**the Social Media Class Hierarchy:**

**1. Access Control and Getters:**

**Create the User class with private members for username and profile picture (string).**

**Implement public member functions for the constructor and getters (accessor methods) for username and profile picture.**

#include <iostream>

#include <string>

using namespace std;

class User {

private:

string username;

string profile\_picture;

public:

// Constructor

User(const string& uname, const string& profile\_pic)

: username(uname), profile\_picture(profile\_pic) {}

// Getter for username

string getUsername() const {

return username;

}

// Getter for profile picture

string getProfilePicture() const {

return profile\_picture;

}

};

int main() {

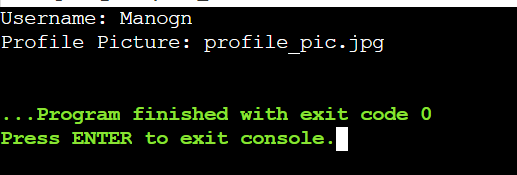
User obj("Manogn", "profile\_pic.jpg");

cout << "Username: " << obj.getUsername() << endl;

cout << "Profile Picture: " << obj.getProfilePicture() << endl;

return 0;

}

**Output:**  
  


**2. Post Class and Display:**

**Create the derived class Post inheriting from User.**

**Add private members for post content (string) and timestamp (date/time format of your choice).**

**Implement a public member function getPostInfo that returns a formatted string containing username, profile picture, post content, and timestamp.**

#include <iostream>

#include <string>

#include <ctime>

using namespace std;

class User {

private:

string username;

string profile\_picture;

public:

// Constructor

User(const string& uname, const string& profile\_pic)

: username(uname), profile\_picture(profile\_pic) {}

// Getter for username

string getUsername() const {

return username;

}

// Getter for profile picture

string getProfilePicture() const {

return profile\_picture;

}

};

class Post : public User {

private:

string post\_content;

string timestamp;

public:

// Constructor

Post(const string& uname, const string& profile\_pic, const string& content)

: User(uname, profile\_pic), post\_content(content) {

// Set the current time as the timestamp

time\_t now = time(0);

timestamp = ctime(&now);

}

// Getter for post content

string getPostContent() const {

return post\_content;

}

// Getter for timestamp

string getTimestamp() const {

return timestamp;

}

// Get post info

string getPostInfo() const {

return "Username: " + getUsername() + "\n" +

"Profile Picture: " + getProfilePicture() + "\n" +

"Post Content: " + getPostContent() + "\n" +

"Timestamp: " + getTimestamp();

}

};

int main() {

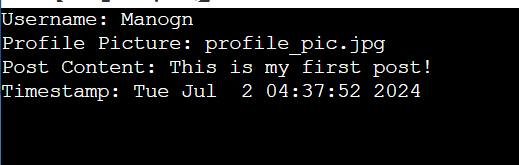
Post obj("Manogn", "profile\_pic.jpg", "This is my first post!");

cout << obj.getPostInfo() << endl;

return 0;

}

**Output:**

****

**3. Basic Interaction Function: Define a friend function basicInteract that takes two User objects (or derived class objects) as arguments. Inside the function, simply print a generic message like "User1 interacts with User2."**

#include <iostream>

#include <string>

using namespace std;

class User {

private:

string username;

string profile\_picture;

public:

// Constructor

User(const string& uname, const string& profile\_pic)

: username(uname), profile\_picture(profile\_pic) {}

// Getter for username

string getUsername() const {

return username;

}

// Getter for profile picture

string getProfilePicture() const {

return profile\_picture;

}

// Friend function declaration

friend void basicInteract(const User& user1, const User& user2);

};

class Post : public User {

private:

string post\_content;

string timestamp;

public:

// Constructor

Post(const string& uname, const string& profile\_pic, const string& content)

: User(uname, profile\_pic), post\_content(content) {

// Set the current time as the timestamp

time\_t now = time(0);

timestamp = ctime(&now);

}

// Getter for post content

string getPostContent() const {

return post\_content;

}

// Getter for timestamp

string getTimestamp() const {

return timestamp;

}

// Get post info

string getPostInfo() const {

return "Username: " + getUsername() + "\n" +

"Profile Picture: " + getProfilePicture() + "\n" +

"Post Content: " + getPostContent() + "\n" +

"Timestamp: " + getTimestamp();

}

};

// Friend function definition

void basicInteract(const User& user1, const User& user2) {

cout << user1.getUsername() << " interacts with " << user2.getUsername() << "." << endl;

}

int main() {

User obj1("Manogn", "profile\_pic1.jpg");

User obj2("Mahesh", "profile\_pic2.jpg");

basicInteract(obj1, obj2);

Post obj3("Manogn", "profile\_pic1.jpg", "This is my first post!");

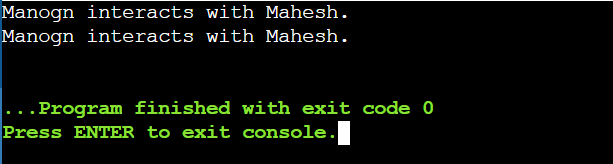
Post obj4("Mahesh", "profile\_pic2.jpg", "This is my second post!");

basicInteract(obj3, obj4);

return 0;

}

**Output:**



**4. Overloaded Interact Functions: Create overloaded versions of the interact function: likePost(User& user, Post& post): This function should print a message indicating the user liked the post. followUser(User& follower, User& followed): This function should print a message indicating the user started following another user.**

#include <iostream>

#include <string>

using namespace std;

class User {

private:

string username;

string profilePicture;

public:

User(string uname, string ppic) : username(uname), profilePicture(ppic) {}

string getUsername() const {

return username;

}

string getProfilePicture() const {

return profilePicture;

}

};

class Post : public User {

private:

string content;

string timestamp;

public:

Post(string uname, string ppic, string cont, string time)

: User(uname, ppic), content(cont), timestamp(time) {}

string getPostInfo() const {

return "Username: " + getUsername() + "\n" +

"Profile Picture: " + getProfilePicture() + "\n" +

"Content: " + content + "\n" +

"Timestamp: " + timestamp;

}

};

// Function to indicate a user liked a post

void likePost(User& user, Post& post) {

cout << user.getUsername() << " liked the post:\n" << post.getPostInfo() << endl;

}

// Function to indicate a user started following another user

void followUser(User& follower, User& followed) {

cout << follower.getUsername() << " started following " << followed.getUsername() << endl;

}

int main() {

// Creating User objects

User obj1("Manogn", "Manogn\_pic.jpg");

User obj2("Mahesh", "bob\_pic.jpg");

// Creating a Post object

Post obj3("Alice", "alice\_pic.jpg", "Hello World!", "2024-07-02 10:00");

// Demonstrating the overloaded interact functions

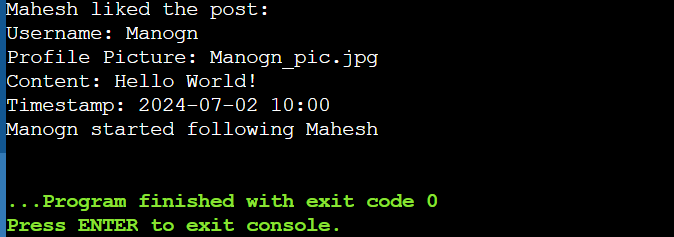
likePost(obj2, obj3); // Bob likes Alice's post

followUser(obj1, obj2); // Alice follows Bob

return 0;

}

**Output:**

****

**5. Refactoring with Encapsulation:**

**Revisit the class design. Can you modify the code to reduce reliance on friend functions?**

**Consider adding public member functions or accessor methods within the User class to provide controlled access to relevant data instead of exposing everything through friend functions.**

#include <iostream>

#include <string>

using namespace std;

class User {

private:

string username;

string profilePicture;

public:

User(string uname, string ppic) : username(uname), profilePicture(ppic) {}

string getUsername() const {

return username;

}

string getProfilePicture() const {

return profilePicture;

}

void follow(User& otherUser) const {

cout << username << " started following " << otherUser.getUsername() << endl;

}

};

class Post : public User {

private:

string content;

string timestamp;

public:

Post(string uname, string ppic, string cont, string time)

: User(uname, ppic), content(cont), timestamp(time) {}

string getContent() const {

return content;

}

string getTimestamp() const {

return timestamp;

}

void like(const User& user) const {

cout << user.getUsername() << " liked the post:\n"

<< "Username: " << getUsername() << "\n"

<< "Profile Picture: " << getProfilePicture() << "\n"

<< "Content: " << content << "\n"

<< "Timestamp: " << timestamp << endl;

}

};

int main() {

// Creating User objects

User user1("Manogn", "Manogn\_pic.jpg");

User user2("Mahesh", "Mahesh\_pic.jpg");

// Creating a Post object

Post post1("Manogn", "Manogn\_pic.jpg", "Hello World!", "2024-07-02 10:00");

// Demonstrating the interaction functions

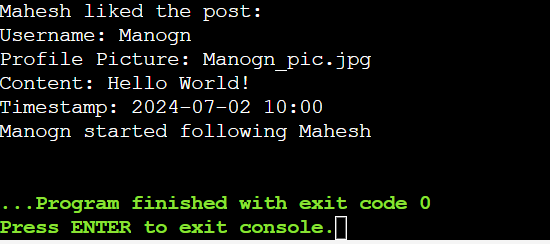
post1.like(user2); // Bob likes Alice's post

user1.follow(user2); // Alice follows Bob

return 0;

}

**Output:**

****

#include<iostream>

using namespace std;

class MyClass {

private:

static int counter;

int count;

public:

MyClass(){

count++;

counter++;

}

static int getCounter() {

return counter;

}

int getCount() {

return count;

}

};

int MyClass::counter = 0;

int main() {

MyClass obj1;

MyClass obj2;

MyClass obj3;

cout<<"Number of objects created:"<<MyClass::getCounter()<<endl;

cout << "objects1 count method: " << obj1.getCount()<<endl;

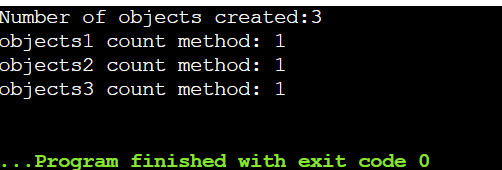
cout << "objects2 count method: " << obj2.getCount()<<endl;

cout << "objects3 count method: " << obj3.getCount()<<endl;

return 0;

}

**Output:**



**Distance Converter:**

**Create a class named DistanceConverter. Include the following static methods:**

**convertMilesToKm(double miles): Converts miles to kilometers (1 mile = 1.60934 kilometers).**

**convertKmToMiles(double kilometers): Converts kilometers to miles. In your main function, prompt the user for a distance and a unit (miles or kilometers). Use the appropriate static method from the DistanceConverter class to perform the conversion and display the result to the user.**

#include <iostream>

using namespace std;

class DistanceConverter {

public:

// Static method to convert miles to kilometers

static double convertMilesToKm(double miles) {

return miles \* 1.60934;

}

// Static method to convert kilometers to miles

static double convertKmToMiles(double kilometers) {

return kilometers / 1.60934;

}

};

int main() {

double distance;

string unit;

// Prompt user for distance and unit

cout << "Enter distance: ";

cin >> distance;

cout << "Enter unit (miles or kilometers): ";

cin >> unit;

// Perform conversion based on the unit

if (unit == "miles") {

double km = DistanceConverter::convertMilesToKm(distance);

cout << distance << " miles is " << km << " kilometers." << endl;

} else if (unit == "kilometers") {

double miles = DistanceConverter::convertKmToMiles(distance);

cout << distance << " kilometers is " << miles << " miles." << endl;

} else {

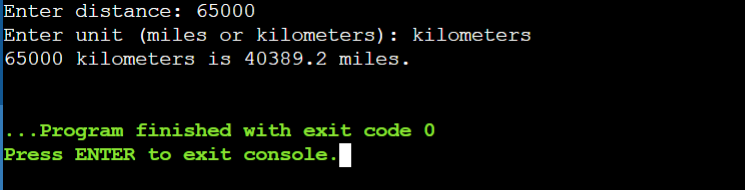
cout << "Invalid unit." << endl;

}

return 0;

}

**Output:**

****

**Math Utility Class:**

**Design a class named MathUtil. Include static methods for basic mathematical operations:**

**add(int a, int b): Adds two integers.**

**subtract(int a, int b): Subtracts two integers.**

**multiply(int a, int b): Multiplies two integers.**

**divide(int a, int b) (optional): Divides two integers with error handling for division by zero. In your main function, prompt the user for two numbers and an operation (+, -, \*, or /). Use the corresponding static method from the MathUtil class to perform the calculation and display the result.**

#include <iostream>

using namespace std;

class MathUtil {

public:

// Static method to add two integers

static int add(int a, int b) {

return a + b;

}

// Static method to subtract two integers

static int subtract(int a, int b) {

return a - b;

}

// Static method to multiply two integers

static int multiply(int a, int b) {

return a \* b;

}

// Static method to divide two integers with error handling for division by zero

static double divide(int a, int b) {

if (b == 0) {

cout << "Error: Division by zero." << endl;

return 0; // or handle error as needed

}

return static\_cast<double>(a) / b;

}

};

int main() {

int num1, num2;

char operation;

// Prompt user for input

cout << "Enter first number: ";

cin >> num1;

cout << "Enter second number: ";

cin >> num2;

cout << "Enter operation (+, -, \*, /): ";

cin >> operation;

// Perform calculation based on operation

switch (operation) {

case '+':

cout << "Result: " << MathUtil::add(num1, num2) << endl;

break;

case '-':

cout << "Result: " << MathUtil::subtract(num1, num2) << endl;

break;

case '\*':

cout << "Result: " << MathUtil::multiply(num1, num2) << endl;

break;

case '/':

cout << "Result: " << MathUtil::divide(num1, num2) << endl;

break;

default:

cout << "Invalid operation." << endl;

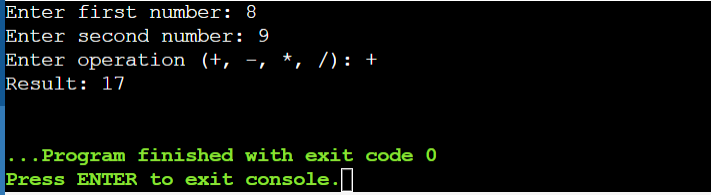
break;

}

return 0;

}

**Output:**

****

**Simple Currency Converter:**

**Create a class named CurrencyConverter. Define a static variable named exchangeRate (e.g., USD to EUR exchange rate). Implement static methods:**

**convertToEur(double amount): Converts an amount from the base currency (USD) to EUR based on the exchange rate.**

**convertFromEur(double amount): Converts an amount from EUR to the base currency (USD). In your main function, prompt the user for an amount and a conversion direction (USD to EUR or EUR to USD). Use the appropriate static method from the CurrencyConverter class to perform the conversion and display the result.**

#include <iostream>

using namespace std;

class CurrencyConverter {

public:

// Static method to convert USD to EUR (assuming exchange rate 1 USD = 0.85 EUR)

static double convertToEur(double amount) {

return amount \* 0.85;

}

// Static method to convert EUR to USD

static double convertFromEur(double amount) {

return amount / 0.85;

}

};

int main() {

double amount;

char direction;

// Prompt user for input

cout << "Enter amount: ";

cin >> amount;

cout << "Enter conversion direction (USD to EUR: 'u', EUR to USD: 'e'): ";

cin >> direction;

// Perform conversion based on direction

switch (direction) {

case 'u':

cout << amount << " USD is " << CurrencyConverter::convertToEur(amount) << " EUR." << endl;

break;

case 'e':

cout << amount << " EUR is " << CurrencyConverter::convertFromEur(amount) << " USD." << endl;

break;

default:

cout << "Invalid conversion direction." << endl;

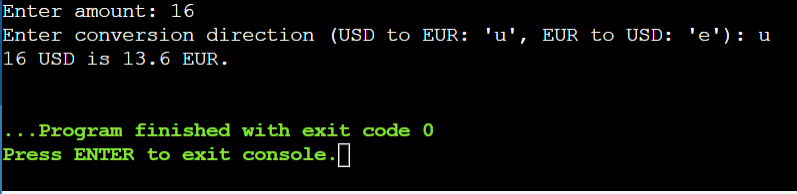
break;

}

return 0;

}

**Output:**

****

**Function Templates:**

#include <iostream>

using namespace std;

template <class T>T add(T&a,T&b)

{

T result = a+b;

return result;

}

int main()

{

int i = 2;

int j = 3;

float m = 2.3;

float n = 1.2;

cout <<"Addition of i and j is : "<<add(i,j);

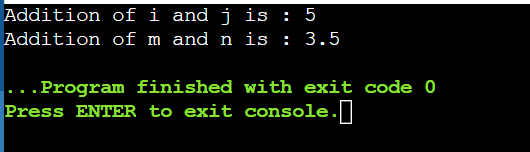
cout <<'\n';

cout <<"Addition of m and n is : "<<add(m,n);

return 0;

}

**Output:**

****

**Overloading Function Template:**

#include <iostream>

using namespace std;

template <class X>void fun(X a)

{

cout <<"value of a is " <<a<<endl;

}

template <class X,class Y>void fun(X b,Y c)

{

cout <<"value of b is "<<b<<endl;

cout <<"value of c is "<<c<<endl;

}

int main()

{

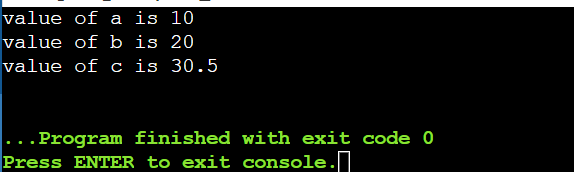
fun(10);

fun (20,30.5);

return 0;

}

**Output:**

****

**Design a function template named compare that takes two arguments of the same type and returns a boolean value indicating whether the first argument is greater than, less than, or equal to the second argument. How would you adapt this template to work with custom data types?**

**Function Template:**

#include <iostream>

using namespace std;

template <typename T>

bool compare(const T& a, const T& b) {

if (a > b) {

cout << "First argument is greater than the second argument." << endl;

return true;

} else if (a < b) {

cout << "First argument is less than the second argument." << endl;

return false;

} else {

cout << "First argument is equal to the second argument." << endl;

return false;

}

}

**Custom Data Type**

#include <iostream>

#include <string>

using namespace std;

class Person {

private:

string name;

int age;

public:

Person(string n, int a) : name(n), age(a) {}

// Overloading comparison operators

bool operator>(const Person& other) const {

return age > other.age;

}

bool operator<(const Person& other) const {

return age < other.age;

}

bool operator==(const Person& other) const {

return age == other.age;

}

friend ostream& operator<<(ostream& os, const Person& person) {

os << "Person(Name: " << person.name << ", Age: " << person.age << ")";

return os;

}

};

template <typename T>

bool compare(const T& a, const T& b) {

if (a > b) {

cout << a << " is greater than " << b << "." << endl;

return true;

} else if (a < b) {

cout << a << " is less than " << b << "." << endl;

return false;

} else {

cout << a << " is equal to " << b << "." << endl;

return false;

}

}

int main() {

int x = 5, y = 10;

compare(x, y); // Works with built-in types

Person p1("Manogn", 24);

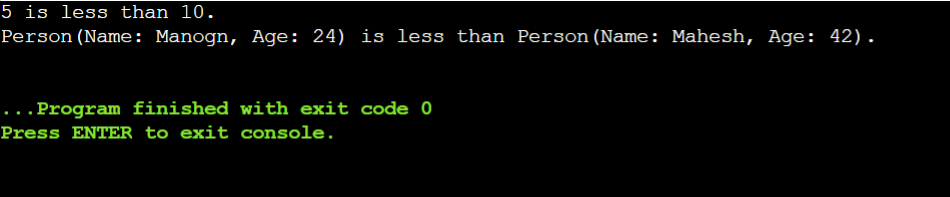
Person p2("Mahesh", 42);

compare(p1, p2); // Works with custom data type

return 0;

}

**Output:**

****

**Implement a function template named swap that exchanges the values of two variables of the same type. Discuss the potential limitations of this approach when dealing with complex data structures.**

#include <iostream>

#include <utility> // For std::move

using namespace std;

template <typename T>

void mySwap(T& a, T& b) {

T temp = std::move(a);

a = std::move(b);

b = std::move(temp);

}

int main() {

// Using mySwap with built-in types

int x = 5, y = 10;

cout << "Before swap: x = " << x << ", y = " << y << endl;

mySwap(x, y);

cout << "After swap: x = " << x << ", y = " << y << endl;

// Using mySwap with custom data type

string str1 = "Hello";

string str2 = "World";

cout << "Before swap: str1 = " << str1 << ", str2 = " << str2 << endl;

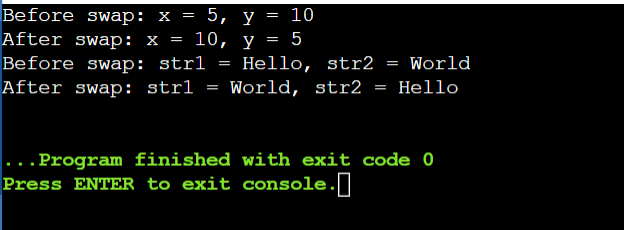
mySwap(str1, str2);

cout << "After swap: str1 = " << str1 << ", str2 = " << str2 << endl;

return 0;

}

**Output:**



**Consider a scenario where you need to find the minimum value in an array. Create a function template named findMin that works with any data type for which the comparison operator (<) is defined. Explain how function templates promote code reusability in this case.**

#include <iostream>

using namespace std;

template <typename T>

T findMin(const T arr[], int size) {

if (size <= 0) {

throw invalid\_argument("Array size must be greater than 0.");

}

T minValue = arr[0];

for (int i = 1; i < size; ++i) {

if (arr[i] < minValue) {

minValue = arr[i];

}

}

return minValue;

}

int main() {

// Example with int array

int intArray[] = {10, 20, 5, 30, 2};

int intSize = sizeof(intArray) / sizeof(intArray[0]);

cout << "Minimum value in intArray: " << findMin(intArray, intSize) << endl;

// Example with double array

double doubleArray[] = {3.5, 2.1, 6.7, 1.9, 4.4};

int doubleSize = sizeof(doubleArray) / sizeof(doubleArray[0]);

cout << "Minimum value in doubleArray: " << findMin(doubleArray, doubleSize) << endl;

// Example with string array

string strArray[] = {"apple", "orange", "banana", "pear"};

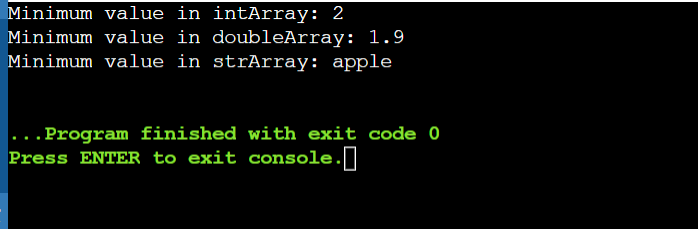
int strSize = sizeof(strArray) / sizeof(strArray[0]);

cout << "Minimum value in strArray: " << findMin(strArray, strSize) << endl;

return 0;

}

**Output:**

****