1. Write a C++ program to add two numbers

```
#include <iostream>
using namespace std;
int main () {
        int a, b, sum;
        Cout << "Enter the first number: ";
        Cin >> a;
        Cout << "Enter the second number: ";
        Cin >> b;
        Sum = a + b;
        Cout << "sum is: " << sum;
        return 0;
}
```

Output - Enter the first number: 5
Enter the second number: 4
Sum is: 9

2. Arithmetic operations using switch

```
#include <iostream>
using namespace std;
int main () {
    int a, b;
    char c;

    cout << "Enter first number: ";
    cin >> a;
    cout << "Enter second number: ";
    cin >> b;
    cout << "Choose an arithmetic operation (+, -, *, /): ";
```

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EXPERIMENT 1

1. Write a program to declare a class book having data members as bid, bname, & bprice. Accept data for 2 books and display name of book having greater price.

```
#include <iostream>
#include <string>
using namespace std;
class book{
    public:
    int price;
    int pages;
    string name;
    void accept (){
        cout << "Enter book name: ";
        cin >> name;
        cout << "Enter price: ";
        cin >> price;
        cout << "Enter pages: ";
        cin >> pages;
    }
    void display (){
        cout << "Book name is: \n" << name;
        cout << "Book price is: \n" << price;
        cout << "Pages of book are: " << pages;
    }
    int get_price (){
    return price;
    }
};
```

```
int main () {
    book b1, b2;
    b1.accept ();
    b2.accept ();
    If (b1.get_price () > b2.get_price () ) {
        cout<<"Book1 has higher price\n";
        b1.display ();
    }
    else {
        cout <<"Book2 has higher price\n";
        b2.display ();
    }
return 0;}
```

Output - Enter book name : Programming in C
Enter price : 120
Enter pages : 230
Enter book name : matilda
Enter price : 230
Enter pages : 120
Book 2 has higher price
Book name is matilda
Book price is 230
Book pages of book are 120

2. Write a program to declare a class student having data members as roll, name. Accept and display data for one object.

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

class student {
    public:
        int roll_no;
        String name;
void display () {
    cout <<"name is: " <<name <<endl;
    cout <<"roll no is: " <<roll_no <<endl;
};

int main () {
    student s1;
    s1.roll_no = 28;
    s1.name = "Anushka";
    s1.display();
    return 0;
}
```

Output - name is: Anushka
roll no is : 28

3. Write a program to declare a class time. Accept time in HH:MM:SS and display total time in seconds

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

```
class Time{
public:
    int hour, min, sec, total;
    void accept () {
        cout << "Enter hours: ";
        cin >> hour;
        cout << "Enter minutes: ";
        cin >> min;
        Cout << "Enter seconds: ";
        cin >> sec;
    }
    void calculateTotal () {
        total = hour * 3600 + min * 60 + sec * 1;
    }
    void display () {
        cout << "Total time in seconds is " <<
        total << "seconds" << endl;
    }
};
int main () {
    Time t1;
    t1.accept ();
    t1.CalculateTotal ();
    t1.display ();
    return 0;
}
```

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Output - Enter hours: 2
Enter minutes: 13
Enter seconds: 45
Total time in seconds is 8025 seconds

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EXPERIMENT 2

Write a C++ program to demonstrate the use of array of objects

1. WAP to declare a class 'city' having data members as name and population. Accept this data for 5 cities and display name of city having highest population.

```
#include <iostream>
using namespace std;
class city {
    private:
        string name;
    public:
        int population;
        void accept () {
            cout << "enter name: ";
            cin >> name;
            cout << "enter population: ";
            cin >> population;
        }
        Void display () {
            cout << " name: " << name << "
                    population: " << population << endl;
        }
};
int main () {
    city c[5];
    int i, max;
    for (i=0; i<5; i++) {
        c[i].accept ();
        c[i].display ();
    }
```

```
max = c[0].population;
for(i=1; i<5; i++){
    if(c[i].population > max){
        max = c[i].population;
    }
}
cout<<"max population is: "<<max<<endl;
return 0;
}
```

Output – enter name: pune
enter population : 12000
name: pune, population: 1200
enter name: mumbai
enter population: 150000
name: mumbai, population: 150000
enter name: nagpur
enter population: 1100
name: nagpur, population: 1100
enter name: nashik
entee population: 1
name: nashik, population: 1
enter name: alibaug
enter population: 5000
name: alibaug, population: 5000
max population: 150000

2. WAP to declare a class 'Account' having data members as Account no. and balance. Accept this data for 10 accounts and give interest of 10% where balance is equal or greater than 5000 and display them.

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```
#include <iostream>
using namespace std;
class Account {
    int a_no, balance;
    public:
    void accept () {
        cout << "Enter account number: ";
        cin >> a_no;
        cout << "Enter account balance: ";
        cin >> balance;
    }
    void disp () {
        cout << "The account number is: " << a_no << endl;
        cout << "Your account balance is: " << balance;
    } };
int main () {
    Account a1;
    if(balance >= 5000){
            balance = balance x 0
    }
    a1.accept ();
    a1.disp();
}
```

Output -

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3. WAP to declare a class 'staff' having data members as name and post. Accept this data for 5 staff and display names of staff who are "HOD".

```
#include <iostream>
using namespace std;
class staff {
    string name;
    string post;
    public:
    void accept () {
        cout << "Enter name and post: ";
        cin >> name >> post;
    }
    void display ()
    {
        if (post == "HOD")
            {
                cout << "HOD: " << name << endl;
            }
    }
};
int main ()
  {
    staff s[5];
    for (i=0; i<5; i++)
    {
      cout << "Enter details for staff: "
                << i+1 << endl;
```

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```
        s[i].accept();
}
    cout << "List of HODs : "; << endl;
    for(i=0; i<5; i++)
    {
        s[i].display();
    }
    return 0;
}
```

Output - Enter details for staff
Enter name and post : Anushka
HOD
Enter name and post : Neel
HOD
Enter name and post : Nakul
Assistant
Enter name and post : Aarya
~~lectu~~ lecturer
Enter name and post : Sejal
Clerk

List of HODS
HOD : Anushka
HOD : Neel

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EXPERIMENT 3

Pointer to object, 'this' pointer, nested class

1. Write a program to declare a class 'book' Containing data members as book-title, author name and price. Accept and display the information for one object using a pointer to that object.

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

Class Book {
    int price;
    String book_title, author_name;
    public:
    void getdata () {
        Cout<<" Enter book name: ";
        getline(cin, this → book_title);
        cout <<"Enter author name: ";
        getline (cin, this → author_name);
        cout << "Enter price: ";
        cin >> price;
};

void void disp() {
        this → getdata();
        Cout << book_title <<" by" << author_name
        <<": Price: " << price;
    }
} b1;
```

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```
int main () {
    book * bp;
    bp = &b1;
    bp → disp();
    return 0;
}
```

2. Write a program to declare a class 'student' having data members roll_no and percentage. Use 'this' pointer to accept and display data for one object.

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

Class student {
    int roll_no;
    float per;
    public:
    void accept ();
        Cout << " Enter roll number: ";
        getline (cin, this → roll_no);
        Cout << " Enter percentage : ";
        getline cin >> per;
}
void disp() {
    this → accept ();
    Cout << " Roll no " << roll_no << ". Percentage:" <<
    per;
}
}; b1;
```

```
int main () {
    b1.display ();
    return 0;
}
```

3. Write a program to demonstrate the use of nested classes

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

class Enclosing {
    int n = 14;
    public:
    void display () {
        cout << "calling from the enclosing
        class, n = " << n << endl;
    }
    class Nested {
        int n = 31;
        public:
        void display () {
            cout << "calling from nested class,
            n = " << n << endl;
        }
    };
};

int main () {
    Enclosing e;
    Enclosing :: Nested n;
    e.display ();
    n.display (); }
```

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EXPERIMENT 4

Write a C++ program to demonstrate passing of object as function argument.

1. WAP to swap two numbers from the same class using object as function argument. Ensure that swap is member.

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

Class Num {
    int x, y;
    public:
    void accept () {
        cout << " Enter first number : ";
        cin >> x;
        cout << " Enter second number : ";
        cin >> y;
    }
    void disp() {
        cout << " First number : "; << x << endl;
        cin cout << " Second number : "; << y << endl;
    }
    void swap (Num &n) {
        int temp = n.x;
        n.x = n.y;
        n.y = temp;
    }
}; n;

int main () {
    n.accept ();
```

```
    n.disp();
    cout << "\n Swapping Numbers...\n\n";
    n.swap(n);
    n.disp();
    return 0;
}
```

2. Write a program to swap 2 numbers of the same class using friend function.

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

class Num {
    int a, b;
    public:
    void accept() {
        cout << "Enter first number: ";
        cin >> a;
        cout << "Enter second number: ";
        cin >> b;
    }
    void disp() {
        cout << "First number: " << a << endl;
        cout << "Second number: " << b << endl;
    }
    friend void swap(Num &n);
} n;

void swap(Num &n) {
```

```
    int temp = n.a;
    n.a = n.b
    n.b = temp;
}
int main () {
    n.accept ();
    n.disp ();
    Cout << "\n Swapping numbers...\n\n";
    swap (n);
    n.disp ();
    return 0;
}
```

3. WAP to swap 2 no.s of different classes using friend function.

```
// #include<iostream>
using namespace std;
Class B;
Class A {
    int x;
    public:
    void accept () {
        Cout << "Enter first number: ";
        Cin >> x;
    }
    void disp () {
        Cout << " First Number: " << x << endl;
    }
    friend void swap (A &a, B &b);
};
```

```
class B {
    int x;
    public:
    void accept () {
        cout << "Enter second number : ";
        cin >> x;
    }
    void disp () {
        cout << "Second number : " << x << endl;
    }
    friend void swap (A &a, B &b);
} n2;

void swap (A &a, B &b) {
int temp = a.x;
a.x = b.x;
b.x = temp;
}
int main () {
    n1.accept ();
    n2.accept ();
    n1.disp ();
    n2.disp ();
    cout << "\n Swapping Numbers... \n";
    n1.disp ();
    n2.disp ();
    return 0;
}
```

Output - Enter first number : 21
Enter second number : 71
First Number : 21
Second Number : 71

Swapping Numbers...
First Number : 71
Second Number : 21

4. Write a program to find the greatest no. from 2 separate classes. Use friend ~~fori~~ function.

```
#include <iostream>
using namespace std;
Class A;
Class B {
    int b;
    public:
    void accept () {
        Cout << "Enter second Number : ";
        Cin >> b;
    }
    friend string findgreater (A &a, B &b);
};

Class A {
    int a;
    public:
    void accept () {
        Cout << "Enter first Number : ";
        Cin >> a;
```

```
    };
    friend string findgreater(A &a, B &b);
};a;

String findgreater(A &a, B &b) {
    if (a.b == b.a) {
        return "Both numbers are equall";
    }
    else if (a.b > b.a) {
        return "The first number is greater";
    }
    else {
        return "The second number is greater";
}}

int main () {
    a.accept();
    b.accept();
    String is greater = find greater (a,b);
    cout << is greater;
    return 0;
}
```

Output - Enter first number : 5
Enter second number : 25
The second number is greater

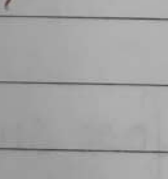
5. WAP to create 2 classes, Result 1 and Result 2. Which stores the marks of a student. Read the value of marks for both classes & compute the avg using friend function.

```
#include <iostream>
using namespace std; Class Result 2;
Class Result 1 {
        float R1;
        public:
        void accept () {
            Cout << "Entere marks for subject 1: ";
            Cin >> R1;
        }

        friend float getAvg (Result 1 & a,
        Result 2 & b);
};

Class Result 2 {
        float R2;
        public:
        void accept (); {
            Cout << "Enter marks for subject 2: ";
            Cin >> R2;
        }

        friend float getAvg (Result 1 & a, Result 2
        & b) {
            float avg = (a.R1 + b.R2)/2;
            return avg;
        }
```

```
int main () {
    r1.accept ();
    r2.accept ();
    float avg = getAvg (r1, r2);
    cout << " Average marks of the student
    is " << avg;
    return 0;
}
```

Output - Enter marks for subject 1 : 97.5
Enter marks for subject 2 : 98.2

Average marks of the student is 97.85



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EXPERIMENT 5

Write a C++ program to implement types of constructors

1. Write a program to find the sum of numbers between 1 to n using a constructor where the value of n will be passed to the constructor.

* Default constructor

```
#include <iostream>
using namespace std;
class Num{
    int n;
    int i;
    int sum = 0;
    public:
      Num(int n1) {
        n = n1; n = 5;
      }
      void add () {
        for(i=1; i<=n; i++) {
            sum = sum+i;
        }
      }
      void disp () {
        Cout << "Sum is : " << sum;
      }
};
```

```
int main (){
    Num no(5);
    no.add ();
    no.disp ();
    return 0;
}
```

* Parameterized constructor

```
#include <iostream>
using namespace std;
class Num{
    int n;
    int i;
    int sum = 0;
    public:
      Num(int n1){
          n=n1;
      }
      void add (){
          for(i=1; i<=n; i++){
              sum = sum+i;
          }
      }
      void disp(){
          cout << " sum is: " << sum;
      }
};
```

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```
int main () {
    Num no(5);
    no.add ();
    no. disp ();
    return 0;
}
```

* Copy Constructor

```
#include <iostream>
using namespace std;
class Num {
    int n, i;
    int sum = 0;
    public:
      Num(int n1) {
          n=n1;
      }
      void add() {
          for(i=1; i<=n; i++) {
              sum = sum+i;
          }
      }
      void disp() {
          cout << "sum is : " << sum << endl;
      }
};
int main () {
```

```
Num no1(5);
Num no2(no1);
no1.add();
no2.add();
no1.disp();
no2.disp();
return 0;
}
```

Output for default and parameterized constructor -
Sum is : 15

Output for copy constructor -
Sum is : 15
Sum is : 15

2. Write a program to declare a class "student" having data members as name and percentage. Write a constructor to initialize these data members. Accept and display data for one student.

* Using parameterized constructor

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

Class student {
        int per;
        String name;
```

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```
public:
    student(int p, string n) {
        per = p;
        name = n;
    }
    void disp() {
        cout << "Name of student : " <<
                name << endl;
        cout << "Percentage = " << per << endl;
    }
};

int main() {
    student s1(93, "Anushka");
    s1.disp();
    return 0;
}
```

Output - Name of student : Anushka
Percentage : 93

3. Define a class "College" members variables as roll_no, name, course, WAP using constructor with default value as "Computer Engineering" for course. Accept this data for two objects of class and display the data.

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

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```
class College {
    int roll_no;
    string name;
    string course;
    public:
        College (string n, int r = 25, string
                c = "CSE") {
            name = n;
            roll_no = r;
            course = c;
        }
        void display () {
            cout << name << endl;
            cout << roll_no << endl;
            cout << course;
        }
};
int main () {
    College c1 ("Anushka");
    c1.display ();
    return 0;
}
```

Output - Anushka
25
CSE

4. Write a program to demonstrate Constructor overloading.

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```
#include <iostream>
using namespace std;
class square {
        int s;
        public:
            square () {
                s=4;
            }
            square (int side) {
                s=side;
            }
            void calculate () {
                int a;
                a=s*s;
                cout << "Area of square =
                    " <<a <<endl;
            }
};
int main () {
    square s1;
    square s2 (5);
    square s3(s2);
    s1.calculate ();
    s2.calculate ();
    s3.calculate ();
    return 0;
}
```

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Output - Area of square = 16
Area of square = 25
Area of square = 25

EXPERIMENT 6

Write a C++ program to implement inheritance

1. Write a program to implement single inheritence

```
#include <iostream>
#include <string>
using namespace std;
class Person {
  protected:
    string name;
    int age;
};
class student : protected Person {
  public:
    int roll;
    void accept () {
      Cout << "Enter name of the person: ";
      Cin >> name;
      Cout << "Enter age of the person: ";
      Cin >> age;
      cout << "Enter roll number of the
      person: ";
      cin >> roll;
    }
    void display () {
      Cout << endl;
      Count << "Name: " << name << endl;
      Cout << "Roll Number: " << roll << endl;
      Cout << "Age: " << age << endl;
}
```

```
};
int main () {
    Student s;
    s.accept ();
    s.display ();
    return 0;
}
```

Output - Enter name of the person: Anushka
Enter age of the person : 16
Enter roll number of the person : 25

Name: Anushka
Roll number: 25
Age: 16

2. Write a program to implement ~~inher~~ multiple inheritance.
Problem: Create ~~a~~ two base ~~to~~ ~~class~~ called Person with ~~attributes~~ classes Academic and Sports.
   - Academic contains marks of a student.
   - Sports class contains marks of a student.

Create a derived class Result that inherits from both Academic & Sports. Write a function to calculate the total score and display details.

```
#include <iostream>
#include <string>
using namespace std;
Class Academic {
```

```
    protected:
        int m;
};
class Sports {
    protected:
        int score;
};
class Result : protected Academic, protected
Sports {
    private:
        int t;
    public:
        void accept () {
            Cout << " Enter academic marks: ";
            Cin >> m;
            Cout << " Enter sports marks: ";
            Cin >> score;
        }
        void calculate () {
            t = m + score;
            Cout << " Total score is: " << t;
        }
};
int main () {
    Result r;
    r.accept ();
    r.calculate ();
    return 0;
}
```

Output - Enter Academic marks : 90
Enter sports marks : 96
Total score is : 186

3. Create a class Vehicle with attributes like brand and model. Derive a class Car from Vehicle which adds an attribute type (eg. sedan, SUV etc) Further derive a class Electric car which adds battery capacity.

• Multilevel Inheritance

```
#include <iostream>
#include <string>
using namespace std;
class Vehicle {
    public:
        string brand;
        string model;
};
class Car : public Vehicle {
    protected:
        string type;
};
class ElectricCar : protected car {
    private:
        int capacity;
    public:
        void accept () {
            cout << " Enter a car brand : ";
            cin >> brand;
```

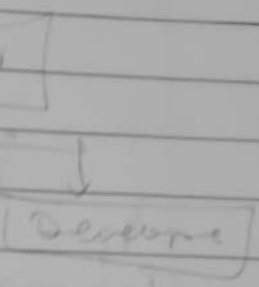
```
        cout << "Enter car model: ";
        cin >> model;
        cout << "Enter car type: ";
        cin >> type;
        cout << "Enter battery capacity:
        cin >> capacity;
    }
};

int main() {
    ElectricCar e;
    e.accept();
    e.display();
    return 0;
}
```

Output - Enter car brand : tata
Enter car model : nexon
Enter car type : SUV
Enter battery capacity : 2000
Brand : tata
Model : nexon
Type : SUV
Battery : 2000

4. Create a base class Employee with attributes empID and name. Derive two classes Manager and Developer from Employee.
Manager has an attribute department and developer has an attribute programming language.

• Hierarchial inheritance




```
#include <iostream>
#include <string>
using namespace std;
class Employee {
  protected:
    string name;
    int empid;
};
class Manager : public Employee {
  private:
    string dept;
  public:
    void accept() {
      cout << "Enter department name: ";
      cin >> dept;
    }
    void display() {
      cout << "Department: " << dept << endl;
    }
};

class Developer : protected Employee {
  private:
    string pl;
  public:
    void accept() {
      cout << "Enter programming
           language: ";
      cin >> pl;
```

```
    }
    void display() {
        cout << "Programming language: " << pl << endl;
    }
};
int main() {
    Manager m;
    m.accept();
    m.display();
    Developer d;
    d.accept();
    d.display();
    return 0;
}
```

Output - Enter department name : IT
Department : IT
Enter programming language : C++
Programming language : C++

5. Combine multilevel and multiple inheritance. Create a base class Person with attributes name and age.
Derive a class Student from Person.

Create two classes Sports & Academics. Derive class Result from students & sports. Write functions to calculate & display total marks & sports score along with student details.

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

class Person {
  protected:
    string name;
    int age;
  public:
    void accept () {
      cout << "Enter name: ";
      cin >> name;
      cout << "Enter age: ";
      cin >> age;
    }
    void display () {
      cout << "Name : " << name << endl;
      cout << "Age : " << age << endl;
    }
};

class Student : public person {
  protected:
    int sid;
  public:
    void accept () {
      cout << "Enter student ID : ";
      cin >> sid;
    }
    void display () {
```

Person

Student Sports Man

```
        cout << "Student ID : " << sid << endl;
    }
};
class

class Sports {
  protected:
    int sscore;
  public:
    void accept() {
      cout << "Enter sports score : ";
      cin >> sscore;
    }
    void display() {
      cout << "Sports score : " << sscore << endl
    }
};

class Academics {
  protected:
    int marks;
  public:
    void accept() {
      cout << "Enter academic marks : ";
      cin >> marks;
    }
    void display() {
      cout << "Academic marks : " marks << endl
    }
};
```

```
class Result : public Student, public Sports {
private:
    Academics academic;
public:
    void display() {
        cout << "Total score: " << (marks +
                                    sscore) << endl;
    }
};
int main() {
    Person p;
    p.accept();
    p.display();
    student s;
    s.accept();
    s.display();
    Sports sp;
    sp.accept();
    sp.display();
    Academics a;
    a.accept();
    a.display();
    Result r;
    r.accept();
    r.display();
}
```

```
Enter stude name : Anushka
Enter age : 16
Enter student ID : 1339
Enter sports score : 85
Enter academic marks : 90
```

Output - Name : Anushka
Age : 16
Student ID : 1339 Sports score : 85
Academic marks : 90
Total score : 175

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EXPERIMENT 7

Write a program to demonstrate the compile time polymorphism (function overloading and operator overloading)

1. WAP using function overloading to calculate the area of a laboratory (which is rectangular) and area of classroom (which is a square)

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

float area(float length, float breadth){
    return length * breadth;
}

float area(float side){
    return side * side;
}
int main(){
    float length, breadth, side;
    cout<<"Enter length & breadth of the laboratory: ";
    cin>>length>>breadth;
    cout<<"Area of laboratory:"<<area(length, breadth)<<endl;

    Cout<<"Enter side of classroom: ";
    cin>>side;
    cout<<"area of classroom:"<<area(size)<<endl;
}
```

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Output - Enter length and breadth of the laboratory : 5 2
Area of laboratory : 10
Enter side of classroom : 5
Area of classroom : 25

2. Write a program using function overloading to calculate the ~~area~~ sum of 5 float values and sum of 10 integer values.

```
#include <iostream>
using namespace std;
class Sum {
 public:
    float calculate (float a, float b, float c,
     float d, float e) {
         return a+b+c+d+e;
    }

    int calculate (int a1, int a2, int a3, int a4,
     int a5, int a6, int a7, int a8, int a9, int a10) {
         return a1+a2+a3+a4+a5+a6+a7+a8+
              a9+a10;
    }
};
int main () {
    Sum s;
    cout << "sum of 5 float values: " << s.calculate
     (1.1, 2.2, 3.3, 4.4, 5.5) << endl;
```

```
    cout << "Sum of 10 integers: " << s.calculate
        (1,2,3,4,5,6,7,8,9,10) << endl;
    return 0;
}
```

Output - Sum of 5 floats values : 16.5
Sum of 10 integer values : 55

3. Write a program to implement Unary ++ operator ~~(for pre-d increment and post Increment)~~ when used with the object so that ~~the n~~ the numeric data member of the class is negated.

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

class num{
    int i;
    public:
    void accept(){
        cout << "Enter the value: ";
        cin >> i;
    }
    void display(){
        cout << "Value is: " << i;
    }

    void operator ++ (){
        i = -++i;
    }
```

```
};
int main () {
    num n;
    n.accept ();
    ++n;
    n.display ();
    return 0;
}
```

Output - Enter the value : 8
Value is : 9

4. WAP to implement the unary ++ operator (for pre increment & post increment) when used with the object so that the numeric data member of the class is incremented.

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

Class num {
    int i;
    public :
        void accept () {
            cout << " Enter the value : ";
            cin >> i;
        }
        void display () {
            cout << " value is : " << i << endl;
        }
```

```
void operator++ () {
        ++i;
}
void operator --() {
        --i;
}
void operator ++(int) {
        i++;
}
void operator --(int) {
        i--;
    }
};
int main() {
    num n, n1;
    n.accept();
    ++n;
    cout<<"After prefix increment";
    n.display();
    n1.accept();
    n1--;
    cout<<"After postfix decrement";
    n1.display();
}
```

Enter the value: 10
Output - After prefix increment value is: 11
Enter the value: 10
After postfix increment value is: 9

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EXPERIMENT 8

Write a program to demonstrate the ~~comip~~ compile time and run time polymorphism (Coperator overloading Binary)

1. Write a program to overload the '+' operator so that two strings can be concatenated.

```
#include <iostream>
#include <string>
using namespace std;
class join {
    string a, b;
  public:

    void accept () {
        cout << "Enter first string: ";
        cin >> a;
        cout << "Enter second string: ";
        cin >> b;
    }

    string concatenated () {
        return a+b;
    }

};

int main () {
    join j;
    j.accept ();
```

```
    string result = j.concatenated();
    cout << "Concatenated string is : "
         << result << endl;
    return 0;
}
```

Output - Enter first string : MIT
Enter second string : WPU
Concatenated string is : MITWPU

2. Write a program to create a base class Ilogin having datamembers name and password. Declare accept() function and derive EmailLogin and MembershipLogin classes from Ilogin. Display Email login details and membership login details of the employee.

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

class Ilogin {
protected:
    string name;
    string password;
public:
    virtual void accept() {
        cout << "Enter name: ";
        cin >> name;
        cout << "Enter password: ";
        cin >> password;
```

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```
    }
    display
    virtual void accept() {
        cout << "Enter name : " << name << endl;
        cout << "password : " << password <<
                                    endl;
    }
};
class Emaillogin : public Ilogin {
  private:
    string email;
  public:
    void accept() override {
        cout << "Email Login : " << endl;
        Ilogin :: accept();
        cout << "Enter email : ";
        cin >> email;
    }
    void display() override {
        cout << "Email login Details
          are : " << endl;
        Ilogin :: display();
        cout << "Email: " << email << endl;
    }
};
class Membershiplogin : public Ilogin {
  private:
    int membershipId;
  public:
    void accept() override {
        cout << "Membership login : " << endl;
```

```
    Ilogin::accept();
    cout << "Enter membership ID: ";
    cin >> membershipID;
}
void display over() override {

    cout << "Membership login details
            are: " << endl;
    Ilogin::display();
    cout << "MembershipID: " <<
            membershipID << endl;
}
};

int main() {
    EmailLogin emailuser;
    Membershiplogin memberuser;

    cout << "Enteremail login details: "
            << endl;
    emailuser.accept();

    cout << "\n Enter Membership login
            details: " << endl;
    memberuser.display();

    cout << "\n Displaying email login
            details: " << endl;
    emailuser.display();
```

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```
    cout << "\n Displaying Membership
            login Details : " << endl;
    memberuser.display ();

    return 0;
}
```

Output – Enter email login details :
Email login :
Enter name : anushka
Enter password : anu@2008
Enter email : anushka.mohite@gmail.com

Enter membership login details :
Membership Login :
Enter name : Anushka
Enter password : ajjsd
Enter membership ID : 1111

Displaying Email Login details :
Name : anushka
password : anu@2008
email : anushka.mohite@gmail.com

Displaying Membership Login details :
Name : Anushka
password : ajjsd

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EXPERIMENT 9

Write a program to perform various operations on file.

1. Write a program to copy the contents of one file into another. Open "First.txt" in read (ios::in) mode and "second.txt" file in write (ios::out) mode. Copy the contents of "First.txt" into "Second.txt". Assume "First.txt" is already created.

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

int main () {
    char ch;
    ifstream fin ("first.txt");
    ofstream fout ("destination.txt");
    if (!fin) {
        cout << "ERROR in opening destination
                file" << endl;
        fin.close ();
        return 1;
    }
    while (fin.get (ch)) {
        fout << ch;
    }

fin.close ();
```

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```
    fout.close();
    cout << "File is successfully copied.";
    return 0;
}
```

Output - first.txt
Welcome to MIT WPU Pune

destination.txt
Welcome to MIT WPU Pune

2. Write a C++ program to count words using file handling.

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

int main() {
    string word;
    string a;
    int count = 0;
    int a_count = 0;
    ifstream fin("source.txt");
    ofstream fout("destination.txt");

    cout << "Enter a word: ";
    cin >> a;
```

```
if (!fin) {
    cout << "ERROR in opening source
            file" << endl;
    return 1;

if (!fout) {
    cout << "ERROR in opening destination
            file" << endl;
    fin.close ();
    return 1;
}

While (fin >> word) {
    fout << word;
    count ++;
    if (word == a) {
        a_count ++;
    } fount << word;
}

fin.close ();
fout.close ();
cout << "Total number of words = " <<
                a_count;
return 0;
```

Output - Total number of words = 2

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3. Write a C++ program to count occurence of a given word using file handling.

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

int main () {
    string word;
    string a;
    int count = 0;
    int a_count = 0;
    ifstream fin ("source.txt");
    ofstream fout ("destination.txt");
    cout << "Enter a word: ";
    cin >> a;

    if (!fin) {
        cout << "ERROR in opening source
                file" << endl;
        return 1;
    }

    if (!fout) {
        cout << "ERROR in opening destination
                file" << endl;
        fin.close ();
        return 1;
    }
```

```
while (fin >> word) {
    fout << word;
    count ++;
    if (word == a) {
        a_count ++;
    }
}

fin.close ();
fout.close ();
cout << "Total number of words = " << a_count;
return 0;
}
```

Output - source.txt

Welcome to mit wpu. wpu pune

Enter a word : wpu
Total number of repeats = 2

4. Write a C++ program to count digits and spaces using file handling.

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

int main () {
    char ch;
```

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```
int digitcount = 0;
int spacecount = 0;
ifstream fin ("source.txt");
ofstream fout ("destination.txt");

if (!fin) {
    cout << "Error in opening source
    file" << endl;
    return 1;
}

if (!fout) {
    cout << "ERROR in opening
    destination file" << endl;
    fin.close();
    return 1;
}

while (fin.get(ch)){
    fout << ch;
    if (isdigit(ch)){
        digitcount++;
    }
    if (isspace(ch)){
        spacecount++;
    }
}

fin.close();
fout.close();
```

```
cout << "File is successfully copied"
     <<endl;

cout << "Number of digits: "
     <<digitcount <<endl;

cout << "Number of spaces: "
     <<spacecount <<endl;

return 0;
}
```

Output - source.txt
welcome to mit 2025

Number of digits: 4
Number of spaces: 3.

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EXPERIMENT 10

Write a program to implement a Function template and class template.

1. Write a C++ program to find sum of array elements using function template (eg. Pass Integer, Float and Double array of 10 elements).

```
#include <iostream>
using namespace std;
template <class t> t func(t a[], int n){
        t sum=0;
        int i;
        for(i=0;i<n;i++){
                sum = sum + a[i];
        }
        return sum;
}
int main(){
        int a1[3] = {2, 0, 2};
        float a2[3] = {1.2, 1.2, 2.4};
        double a3[3] = {10.5, 20.5, 30.5};

        cout << "sum of integer array is: "
             << func(a1, 3) << endl;
        cout << "sum of integer or float
             array is: " << func(a2, 3)
             << endl;
        cout << "Sum of double array is: "
             << func(a3, 3)
             << endl;
```

Output - Sum of integer array : 4
Sum of float array : 4.8
Sum of double array : 61.5

2. Write a C++ Program of square function using template specialization.

```
#include<iostream>
using namespace std;
template <class T> T square (T x){
        T sum = 0;
        sum = x * x;
        return sum;
}
template <> string square <string>
        (string ss) {
    return (ss+ss);
}
int main (){
    int i = 2, ii;
    String www ("MIT");
    ii = square <int> (i);
    cout << "Square of 2 is : "<<ii<<
                endl;
    cout << "Square of given string
        is : " << square <<
        String (www)<<endl;
```

Output - Square of 2 is : 4
Square of given string is : MIT MIT

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3. Write a C++ program to build simple calculator using class template.

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

template <class T>
class Calculator {
  private:
    T num1, num2;
  public:
    Calculator(T n1, T n2) {
        num1 = n1;
        num2 = n2;
    }
    T add() {
        return num1 + num2;
    }
    T sub() {
        return num1 - num2;
    }
    T mul() {
        return num1 * num2;
    }
    T divide() {
        return num1/num2;
    }
    T mod() {
        return fmod(num1, num2);
    }
```

```
    void display() {
        cout << "Numbers: " << num1 <<
                " and " << num2 << endl;
    }
};

int main() {
    double a, b;
    int ch;
    cout << "Enter two numbers: ";
    cin >> a >> b;

    Calculator<double> calc(a, b);
    do {

        cout << "\n Choose an operation:\n";
        cout << "1. Addition\n";
        cout << "2. Subtraction\n";
        cout << "3. Multiplication\n";
        cout << "4. Division\n";
        cout << "5. Modulus\n";
        cout << "6.
        cout << "6. Exit\n";

        cout << "Enter your choice: ";
        cin >> ch;

    switch (ch) {
      case 1:
        cout << "Addition: " << calc.add()
             << endl;
```

```
        break;
    case 2:
        cout << "Subtraction: " << calc.Sub()
             << endl;
        break;
    case 3:
        cout << "Multiplication: " << calc.mul()
             << endl;
        break;
    case 4:
        cout << "Division: " << calc.div()
             division() << endl;
        break;
    case 5:
        cout << "Modulus: " << calc.mod()
             << endl;
        break;
    case 6:
        cout << "Exiting..." << endl;
        break;
    default:
        cout << "Invalid choice!!" <<
             endl;
    }
} while (ch != 6);

return 0;
}
```

Output - Enter two numbers: 2 2

Choose an operation:
1. Addition
2. Subtraction
3. Multiplication
4. Division
5. Modulus
6. Exit
Enter your choice: 4
Division: 1

Choose an operation:
1. Addition
2. Subtraction
3. Multiplication
4. Division
5. Modulus
6. Exit
Enter your choice: 6
Exiting...

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EXPERIMENT 11

Write a C++ program to implement generic vectors. Include the following member functions:

To create the vector.
(a) To modify the value of a given element.
(b) To multiply by a scalar value.
(c) To display the vector in the form (10, 20, 30...)

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

template <typename T>
class GenericVector {
        vector <T> data;
    public:
        void create (int n) {
            data.resize(n);
            cout << "Enter " << n << "element:"
                 << endl;
            for (int i=0; i<n; i++) {
                cin >> data[i];
            }
        void modify (int index, T value) {
            if (index >= 0 && index << data.
                                    size()) {
                data [index] = value;
            }
        void multiply (T scalar) {
```

```
        for (auto &el : data)
            el *= scalar;
    void display() {
        cout << "Vector: ";
        for (const auto &el : data)
            cout << el << " ";
        cout << endl;
    }
};

int main() {
    GenericVector<int> vec;
    int n;
    cout << "Enter no. of elements: ";
    cin >> n;
    vec.create(n);
    vec.display();
    cout << "Modify element at index 1 to
        20: " << endl;
    vec.modify(1, 20);
    vec.display();

    cout << "Multiply all elements by 2: "
        << endl;
    vec.multiply(2);
    vec.display();

    return 0;
}
```

Output - Enter number of elements : 3
Enter 3 elements :
10 15 30
vector : 10 15 30
Modify element at index 1 to 20 :
Vector : 10 20 30
Multiply all elements by 2 :
Vector : 20 40 60

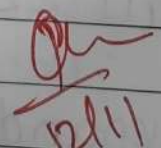
* Without Iterator :

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

int main() {
    vector <char> V30;
    unsigned int i;
    cout << " size = " << V.size()
         <<endl;
    for(i=0; i<v.size(); i++) {
        cout << V[i] << " ";
        cout << "\n\n";
    }
    cout << "Expand vectors: \n";
    for(i=0; i<v.size(); i++){
        V.push_back(i+40+'a');
        cout
    cout << "size now = "<v.size() <<endl;
    cout << "Current contents : \n");
```

```
for(i=0; i<n v.size(); i++); {
    cout << v[i] << " ";
    cout << "\n\n";
for(i=0; i<v.size(); i++) {
    v[i] = toupper(v[i]) (v[i]);
cout << "Modify contents :\n";
for(i=0; i<v.size(); i++) {
    cout << v[i] << " ";
cout << "\n\n";
return 0;
}
```

Output - Initial size = 5
Original contents : a b c d e
Expand vectors
Size now = 10
Current Contents = a b c d e f g h i j
Modifying contents to uppercase.
Modified contents : A B C D E F G H I J.



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EXPERIMENT 12

Write C++ program using STL

(a) Implement stack (b) Implement Queue (c) Implement sorting and Searching with user-defined records such as Person Record (Name, birth date, telephone no), item record (item code, item name, quantity & cost).

Implement Stack :

```
#include <iostream>
#include <stack>
using namespace std;
int main () {
    Stack <int> S;
    S.push (10);
    S. push (20);
    S. push (30);
    cout << "Stack top: " << S.top () << endl;
    S.pop ();

    cout << "Stack top after pop: " << S.top ()
        << endl;
    return 0;
```

Output - Stack top : 30
Stack top after pop : 10

Implement Queue :

```
#include <iostream>
#include <queue>

using namespace std;
int main(){
    q.push(100);
    q.push(200);
    q.push(300);
    cout << "Queue front : " << q.front()
         << endl;
    q.pop();
    cout << "Queue front after pop : " <<
         q.front() << endl;
    return 0;
}
```

Output - Queue front : 100
Queue front after pop : 200.

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