**Лабораторна робота №3. Успадкування і віртуальні функції**

**Мета:** Одержати практичні навички створення ієрархії класів і використання статичних компонентів класу.

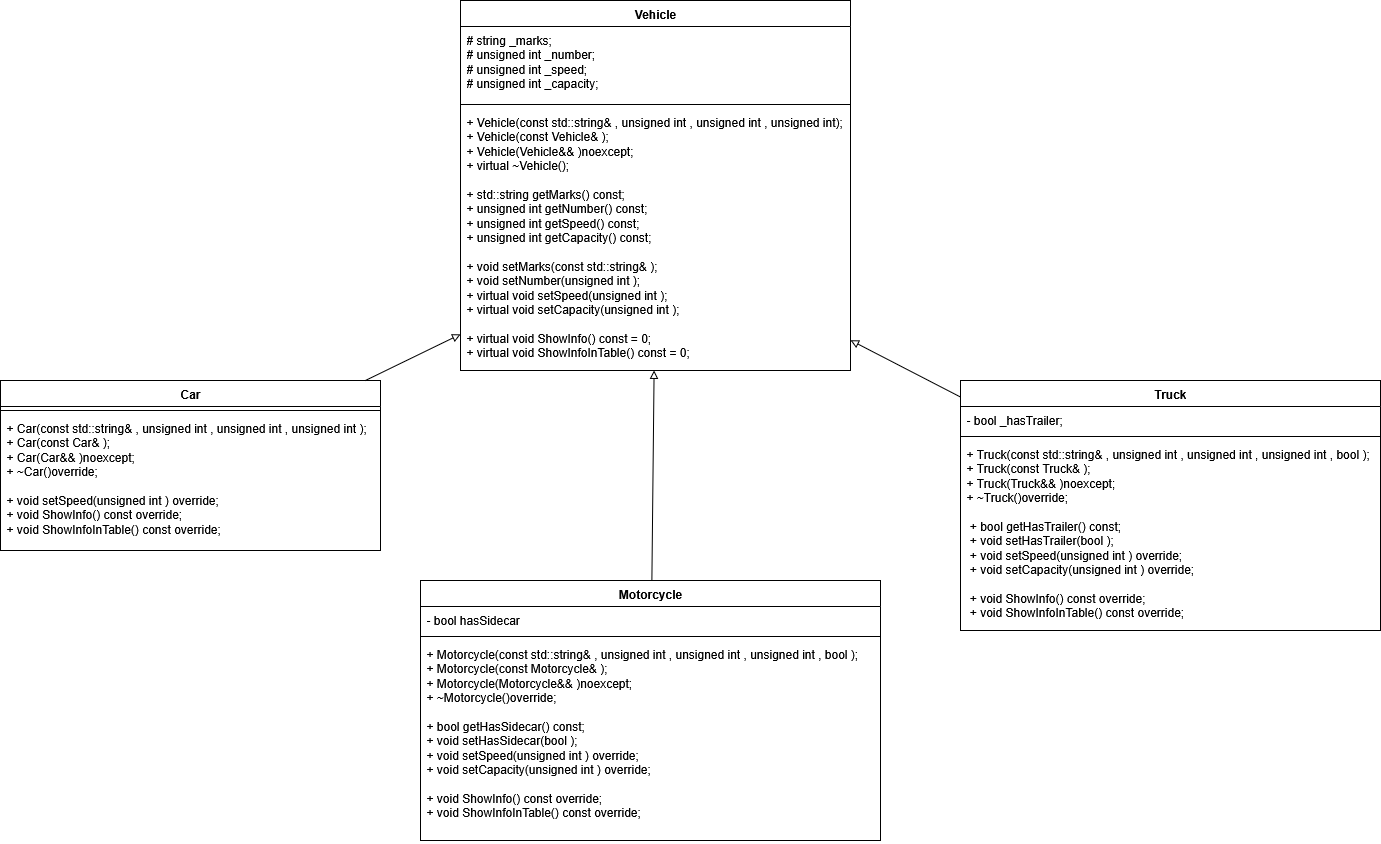
**Основний зміст роботи.**

Написати програму, в якій створюється ієрархія класів. Включити поліморфні об'єкти в зв'язаний список, використовуючи статичні компоненти класу. Показати використання віртуальних функцій.

**Задача**

1. Створити абстрактний клас Trans з методами дозволяючими вивести на екран інформацію про транспортний засіб, а також визначити вантажопідйомність транспортного засобу.
2. Створити похідні класи: Легковая\_машина (марка, номер, швидкість, вантажопідйомність), Мотоцикл (марка, номер, швидкість, вантажопідйомність, наявність коляски, при цьому якщо коляска відсутня, то вантажопідйомність рівна 0), Грузовик (марка, номер, швидкість, вантажопідйомність, наявність причепа, при цьому якщо є причіп, то вантажопідйомність збільшується в два рази) з своїми методами виведення інформації на екран, і визначення вантажопідйомності.
3. Створити базу (масив) з n машин, вивести повну інформацію з бази на екран, а також організувати пошук машин, що задовольняють вимогам вантажопідйомності.

**Ієрархія класів**

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**Код програми**

**Vehicle.hpp**

#pragma once

#ifndef VEHICLE\_HPP

#define VEHICLE\_HPP

class Vehicle

{

protected:

std::string \_marks;

unsigned int \_number;

unsigned int \_speed;

unsigned int \_capacity;

public:

// ---------------------- Constructor and Destructor -----------------------------

Vehicle(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity);

Vehicle(const Vehicle& other);

Vehicle(Vehicle&& other)noexcept;

virtual ~Vehicle();

// -------------------------- Getters and Setters -----------------------------

std::string getMarks() const;

unsigned int getNumber() const;

unsigned int getSpeed() const;

unsigned int getCapacity() const;

void setMarks(const std::string& marks);

void setNumber(unsigned int number);

virtual void setSpeed(unsigned int speed);

virtual void setCapacity(unsigned int capacity);

// -------------------------- Other Methods -----------------------------

virtual void ShowInfo() const = 0;

virtual void ShowInfoInTable() const = 0;

};

#endif // VEHICLE\_HPP

**Vehicle.cpp**

#include <string>

#include <iostream>

#include "Vehicle.hpp"

// ---------------------- Constructor and Destructor -----------------------------

Vehicle::Vehicle(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity)

{

setMarks(marks);

setNumber(number);

setSpeed(speed);

setCapacity(capacity);

std::cout << "Vehicle::Vehicle(string,uint,uint,uint) called" << std::endl;

}

Vehicle::Vehicle(const Vehicle& other)

{

setMarks(other.\_marks);

setNumber(other.\_number);

setSpeed(other.\_speed);

setCapacity(other.\_capacity);

std::cout << "Vehicle::Vehicle(const Vehicle&) called" << std::endl;

}

Vehicle::Vehicle(Vehicle&& other)noexcept

{

setMarks(other.\_marks);

setNumber(other.\_number);

setSpeed(other.\_speed);

setCapacity(other.\_capacity);

other.\_marks = "NoName";

other.\_number = 0;

other.\_speed = 0;

other.\_capacity = 0;

std::cout << "Vehicle::Vehicle(Vehicle&&) called" << std::endl;

}

Vehicle::~Vehicle()

{

std::cout << "Vehicle::~Vehicle() called" << std::endl;

}

// -------------------------- Getters and Setters -----------------------------

std::string Vehicle::getMarks() const

{

return \_marks;

}

unsigned int Vehicle::getNumber() const

{

return \_number;

}

unsigned int Vehicle::getSpeed() const

{

return \_speed;

}

unsigned int Vehicle::getCapacity() const

{

return \_capacity;

}

void Vehicle::setMarks(const std::string& marks)

{

if (marks != " " && !marks.empty()) {

\_marks = marks;

}

else \_marks = "NoName";

}

void Vehicle::setNumber(unsigned int number)

{

if (number > 0) {

\_number = number;

}

else \_number = 0;

}

void Vehicle::setSpeed(unsigned int speed)

{

if (speed > 0) {

\_speed = speed;

}

else \_speed = 0;

}

void Vehicle::setCapacity(unsigned int capacity)

{

if (capacity > 0) {

\_capacity = capacity;

}

else \_capacity = 0;

}

**Car.hpp**

#pragma once

#ifndef CAR\_HPP

#define CAR\_HPP

class Car : public Vehicle

{

public:

// ---------------------- Constructor and Destructor -----------------------------

Car(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity);

Car(const Car& other);

Car(Car&& other)noexcept;

~Car()override;

// -------------------------- Getters and Setters -----------------------------

void setSpeed(unsigned int speed) override;

// -------------------------- Other Methods -----------------------------

void ShowInfo() const override;

void ShowInfoInTable() const override;

};

#endif // CAR\_HPP

**Car.cpp**

#include <string>

#include <iostream>

#include <iomanip>

#include "Vehicle.hpp"

#include "Car.hpp"

Car::Car(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity)

: Vehicle(marks, number, speed, capacity)

{

std::cout << "Car::Car(string,uint,uint,uint) called" << std::endl;

}

Car::Car(const Car& other)

: Vehicle(other)

{

std::cout << "Car::Car(const Car&) called" << std::endl;

}

Car::Car(Car&& other)noexcept

: Vehicle(std::move(other))

{

std::cout << "Car::Car(Car&&) called" << std::endl;

}

Car::~Car()

{

std::cout << "Car::~Car() called" << std::endl;

}

void Car::setSpeed(unsigned int speed)

{

if (speed > 0) {

\_speed = speed;

}

\_speed = 100;

}

void Car::ShowInfo() const

{

std::cout << "Car Info: " << std::endl;

std::cout << "Marks: " << \_marks << std::endl;

std::cout << "Number: " << \_number << std::endl;

std::cout << "Speed: " << \_speed << std::endl;

std::cout << "Capacity: " << \_capacity << std::endl;

}

void Car::ShowInfoInTable() const

{

std::cout << std::left;

std::cout << std::setw(15) << \_marks

<< std::setw(15) << \_number

<< std::setw(15) << \_speed

<< std::setw(15) << \_capacity << std::endl;

std::cout << std::right;

}

**Motorcycle.hpp**

#pragma once

#ifndef MOTORCYCLE\_HPP

#define MOTORCYCLE\_HPP

class Motorcycle : public Vehicle

{

bool \_hasSidecar;

public:

// ---------------------- Constructor and Destructor -----------------------------

Motorcycle(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity, bool hasSidecar);

Motorcycle(const Motorcycle& other);

Motorcycle(Motorcycle&& other)noexcept;

~Motorcycle()override;

// -------------------------- Getters and Setters -----------------------------

bool getHasSidecar() const;

void setHasSidecar(bool hasSidecar);

void setSpeed(unsigned int speed) override;

void setCapacity(unsigned int capacity) override;

// -------------------------- Other Methods -----------------------------

void ShowInfo() const override;

void ShowInfoInTable() const override;

};

#endif // MOTORCYCLE\_HPP

**Motorcycle.cpp**

#include <string>

#include <iostream>

#include <iomanip>

#include "Vehicle.hpp"

#include "Motorcycle.hpp"

// ---------------------- Constructor and Destructor -----------------------------

Motorcycle::Motorcycle(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity, bool hasSidecar)

: Vehicle(marks, number, speed, capacity), \_hasSidecar(hasSidecar)

{

std::cout << "Motorcycle::Motorcycle(string,uint,uint,uint,bool) called" << std::endl;

}

Motorcycle::Motorcycle(const Motorcycle& other)

: Vehicle(other), \_hasSidecar(other.\_hasSidecar)

{

std::cout << "Motorcycle::Motorcycle(const Motorcycle&) called" << std::endl;

}

Motorcycle::Motorcycle(Motorcycle&& other) noexcept

: Vehicle(std::move(other)), \_hasSidecar(other.\_hasSidecar)

{

std::cout << "Motorcycle::Motorcycle(Motorcycle&&) called" << std::endl;

}

Motorcycle::~Motorcycle()

{

std::cout << "Motorcycle::~Motorcycle() called" << std::endl;

}

// -------------------------- Getters and Setters -----------------------------

bool Motorcycle::getHasSidecar() const

{

return \_hasSidecar;

}

void Motorcycle::setHasSidecar(bool hasSidecar)

{

\_hasSidecar = hasSidecar;

}

void Motorcycle::setSpeed(unsigned int speed)

{

if (speed > 0) {

\_speed = speed;

}

\_speed = 150;

}

void Motorcycle::setCapacity(unsigned int capacity)

{

if (capacity < 0 && getHasSidecar()) {

\_capacity = 0;

}

else {

\_capacity = capacity;

}

}

// -------------------------- Other Methods -----------------------------

void Motorcycle::ShowInfo() const

{

std::cout << "Motorcycle Info: " << std::endl;

std::cout << "Marks: " << \_marks << std::endl;

std::cout << "Number: " << \_number << std::endl;

std::cout << "Speed: " << \_speed << std::endl;

std::cout << "Capacity: " << \_capacity << std::endl;

std::cout << "Has Sidecar: " << (\_hasSidecar ? "Yes" : "No") << std::endl;

}

void Motorcycle::ShowInfoInTable() const

{

std::cout << std::left;

std::cout << std::setw(15) << \_marks

<< std::setw(15) << \_number

<< std::setw(15) << \_speed

<< std::setw(15) << \_capacity

<< std::setw(15) << (\_hasSidecar ? "Sidecar" : "NoSidecar") << std::endl;

std::cout << std::right;

}

**Truck.hpp**

#pragma once

#ifndef TRUCK\_HPP

#define TRUCK\_HPP

class Truck : public Vehicle

{

private:

bool \_hasTrailer;

public:

// ---------------------- Constructor and Destructor -----------------------------

Truck(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity, bool hasTrailer);

Truck(const Truck& other);

Truck(Truck&& other)noexcept;

~Truck()override;

// -------------------------- Getters and Setters -----------------------------

bool getHasTrailer() const;

void setHasTrailer(bool hasTrailer);

void setSpeed(unsigned int speed) override;

void setCapacity(unsigned int capacity) override;

// -------------------------- Other Methods -----------------------------

void ShowInfo() const override;

void ShowInfoInTable() const override;

};

#endif // TRUCK\_HPP

**Truck.cpp**

#include <string>

#include <iostream>

#include <iomanip>

#include "Vehicle.hpp"

#include "Truck.hpp"

// ---------------------- Constructor and Destructor -----------------------------

Truck::Truck(const std::string& marks, unsigned int number, unsigned int speed, unsigned int capacity, bool hasTrailer)

: Vehicle(marks, number, speed, capacity), \_hasTrailer(hasTrailer)

{

std::cout << "Truck::Truck(string,uint,uint,uint,bool) called" << std::endl;

}

Truck::Truck(const Truck& other)

: Vehicle(other), \_hasTrailer(other.\_hasTrailer)

{

std::cout << "Truck::Truck(const Truck&) called" << std::endl;

}

Truck::Truck(Truck&& other) noexcept

: Vehicle(std::move(other)), \_hasTrailer(other.\_hasTrailer)

{

std::cout << "Truck::Truck(Truck&&) called" << std::endl;

}

Truck::~Truck()

{

std::cout << "Truck::~Truck() called" << std::endl;

}

// -------------------------- Getters and Setters -----------------------------

bool Truck::getHasTrailer() const

{

return \_hasTrailer;

}

void Truck::setHasTrailer(bool hasTrailer)

{

\_hasTrailer = hasTrailer;

}

void Truck::setSpeed(unsigned int speed)

{

if (speed > 0) {

\_speed = speed;

}

\_speed = 80;

}

void Truck::setCapacity(unsigned int capacity)

{

if (capacity < 0) { \_capacity = 0; }

else if (getHasTrailer()) { \_capacity = capacity \* 2; }

else \_capacity = capacity;

}

// -------------------------- Other Methods -----------------------------

void Truck::ShowInfo() const

{

std::cout << "Truck Info: " << std::endl;

std::cout << "Marks: " << \_marks << std::endl;

std::cout << "Number: " << \_number << std::endl;

std::cout << "Speed: " << \_speed << std::endl;

std::cout << "Capacity: " << \_capacity << std::endl;

std::cout << "Has Trailer: " << (\_hasTrailer ? "Yes" : "No") << std::endl;

}

void Truck::ShowInfoInTable() const

{

std::cout << std::left;

std::cout << std::setw(15) << \_marks

<< std::setw(15) << \_number

<< std::setw(15) << \_speed

<< std::setw(15) << \_capacity

<< std::setw(15) << (\_hasTrailer ? "Trailer" : "NoTrailer") << std::endl;

std::cout << std::right;

}

**Main.cpp**

#include <iostream>

#include <vector>

#include "Vehicle.hpp"

#include "Car.hpp"

#include "Motorcycle.hpp"

#include "Truck.hpp"

int main() {

std::vector<Vehicle\*> base;

base.push\_back(new Car("Toyota", 53895, 180, 500));

base.push\_back(new Motorcycle("Honda", 85837, 160, 100, false));

base.push\_back(new Motorcycle("BMW", 46628, 170, 120, true));

base.push\_back(new Truck("Volvo", 11284, 120, 3000, true));

base.push\_back(new Truck("MAN", 34674, 110, 4000, false));

std::cout << "============= Vehicle database =================\n\n";

for (auto t : base) {

t->ShowInfoInTable();

}

std::cout << "================================================\n\n";

double required;

std::cout << "\nEnter minimal capacity to search: ";

std::cin >> required;

std::cout << "\n=== Search result (min. " << required << " kg) ===\n\n";

bool found = false;

for (auto t : base) {

if (t->getCapacity() >= required) {

t->ShowInfoInTable();

found = true;

}

}

if (!found) {

std::cout << "There are no vehicles with this load capacity..\n";

}

for (auto t : base) {

delete t;

}

return 0;

}

**Результат**

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**Висновок**

На лабораторній роботі було одержано практичні навички створення ієрархії класів і використання статичних компонентів класу.