;
  *y = t;
}
```

Q.3. Write a program that declares five integer variables a, b, c, d and e. It also declares an array of pointer with five elements. The first element refers to a, the second element refers to b and so on. The program should use the array to input values in the variables and then display the maximum value.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int *ptr[5], a, b, c, d, e, max, i;
  cout<<"Enter five integers: ";
  cin>>a>>b>>c>>d>>e;
  ptr[0] = &a;
  ptr[1] = &b;
  ptr[2] = &c;
  ptr[3] = &d;
  ptr[4] = &e;
  max = *ptr[0];
  for(i=1; i<5; i++)
    if(max < *ptr[i])
      max = *ptr[i];
```

```
    cout<<"Maximum value: "<<max<<endl;
    getch();
}
```

Q.4. Write a program that declares structure to store account ID and amount. It inputs the number of account holders from the user and creates a dynamic array of structures to store the records of accounts. The program should declare two functions i.e. one for getting input from the user and the other for showing records to the user.

```
#include <iostream.h>
#include <conio.h>

struct Account
{
  int aid;
  long amount;
};

void input(Account *ac, int n)
{
  int i;
  for(i=0; i<n; i++)
  {
    cout<<"Enter account id: ";
    cin>>ac->aid;
    cout<<"Enter amount: ";
    cin>>ac->amount;
    ac++;
  }
}

void output(Account *ac, int n)
{
  int i;
  for(i=0; i<n; i++)
  {
    cout<<"Account id: "<<ac->aid<<endl;
    cout<<"Amount: "<<ac->amount<<endl;
    ac++;
  }
}

void main()
{
  clrscr();
  int num;
  Account *ptr;
  cout<<"Enter number of account holders: ";
  cin>>num;
  ptr = new Account[num];
```

```
    input(ptr, num);
    output(ptr, num);
    delete ptr;
    getch();
}
```

Q.5. Write a program that inputs the number of students in a class from user. It then declares a dynamic array with same number of elements. It inputs the marks of students and finally displays the average marks of the whole class.

```
#include <iostream.h>
#include <conio.h>
void main()
{
  clrscr();
  int num, tot, i, *ptr;
  float avg;
  tot = 0;
  cout<<"Enter number of students in class: ";
  cin>>num;
  ptr = new int[num];
  for(i=0; i<num; i++)
  {
    cout<<"Enter marks: ";
    cin>>*ptr;
    tot += *ptr;
    ptr++;
  }
  avg = tot / float(num);
  cout<<"Average marks: "<<avg;
  delete ptr;
  getch();
}
```

Q.6. Write a program to swap two values by passing pointers as arguments to function.

```
#include <iostream.h>
#include <conio.h>

void swap(int*,int*);

void main()
{
  clrscr();
  int a, b, *p, *q;
  p = &a;
  q = &b;
  cout<<"Enter two integers: ";
  cin>>*p>>*q;
```

```
    cout<<"Values before swapping: \n";
    cout<<"a = "<<*p<<endl;
    cout<<"b = "<<*q<<endl;
    swap(p, q);
    cout<<"Values after swapping: \n";
    cout<<"a = "<<*p<<endl;
    cout<<"b = "<<*q<<endl;
    getch();
}
void swap(int *x, int *y)
{
    int t;
    t = *x;
    *x = *y;
    *y = t;
}
```

Q.7. Write a program to input any integer value and then to find out if the given value is a prime number or not by passing a number to a function as pointer argument.

```
#include <iostream.h>
#include <conio.h>
void prime(int*);
void main()
{
    clrscr();
    int a, *p;
    p = &a;
    cout<<"Enter an integer: ";
    cin>>*p;
    prime(p);
    getch();
}
void prime(int *x)
{
    int c, p = 1;
    for(c=2; c<=*x/2; c++)
        if(*x%c==0)
        {
            p = 0;
            break;
        }
    if(p==1)
        cout<<*x<<" is a prime number.";
    else
        cout<<*x<<" is not prime number.";
}
```

CHAPTER 12

STRING HANDLING

Q.1. Write a program that inputs a string from user and checks the string is a palindrome or not. A palindrome is a string that reads the same backwards as forwards such as MADAM and MOM.

```
#include <iostream.h>
#include <conio.h>
#include <string.h>
void main()
{
  clrscr();
  char s1[100], s2[100];
  cout<<"Enter a string: ";
  cin.getline(s1, 100);
  strcpy(s2, s1);
  strrev(s2);
  if(strcmp(s1, s2) == 0)
    cout<<"The string is palindrome.";
  else
    cout<<"The string is not palindrome.";
  getch();
}
```

Q.2. Write a program that inputs a string and displays number of words and number of characters without spaces in the string.

```
#include <iostream.h>
#include <conio.h>
#include <string.h>
void main()
{
  clrscr();
  char str[100];
  int word, ch, i;
  word = ch = i = 0;
  cout<<"Enter a string: ";
  cin.getline(str, 100);
  while(str[i] != '\0')
  {
    if(str[i] == ' ')
      word++;
```

```
    else
      ch++;
    i++;
  }
  cout<<"Number of words: "<<word+1<<endl;
  cout<<"Number of characters: "<<ch<<endl;
  getch();
}
```

Q.3. Write a program that inputs a string and displays it in reverse order.

```
#include <iostream.h>
#include <conio.h>
#include <string.h>
void main()
{
  clrscr();
  char str[100];
  cout<<"Enter a string: ";
  cin.getline(str, 100);
  cout<<"Original string: "<<str<<endl;
  cout<<"Reversed string: "<<strrev(str)<<endl;
  getch();
}
```

Q.4. Write a program that inputs a string and displays it as triangle. For example, if the user enters World, the program displays the following:

```
W
W o
W o r
W o r l
W o r l d
```

```
#include <iostream.h>
#include <conio.h>
#include <string.h>
void main()
{
  clrscr();
  char str[100];
  int i, j, len;
  cout<<"Enter a string: ";
  cin.getline(str, 100);
  len = strlen(str);
  for(i=0; i<len; i++)
  {
```

```
        for(j=0; j<=i; j++)
          cout<<str[j];
        cout<<endl;
      }
      getch();
}
```

Q.5. Write a program that inputs a string and a character. It converts each occurrence of the given character in the string to opposite case.

```
#include <iostream.h>
#include <conio.h>
#include <string.h>
#include <ctype.h>
void main()
{
  clrscr();
  char ch, c, str[100];
  int i, j, len;
  cout<<"Enter a string: ";
  cin.getline(str, 100);
  cout<<"Enter a character: ";
  cin>>ch;
  len = strlen(str);
  for(i=0; i<len; i++)
  {
    if(toupper(str[i]) == ch || tolower(str[i]) == ch)
    {
      c = str[i];
      if(c >= 65 && c <= 90)
        c = c + 32;
      else if(c >= 97 && c <= 122)
        c = c - 32;
      str[i] = c;
    }
  }
  cout<<str;
  getch();
}
```

CHAPTER 13

BASICS OF OBJECT-ORIENTED PROGRAMMING

Q.1. Write a class Player that contains attributes for the player's name, average and team. Write three functions to input, change and display these attributes. Also write a constructor that asks for input to initialize all the attributes.

```
#include <iostream.h>
#include <conio.h>
#include <string.h>
#include <stdio.h>

class Player
{
  private:
  char name[50];
  float avg;
  char team[50];
  public:
  Player()
  {
    cout<<"Enter player name: ";
    gets(name);
    cout<<"Enter average: ";
    cin>>avg;
    cout<<"Enter team name: ";
    gets(team);
  }
  void input()
  {
    cout<<"Enter player name: ";
    gets(name);
    cout<<"Enter average: ";
    cin>>avg;
    cout<<"Enter team name: ";
    gets(team);
  }
  void display()
  {
    cout<<"Player name: "<<name<<endl;
    cout<<"Average: "<<avg<<endl;
```

```
    cout<<"Team name: "<<team<<endl;
  }
  void change(char n[], float a, char t[])
  {
    strcpy(name, n);
    avg = a;
    strcpy(team, t);
  }
};

void main()
{
  clrscr();
  Player p1;
  p1.display();
  p1.change("Yousuf", 80.59, "Pakistan");
  p1.display();
  getch();
}
```

Q.2. Define a class for a bank account that includes the following data members:

- Name of the depositor
- Account Number
- Type of account
- Balance amount in the account

The class also contains the following member functions:

- A constructor to assign initial values
- Deposit function to deposit some amount. It should accept the amount as parameter.
- Withdraw function to withdraw an amount after checking the balance. It should accept the amount as parameter.
- Display function to display name and balance.

```
#include <iostream.h>
#include <stdio.h>
#include <string.h>
#include <conio.h>

class bank
{
  private:
  char name[20];
  int acno;
```

```
    char actype[20];
    int bal;
    public:
    bank();
    void deposit(int amt);
    void withdraw(int amt);
    void display();
};

void bank::bank()
{
    cout<<"Enter account name: ";
    gets(name);
    cout<<"Enter account no: ";
    cin>>acno;
    cout<<"Enter account type: ";
    gets(actype);
    cout<<"Enter opening balance: ";
    cin>>bal;
}

void bank::deposit(int amt)
{
    bal = bal + amt;
    cout<<"\nBalance after deposit: "<<bal;
}

void bank::withdraw(int amt)
{
    if(amt > bal)
        cout<<"Not enough amount in account!"<<endl;
    else
    {
        bal = bal - amt;
        cout<<"Balance after withdraw: "<<bal;
    }
}

void  bank :: display(void)
{
    cout<<"Account Details: "<<endl;
    cout<<"Account Name:    "<<name<<endl;
    cout<<"Account No.      "<<acno<<endl;
    cout<<"Account Type:    "<<actype<<endl;
    cout<<"Current Balance: "<<bal<<endl;
}
```

```
void main()
{
  int a, choice;
  bank ac;
  clrscr();
  do
  {
    cout<<"\n\nChoice List\n\n";
    cout<<"1) Deposit\n";
    cout<<"2) Withdraw\n";
    cout<<"3) Display All Details\n";
    cout<<"4) EXIT\n";
    cout<<"Enter your choice: ";
    cin>>choice;
    switch(choice)
    {
     case 1:
       cout<<"Enter amount to deposit: ";
       cin>>a;
       ac.deposit(a);
       break;
     case 2:
       cout<<"Enter amount to withdraw: ";
       cin>>a;
       ac.withdraw(a);
       break;
     case 3:
       ac.display();
       break;
     case 4:
       goto end;
    }
  }while(1);
  end:
}
```

Q.3. Create two classes DM and DB to store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. **Hint:** Use friend function.

```
#include <iostream.h>
#include <conio.h>

class DB;
```

```
class DM
{
  float mt;
  int cm;
  public:
  void input();
  void output();
  friend DM add(DM, DB);
};

class DB
{
  int feet;
  float inches;
  public:
  void input();
  void output();
  friend DM add(DM, DB);
};

void DM::input()
{
  cout<<"Enter metres: ";
  cin>>mt;
  cout<<"Enter centimetres: ";
  cin>>cm;
}

void DM::output()
{
  cout<<"Distance in metres: "<<mt<<endl;
  cout<<"Distance in centimetres: "<<cm<<endl;
}

void DB::input()
{
  cout<<"Enter feet: ";
  cin>>feet;
  cout<<"Enter inches: ";
  cin>>inches;
}

void DB::output()
{
  cout<<"Distance: "<<feet<<" feet "<<inches<<" inches."<<endl;
}
```

```
DM add(DM a, DB b)
{
  DM t;
  t.cm = a.cm + (b.feet * 12 * 2.54) + ((b.inches * 2.54));
  t.mt = a.mt + (t.cm / 100);
  t.cm = t.cm % 100;
  return t;
}

void main()
{
  DM x, y;
  DB z;
  clrscr();
  x.input();
  z.input();
  cout<<endl;
  y = add(x, z);
  y.output();
  getch();
}
```

Q.4. Write a class Run that contains the following data members:

- The name of the runner
- The distance covered by a runner.

The class has the following member functions:

- Get function to input runner name and distance.
- Show function to displays runner name and distance.

The user should be able to show the name of the runner who has covered the longest distance at any point of time.

Hint: Use static data members.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>
#include <string.h>

class Run
{
  char name[50];
  float dis;
  static char tname[50];
  static float tdis;
  public:
  void get();
  void show();
  void topper();
};
```

```
void Run::get()
{
  cout<<"Enter runner name: ";
  gets(name);
  cout<<"Enter distance covered: ";
  cin>>dis;
  if(dis > tdis)
  {
    tdis = dis;
    strcpy(tname, name);
  }
}

void Run::show()
{
  cout<<"Runner name: "<<name<<endl;
  cout<<"Distance covered: "<<dis<<endl;
}

void Run::topper()
{
  cout<<tname<<" covered the longest distance."<<endl;
  cout<<"The distance is "<<tdis<<" miles."<<endl;
}

float Run::tdis = 0;
char Run::tname[50] = "Noname";

void main()
{
  Run x, y, z;
  clrscr();
  x.get();
  x.topper();
  y.get();
  z.get();
  z.topper();
  getch();
}
```

Q.5. Write a class Car that contains the following attributes:

- The name of car
- The direction of car (E, W, N, S)
- The position of car (from imaginary zero point)

The class has the following member functions:

- A constructor to initialize the attributes.

- Turn function to change the direction of car to one step right side (e.g. if the direction is to E, it should be changed to S and so on.)
- Overload the Turn function to change the direction to any side directly. It should accept the direction as parameter.
- Move function to change the position of car away from zero point. It should accept the distance as parameter.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>
#include <string.h>

class Car
{
  char name[50], dir;
  int pos;
  public:
  Car()
  {
    strcpy(name, "Noname");
    dir = 'E';
    pos = 0;
  }
  void reset()
  {
    cout<<"Enter car name: ";
    gets(name);
    cout<<"Enter direction: ";
    cin>>dir;
    cout<<"Enter position: ";
    cin>>pos;
  }
  void turn ()
  {
    if(dir == 'E')
      dir = 'N';
    else if(dir == 'N')
      dir = 'W';
    else if(dir == 'W')
      dir = 'S';
    else if(dir == 'S')
      dir = 'E';
  }
  void turn(char d)
  {
    dir = d;
  }
```

```
    void move(int d)
    {
      pos = pos + d;
    }
    void show()
    {
      cout<<"The direction of car is ";
      switch(dir)
      {
        case 'E':
        cout<<"East";
        break;
        case 'N':
        cout<<"North";
        break;
        case 'W':
        cout<<"West";
        break;
        case 'S':
        cout<<"South";
        break;
      }
      cout<<"\nIt is standing at "<<pos<<" position."<<endl;
    }
};

void main()
{
  Car x;
  clrscr();
  x.reset();
  x.show();
  x.turn();
  x.move(100);
  x.show();
  getch();
}
```

CHAPTER 14

OPERATOR OVERLOADING

Q.1. Write a class Time that has three data member hour, minutes and seconds. The class has the following member functions:

- A constructor to initialize the time.
- Show function to show the time.
- Overload ++ operator to increase the time by 1 minute.
- Overload – – operator to decrease the time by 1 minute.

```
#include <iostream.h>
#include <conio.h>
class Time
{
  private:
  int h, m, s;
  public:
  Time()
  {
    h = m = s = 0;
  }
  Time(int hh, int mm, int ss)
  {
    h = hh; m = mm; s = ss;
  }
  void operator ++(int)
  {
    if(m == 59)
    {
      m = 0;
      h++;
    }
    else
      m++;
  }
  void operator --(int)
  {
    if(m == 0)
    {
      m = 59;
      h--;
    }
```

```
    else
      m--;
  }
  void show()
  {
    cout<<h<<":"<<m<<":"<<s<<endl;
  }
};
void main()
{
  clrscr();
  Time x(10,50,50);
  x.show();
  x++;
  x.show();
  x--;
  x.show();
  getch();
}
```

Q.2. Define a class for a bank account that includes the following data members:

- Name of the depositor
- Account Number
- Type of account
- Balance amount in the account

The class also contains the following member functions:

- A constructor to assign initial values
- Deposit function to deposit some amount. It should accept the amount as parameter.
- Withdraw function to withdraw an amount after checking the balance. It should accept the amount as parameter.
- Display function to display name and balance.
- Overload binary + operator that adds the balance of one account to another account. It should accept an object as parameter and add the values of the parameter to the calling object.

```
#include <iostream.h>
#include <stdio.h>
#include <string.h>
#include <conio.h>
```

```
class bank
{
  private:
  char name[20];
  int acno;
  char actype[20];
  int bal;
  public:
  bank();
  void deposit(int amt);
  void withdraw(int amt);
  void display();
  void add(bank ac);
};

void bank::bank()
{
  cout<<"Enter account name: ";
  gets(name);
  cout<<"Enter account no: ";
  cin>>acno;
  cout<<"Enter account type: ";
  gets(actype);
  cout<<"Enter opening balance: ";
  cin>>bal;
}

void bank::deposit(int amt)
{
  bal = bal + amt;
  cout<<"\nBalance after deposit: "<<bal;
}

void bank::withdraw(int amt)
{
  if(amt > bal)
    cout<<"Not enough amount in account!"<<endl;
  else
  {
    bal = bal - amt;
    cout<<"Balance after withdraw: "<<bal;
  }
}

void  bank :: display(void)
{
  cout<<"Account Details: "<<endl;
  cout<<"Account Name:    "<<name<<endl;
```

```
    cout<<"Account No.      "<<acno<<endl;
    cout<<"Account Type:    "<<actype<<endl;
    cout<<"Current Balance: "<<bal<<endl;
}

void bank::add(bank ac)
{
    bal = bal + ac.bal;
}

void main()
{
    clrscr();
    bank x, y;
    x.add(y);
    x.display();
    getch();
}
```

Q.3. Write a class Array that contains an array of integers as data member. The class contains the following member functions:

- A constructor that initializes the array elements to -1.
- Input function to input the values in the array.
- Show function to display the values of the array.
- Overload == operator to compare the values of two objects. The overloaded function returns 1 if all values of both objects are same and returns 0 otherwise.

```
#include <iostream.h>
#include <conio.h>

class Array
{
    private:
    int arr[5];
    public:
    Array();
    void input();
    void show();
    int operator==(Array a);
};

Array::Array()
{
    int i;
    for(i=0; i<5; i++)
```

```
    arr[i] = -1;
}

void Array::input()
{
  int i;
  for(i=0; i<5; i++)
  {
    cout<<"Enter an integer: ";
    cin>>arr[i];
  }
}

void Array::show()
{
  int i;
  cout<<"Array values: ";
  for(i=0; i<5; i++)
    cout<<arr[i]<<" ";
}

int Array::operator==(Array a)
{
  int i, eq = 1;
  for(i=0; i<5; i++)
    if(arr[i] != a.arr[i])
      eq = 0;
  return eq;
}

void main()
{
  clrscr();
  Array x, y;
  int n;
  x.input();
  y.input();
  if(x==y)
    cout<<"Both arrays are equal.";
  else
    cout<<"Both arrays are different.";

  getch();
}
```

CHAPTER 15

INHERITANCE

Q.1. Write a class Employee that contains attributes of employee id and his scale. The class contains member functions to input and show the attribute. Write a child class Manager that inherits Employee class. The child class has attributes of manager id and his department. It also contains the member functions to input and show its attributes.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>

class Employee
{
  protected:
  int eid, scale;
  public:
  Employee()
  {
    eid = -1;
    scale = 0;
  }

  void input()
  {
    cout<<"Enter employee id: ";
    cin>>eid;
    cout<<"Enter scale: ";
    cin>>scale;
  }

  void show()
  {
    cout<<"Employee ID: "<<eid<<endl;
    cout<<"Scale: "<<scale<<endl;
  }
};

class Manager : public Employee
{
  private:
  int mid;
  char dept[30];
```

```
  public:
  Manager()
  {
    Employee();
    mid = 0;
  }

  void input()
  {
    Employee::input();
    cout<<"Enter manager id: ";
    cin>>mid;
    cout<<"Enter department: ";
    gets(dept);
  }

  void show()
  {
    Employee::show();
    cout<<"Manager ID: "<<mid<<endl;
    cout<<"Department: "<<dept<<endl;
  }
};

void main()
{
  clrscr();
  Manager m;
  m.input();
  m.show();
  getch();
}
```

Q.2. Write a class LocalPhone that contains an attribute phone to store a local telephone number. The class contains member functions to input and display phone number. Write a child class NatPhone for national phone numbers that inherits LocPhone class. It additionally contains an attribute to store city code. It also contains member functions to input and show the city code. Write another class IntPhone for international phone numbers that inherits NatPhone class. It additionally contains an attribute to store country code. It also contains member functions to input and show the country code.

```
#include <iostream.h>
#include <conio.h>
```

```
class LocalPhone
{
  protected:
  long ph;
  public:
  void input()
  {
    cout<<"Enter phone no: ";
    cin>>ph;
  }
  void show()
  {
    cout<<ph<<endl;
  }
};

class NatPhone : public LocalPhone
{
  protected:
  int ccode;
  public:
  void input()
  {
    cout<<"Enter city code: ";
    cin>>ccode;
    LocalPhone::input();
  }
  void show()
  {
    cout<<ccode<<" ";
    LocalPhone::show();
  }
};

class IntPhone : public NatPhone
{
  private:
  int ncode;
  public:
  void input()
  {
    cout<<"Enter country code: ";
    cin>>ncode;
    NatPhone::input();
  }
  void show()
  {
    cout<<ncode<<" ";
```

```
    NatPhone::show();
  }
};

void main()
{
  clrscr();
  IntPhone p;
  p.input();
  p.show();
  getch();
}
```

Q.3. Write a class Teacher that contains the attribute teacher name, age and address. It also contains member function to input and display its attributes. Write another class Writer that contains the attributes writer name, address and number of books written by him. It also contains member functions to input and display its attributes. Write a third class Scholar that inherits both Teacher and Writer classes.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>

class Teacher
{
  protected:
  char name[50], address[100];
  int age;
  public:
  void input()
  {
    cout<<"Enter teacher name: ";
    gets(name);
    cout<<"Enter teacher age: ";
    cin>>age;
    cout<<"Enter teacher address: ";
    gets(address);
  }
  void show()
  {
    cout<<"Name: "<<name<<endl;
    cout<<"Age: "<<age<<endl;
    cout<<"Address: "<<address<<endl;
  }
};
```

```
class Writer
{
  protected:
  char name[50], address[100];
  int books;
  public:
  void input()
  {
    cout<<"Enter writer name: ";
    gets(name);
    cout<<"Enter writer address: ";
    gets(address);
    cout<<"Enter number of books written: ";
    cin>>books;
  }
  void show()
  {
    cout<<"Writer name: "<<name<<endl;
    cout<<"Address: "<<address<<endl;
    cout<<"Number of books: "<<books<<endl;
  }
};

class Scholar : public Teacher, public Writer
{
  public:
  void input()
  {
    Teacher::input();
    Writer::input();
  }
  void show()
  {
    Teacher::show();
    Writer::show();
  }
};

void main()
{
  clrscr();
  Scholar s;
  s.input();
  s.show();
  getch();
}
```

Q.4. Write a class Book that contains the attributes BookID, book name and price. It also contains member functions to input and show its attributes. Write another class Writer that contains the attributes writer name, address and number of books written by him. It contains an array of Book objects as its member. The length of array should be 5 to store the data of five books. It also contains member functions to input and display its attributes.

```
#include <iostream.h>
#include <conio.h>
#include <stdio.h>

class Book
{
  protected:
  int bid;
  char bname[50];
  float price;
  public:
  void input()
  {
    cout<<"Enter book id: ";
    cin>>bid;
    cout<<"Enter book name: ";
    gets(bname);
    cout<<"Enter book price: ";
    cin>>price;
  }
  void show()
  {
    cout<<"Book ID: "<<bid<<endl;
    cout<<"Book name: "<<bname<<endl;
    cout<<"Price: "<<price<<endl;
  }
};

class Writer
{
  protected:
  char name[50], address[100];
  int books;
  Book bk[5];
  public:
  void input()
  {
    cout<<"Enter writer name: ";
    gets(name);
    cout<<"Enter writer address: ";
```

```
        gets(address);
        cout<<"Enter number of books written: ";
        cin>>books;
        cout<<"Enter detail of five books: "<<endl;
        for(int i=0; i<5; i++)
          bk[i].input();
    }
    void show()
    {
      cout<<"\nWriter name: "<<name<<endl;
      cout<<"Address: "<<address<<endl;
      cout<<"Number of books: "<<books<<endl;
      cout<<"\nDetail of five books: \n"<<endl;
      for(int i=0; i<5; i++)
        bk[i].show();
    }
};

void main()
{
  clrscr();
  Writer w;
  w.input();
  w.show();
  getch();
}
```

CHAPTER 17

TEMPLATES

Q.1. Write a function template that finds the minimum value in the array and returns it.

```
#include <iostream.h>
#include <conio.h>

template <class Type>
Type Max(Type a[], int l)
{
  Type max = a[0];
  for(int i=0; i<l; i++)
    if(a[i] > max)
      max = a[i];
  return max;
}

void main()
{
  clrscr();
  int n[5], m, i;
  float avg[5], am;
  cout<<"Enter five integers: ";
  for(i=0; i<5; i++)
    cin>>n[i];
  m = Max(n, 5);
  cout<<"Maximum value: "<<m<<endl;
  cout<<"Enter five floating point numbers: ";
  for(i=0; i<5; i++)
    cin>>avg[i];
  am = Max(avg, 5);
  cout<<"Maximum value: "<<am<<endl;
  getch();
}
```

Q.2. Write a function template that accepts three parameters and displays them in reverse order.

```
#include <iostream.h>
#include <conio.h>
```

```
template <class Type>
void Reverse(Type a, Type b, Type c)
{
  cout<<"The values in reverse order: ";
  cout<<c<<" "<<b<<" "<<a<<endl;
}

void main()
{
  int x, y, z;
  float d, e, f;
  cout<<"Enter three integers: ";
  cin>>x>>y>>z;
  Reverse(x, y, z);
  cout<<"Enter three floating point numbers: ";
  cin>>d>>e>>f;
  Reverse(d, e, f);
  getch();
}
```

Q.3. Write a class template that that inputs the index of the array and displays the value in the specified index.

```
#include <iostream.h>
#include <conio.h>

template <class Type>
class Test
{
  private:
  Type arr[5];
  public:
  void input()
  {
    for(int i=0; i<5; i++)
      cin>>arr[i];
  }
  void show()
  {
    int i;
    cout<<"\nEnter an index: ";
    cin>>i;
    cout<<"The value at required index: "<<arr[i];
  }
};
```

```
void main()
{
  Test <int> x;
  Test <char>y;
  cout<<"\nEnter five integers: "<<endl;
  x.input();
  x.show();
  cout<<"\nEnter five characters: "<<endl;
  y.input();
  y.show();
  getch();
}
```

CHAPTER 18

FILE HANDLING

Q.1. Write a program that inputs up to 10 integer values from a data file and displays them on the screen. If there are not 10 integers in file, the message "The file is finished." should be displayed after last number.

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <fstream.h>
void main()
{
  clrscr();
  int i, num;
  ifstream file("d:\\numbers.txt");
  if(!file)
  {
    cout<<"Error in opening file.";
    exit(1);
  }
  cout<<"The file contains the following integers: "<<endl;
  for(i=1; i<=10; i++)
  {
    file>>num;
    cout<<num<<endl;
    if(i<10 && file.eof())
    {
      cout<<"File is finished ";
      break;
    }
  }
  file.close();
  getch();
}
```

Q.2. Write a program that counts the number of words in a file.

```
#include <iostream.h>
#include <conio.h>
#include <fstream.h>
void main()
{
  clrscr();
  char ch;
  int t, w = 0;
```

```
    ifstream in("d:\\sample.txt");
    while(!in.eof())
    {
      in.get(ch);
      if(ch==' ')
        w++;
      cout<<ch;
    }
    cout<<"\nTotal words: "<<w+1<<endl;
    in.close();
    getch();
}
```

Q.3. Write a program that copies the contents of one file to another file as a string.

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <fstream.h>
void main()
{
  clrscr();
  char str[50];
  ifstream in("d:\\one.txt");
  ofstream out("d:\\two.txt");
  if(!in)
  {
    cout<<"Error in opening file.";
    exit(1);
  }
  while(!in.eof())
  {
    in>>str;
    out<<str<<" ";
  }
  in.close();
  out.close();
  getch();
}
```

Q.4. Write a program that inputs character from the user and appends it in an existing file. The input ends if the user enters a full stop " ".

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <fstream.h>
```

```
void main()
{
  clrscr();
  char ch;
  ofstream out("d:\\two.txt", ios::app);
  while(ch != '.')
  {
    cout<<"Enter a character: ";
    cin>>ch;
    out.put(ch);
  }
  out.close();
}
```

Q.5. Write a program that copies the contents of a file to other file character by character.

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <fstream.h>
void main()
{
  clrscr();
  char ch;
  ifstream in("d:\\one.txt");
  ofstream out("d:\\two.txt");
  if(!in)
  {
    cout<<"Error in opening file.";
    exit(1);
  }
  while(!in.eof())
  {
    in.get(ch);
    out.put(ch);
  }
  in.close();
  out.close();
  getch();
}
```

Q.6. Suppose a file "test.dat" contains three integers separated by spaces. Write a program to open file, read the integers and display them in reverse order separated by spaces.

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <fstream.h>
```

```
void main()
{
  clrscr();
  char ch, a[5];
  int i = 0;
  ifstream in("d:\\test.txt");
  if(!in)
  {
    cout<<"Error in opening file.";
    exit(1);
  }
  while(!in.eof())
  {
    in.get(ch);
    a[i++] = ch;
  }
  for(i=4; i>=0; i--)
    cout<<a[i];
  in.close();
  getch();
}
```

Q.7. Write a program that inputs three strings from user and appends to an existing file.

```
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <stdio.h>
#include <fstream.h>
void main()
{
  clrscr();
  char str[50];
  int i;
  ofstream out("d:\\sample.txt", ios::app);
  if(!out)
  {
    cout<<"Error in opening file.";
    exit(1);
  }
  for(i=1; i<=3; i++)
  {
    cout<<"Enter a string: ";
    gets(str);
    out<<str<<" ";
  }
  out.close();
}
```