

Московский Авиационный Институт
(Национальный исследовательский Университет)

Факультет: «Информационные технологии и прикладная математика»
Кафедра: 806 «Вычислительная математика и программирование»

**Лабораторная работа
по курсу «ООП»**

Тема:
Проектирование структуры классов.

Студент:	Петрин С.А.
Группа:	М80-207Б-18
Преподаватель:	Журавлев А.А.
Вариант:	17
Оценка:	
Дата:	

Москва
2019

1. Постановка задачи

Спроектировать простейший графический векторный редактор.

Требование к функционалу редактора:

- создание нового документа
- импорт документа из файла
- экспорт документа в файл
- создание графического примитива (согласно варианту задания)
- удаление графического примитива
- отображение документа на экране (печать перечня графических объектов и их характеристик)
- реализовать операцию undo, отменяющую последнее сделанное действие. Должно действовать для операций добавления/удаления фигур.

Требования к реализации:

- Создание графических примитивов необходимо вынести в отдельный класс – Factory.
- Сделать упор на использовании полиморфизма при работе с фигурами;
- Взаимодействие с пользователем (ввод команд) реализовать в функции main;

Вариант 17:

Треугольник, квадрат, прямоугольник.

2. Код программы на языке C++

main.cpp:

```
#include <iostream>

#include <string>

#include "editor.h"

void menu() {

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

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

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

    std::cout << "Save <fileName>\n";

    std::cout << "Add <figureType>\n";

    std::cout << "Remove <figure ID>\n";

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

    std::cout << "Print\n\n";
```

```
}
```

```
void create(Editor &editor) {  
    std::string cmd;  
    if (editor.DocumentExist()) {  
        std::cout << "Save old document or don't save? Yes/No\n";  
        std::cin >> cmd;  
        if (cmd == "Yes") {  
            std::string filename;  
            std::cout << "Enter name of file\n";  
            std::cin >> filename;  
            try {  
                editor.SaveDocument(filename);  
                std::cout << "Document save in file " << filename << "\n";  
            } catch (std::runtime_error &err) {  
                std::cout << err.what() << "\n";  
            }  
        }  
        std::cout << "Enter name of new project\n";  
    }  
    std::cin >> cmd;  
    editor.CreateDocument(cmd);  
    std::cout << "Document " << cmd << " is created\n";  
}
```

```
void save(Editor &editor) {  
    if (!editor.DocumentExist()) {  
        throw std::runtime_error("Document does not exist");  
    }  
    std::string filename;  
    std::cin >> filename;
```

```

try {
    editor.SaveDocument(filename);

    std::cout << "Document save if file " << filename << "\n";
} catch (std::runtime_error &err) {
    std::cout << err.what() << "\n";
}
}

```

```

void load(Editor &editor) {
    std::string cmd;
    std::string filename;

    if (editor.DocumentExist()) {
        std::cout << "Save old document or don't save? Yes/No\n";
        std::cin >> cmd;

        if (cmd == "Yes") {
            std::cout << "Enter name of file\n";
            std::cin >> filename;

            try {
                editor.SaveDocument(filename);

                std::cout << "Document save in file " << filename << "\n";
            } catch (std::runtime_error& err) {
                std::cout << err.what() << "\n";
            }
        }
    }

    std::cin >> filename;

    try {
        editor.LoadDocument(filename);

        std::cout << "Document loaded from file " << filename << "\n";
    } catch (std::runtime_error& err) {
        std::cout << err.what() << "\n";
    }
}

```

```

    }
}
}

```

```

void add(Editor &editor) {
    if (!editor.DocumentExist()) {
        throw std::runtime_error("Document does not exist");
    }
    char type;
    std::cin >> type;
    if (type == 'T') {
        std::pair<double, double> *vertices = new std::pair<double, double>[3];
        for (int i = 0; i < 3; i++) {
            std::cin >> vertices[i].first >> vertices[i].second;
        }
        try {
            editor.InsertPrimitive(TRIANGLE, vertices);
        } catch (std::logic_error &err) {
            std::cout << err.what() << "\n";
            return;
        }
    }
    else if (type == 'S') {
        std::pair<double, double> *vertices = new std::pair<double, double>[4];
        for (int i = 0; i < 4; i++) {
            std::cin >> vertices[i].first >> vertices[i].second;
        }
        try {
            editor.InsertPrimitive(SQUARE, vertices);
        } catch (std::logic_error &err) {
            std::cout << err.what() << "\n";

```

```

        return;
    }
}
else if (type == 'R') {
    std::pair<double, double> *vertices = new std::pair<double, double>[4];
    for (int i = 0; i < 4; i++) {
        std::cin >> vertices[i].first >> vertices[i].second;
    }
    try {
        editor.InsertPrimitive(RECTANGLE, vertices);
    } catch (std::logic_error &err) {
        std::cout << err.what() << "\n";
        return;
    }
}
else {
    std::cout << "Primitive isn't added\n";
    std::cin.clear();
    std::cin.ignore(30000, '\n');
    return;
}
std::cout << "Primitive is added\n";
}

```

```

void remove(Editor &editor) {
    if (!editor.DocumentExist()) {
        throw std::runtime_error("Document does not exist");
    }
    int id;

    std::cin >> id;

```

```

try {
    editor.RemovePrimitive(id);
} catch (std::exception &err) {
    return;
}

std::cout << "Primitive with " << id << " is removed\n";
}

```

```

int main(int argc, char **argv) {
    /*SDL_Window *gWindow = nullptr;
    SDL_Renderer *gRenderer = nullptr;*/

    Editor editor;
    std::string cmd;

    while(std::cin >> cmd) {
        if (cmd == "Menu") {
            menu();
        }
        else if (cmd == "Create") {
            create(editor);
        }
        else if (cmd == "Save") {
            try {
                save(editor);
            } catch (std::runtime_error &err) {
                std::cout << err.what() << "\n\n";
            }
        }
        else if (cmd == "Load") {
            try {

```

```

        load(editor);

    } catch (std::runtime_error &err) {

        std::cout << err.what() << "\n\n";

    }

}

else if (cmd == "Add") {

    try {

        add(editor);

    } catch (std::runtime_error &err) {

        std::cout << err.what() << "\n\n";

    }

}

else if (cmd == "Remove") {

    try {

        remove(editor);

    } catch (std::exception &err) {

        std::cout << err.what() << "\n";

    }

}

else if (cmd == "Undo") {

    try {

        editor.Undo();

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

    } catch (std::logic_error &err) {

        std::cout << err.what() << "\n\n";

    }

}

else if (cmd == "Print") {

    if (!editor.DocumentExist()) {

        std::cout << "Document does not exist" << "\n\n";

        continue;
    }
}

```



```

        }

        editor.PrintDocument();
    }

    else {

        std::cin.clear();

        std::cin.ignore(30000, '\n');

    }

    std::cout << "\n";

}

return 0;

}

```

figures.h:

```

#ifndef FIGURES_H
#define FIGURES_H 1

#include <iostream>
#include <fstream>
#include <utility>
#include <cmath>
#include <memory>

enum FigureType {
    TRIANGLE,
    SQUARE,
    RECTANGLE
};

class Figure {
public:
    virtual double Area() const = 0;

```

```

virtual std::pair<double, double> Center() const = 0;

virtual std::ostream &Print(std::ostream &out) const = 0;

virtual void Serialize(std::ofstream &os) const = 0;

virtual void Deserialize(std::ifstream &is) = 0;

virtual int getId() const = 0;

virtual ~Figure() = default;

};

namespace Geometry {

    using Vertex = std::pair<double, double>;

    double Product(const Vertex &v1, const Vertex &v2) {

        return v1.first * v2.first + v1.second * v2.second;

    }

    double PointDistance(const Vertex &v1, const Vertex &v2) {

        return sqrt(pow((v2.first - v1.first), 2) +

            pow((v2.second - v1.second), 2));

    }

    class Vector {

        double x, y;

    public:

        Vector(double x_cord, double y_cord) : x{x_cord}, y{y_cord} {};

        Vector(Vertex &v1, Vertex &v2) : x{v2.first - v1.first},

            y{v2.second - v1.second} {};

        double operator*(const Vector &a) const {

            return (x * a.x) + (y * a.y);

        }

    }

```

```

Vector &operator=(const Vector &a) {
    x = a.x;
    y = a.y;

    return *this;
}

friend double LengthVector(const Vector &a);
friend bool VectorsAreParallel(const Vector &a, const Vector &b);
};

```

```

double LengthVector(const Vertex &v1, const Vertex &v2) {
    return PointDistance(v1, v2);
}

```

```

double LengthVector(const Vector &a) {
    return sqrt(pow(a.x, 2) + pow(a.y, 2));
}

```

```

bool VectorsAreParallel(const Vector &a, const Vector &b) {
    return (a.x * b.y) - (a.y * b.x) == 0;
}

```

```

double Area(const Vertex *vertices, int n) {
    double res = 0;

    for (int i = 0; i < n - 1; i++) {
        res += (vertices[i].first * vertices[i + 1].second -
                vertices[i + 1].first * vertices[i].second);
    }

    res += (vertices[n - 1].first * vertices[0].second -
            vertices[0].first * vertices[n - 1].second);
}

```

```
    return 0.5 * std::abs(res);  
}
```

```
Vertex Center(const Vertex *vertices, int n) {  
    double x = 0, y = 0;  
  
    for (int i = 0; i < n; i++) {  
        x += vertices[i].first;  
        y += vertices[i].second;  
    }  
  
    return std::make_pair(x / n, y / n);  
}  
}
```

```
std::ostream &operator<<(std::ostream &out, std::pair<double, double> v) {  
    out << "(" << v.first << ", " << v.second << ")";  
    return out;  
}  
}
```

```
class Triangle : public Figure {  
    using Vertex = std::pair<double, double>;  
    int Id;  
    Vertex *vertices;  
public:  
    Triangle() : Id{0}, vertices{new Vertex[3]} {  
        for (int i = 0; i < 3; i++) {  
            vertices[i] = std::make_pair(0, 0);  
        }  
    }  
}
```

```

Triangle(Vertex a, Vertex b, Vertex c, int id) : Id{id},
    vertices{new Vertex[3]} {

    vertices[0] = a;
    vertices[1] = b;
    vertices[2] = c;

    double AB = Geometry::PointDistance(a, b), BC =
    Geometry::PointDistance(b, c), AC = Geometry::PointDistance(a, c);
    if (AB >= BC + AC || BC >= AB + AC || AC >= AB + BC) {
        throw std::logic_error("Points must not be on the same line.");
    }
}

double Area() const override {
    return Geometry::Area(vertices, 3);
}

Vertex Center() const override {
    return Geometry::Center(vertices, 3);
}

std::ostream &Print(std::ostream &out) const override{
    out << "Id: " << Id << "\n";
    out << "Figure: Triangle\n";
    out << "Coords:\n";
    for (int i = 0; i < 3; i++) {
        out << vertices[i] << "\n";
    }
    return out;
}

```

```

void Serialize(std::ofstream &os) const override{

    FigureType type = TRIANGLE;

    os.write((char *) &type, sizeof(type));

    os.write((char *) &Id, sizeof(Id));

    for (int i = 0; i < 3; i++) {

        os.write((char *) &(vertices[i].first),

            sizeof(vertices[i].first));

        os.write((char *) &(vertices[i].second),

            sizeof(vertices[i].second));

    }

}

```

```

void Deserialize(std::ifstream &is) override {

    is.read((char *) &Id, sizeof(Id));

    for (int i = 0; i < 3; i++) {

        is.read((char *) &(vertices[i].first),

            sizeof(vertices[i].first));

        is.read((char *) &(vertices[i].second),

            sizeof(vertices[i].second));

    }

}

```

```

int getId() const override {

    return Id;

}

};

```

```

class Square : public Figure {

    using Vertex = std::pair<double, double>;

    int Id;

    Vertex *vertices;

```

public:

```
Square() : Id{0}, vertices{new Vertex[4]} {  
    for (int i = 0; i < 4; i++) {  
        vertices[i] = std::make_pair(0, 0);  
    }  
}
```

Square(Vertex a, Vertex b, Vertex c, Vertex d, int id) :

```
    Id{id}, vertices{new Vertex[4]} {  
  
        vertices[0] = a;  
        vertices[1] = b;  
        vertices[2] = c;  
        vertices[3] = d;  
  
        Geometry::Vector AB{ a, b }, BC{ b, c }, CD{ c, d }, DA{ d, a };  
        if (!Geometry::VectorsAreParallel(DA, BC)) {  
            std::swap(vertices[0], vertices[1]);  
            AB = { vertices[0], vertices[1] };  
            BC = { vertices[1], vertices[2] };  
            CD = { vertices[2], vertices[3] };  
            DA = { vertices[3], vertices[0] };  
        }  
        if (!Geometry::VectorsAreParallel(AB, CD)) {  
            std::swap(vertices[1], vertices[2]);  
            AB = { vertices[0], vertices[1] };  
            BC = { vertices[1], vertices[2] };  
            CD = { vertices[2], vertices[3] };  
            DA = { vertices[3], vertices[0] };  
        }  
    }
```

```
    if (AB * BC || BC * CD || CD * DA || DA * AB) {  
        throw std::logic_error("The sides of the square should be perpendicular");  
    }
```

```

    }

    if (LengthVector(AB) != LengthVector(BC) || LengthVector(BC) != LengthVector(CD) ||
LengthVector(CD) != LengthVector(DA) || LengthVector(DA) != LengthVector(AB)) {
        throw std::logic_error("The sides of the square should be equal");
    }

    if (!LengthVector(AB) || !LengthVector(BC) || !LengthVector(CD) || !LengthVector(DA)) {
        throw std::logic_error("The sides of the square must be greater than zero");
    }
}

```

```

double Area() const override {
    return Geometry::Area(vertices, 4);
}

```

```

Vertex Center() const override {
    return Geometry::Center(vertices, 4);
}

```

```

std::ostream &Print(std::ostream &out) const override{
    out << "Id: " << Id << "\n";
    out << "Figure: Square\n";
    out << "Coords:\n";
    for (int i = 0; i < 4; i++) {
        out << vertices[i] << "\n";
    }
    return out;
}

```

```

void Serialize(std::ofstream &os) const override{
    FigureType type = SQUARE;
    os.write((char *) &type, sizeof(type));
}

```



```

        os.write((char *) &Id, sizeof(Id));

        for (int i = 0; i < 4; i++) {

            os.write((char *) &(vertices[i].first),

                    sizeof(vertices[i].first));

            os.write((char *) &(vertices[i].second),

                    sizeof(vertices[i].second));

        }

    }
}

```

```

void Deserialize(std::ifstream &is) override {

    is.read((char *) &Id, sizeof(Id));

    for (int i = 0; i < 4; i++) {

        is.read((char *) &(vertices[i].first),

                sizeof(vertices[i].first));

        is.read((char *) &(vertices[i].second),

                sizeof(vertices[i].second));

    }

}

```

```

int getId() const override {

    return Id;

}

};

```

```

class Rectangle : public Figure {

    using Vertex = std::pair<double, double>;

    int Id;

    Vertex *vertices;

public:

    Rectangle() : Id{0}, vertices{new Vertex[4]} {

        for (int i = 0; i < 4; i++) {

```

```

        vertices[i] = std::make_pair(0, 0);
    }
}

```

Rectangle(Vertex a, Vertex b, Vertex c, Vertex d, int id) :

```

        Id{id}, vertices{new Vertex[4]} {
    vertices[0] = a;
    vertices[1] = b;
    vertices[2] = c;
    vertices[3] = d;

    Geometry::Vector AB{ a, b }, BC{ b, c }, CD{ c, d }, DA{ d, a };
    if (!Geometry::VectorsAreParallel(DA, BC)) {
        std::swap(vertices[0], vertices[1]);

        AB = { vertices[0], vertices[1] };
        BC = { vertices[1], vertices[2] };
        CD = { vertices[2], vertices[3] };
        DA = { vertices[3], vertices[0] };
    }

    if (!Geometry::VectorsAreParallel(AB, CD)) {
        std::swap(vertices[1], vertices[2]);

        AB = { vertices[0], vertices[1] };
        BC = { vertices[1], vertices[2] };
        CD = { vertices[2], vertices[3] };
        DA = { vertices[3], vertices[0] };
    }

    if (AB * BC || BC * CD || CD * DA || DA * AB) {
        throw std::logic_error("The sides of the square should be perpendicular");
    }

    if (!LengthVector(AB) || !LengthVector(BC) || !LengthVector(CD) || !LengthVector(DA)) {
        throw std::logic_error("The sides of the square must be greater than zero");
    }
}

```

```

    }
}

double Area() const override {
    return Geometry::Area(vertices, 4);
}

Vertex Center() const override {
    return Geometry::Center(vertices, 4);
}

std::ostream &Print(std::ostream &out) const override{
    out << "Id: " << Id << "\n";
    out << "Figure: Rectangle\n";
    out << "Coords:\n";
    for (int i = 0; i < 4; i++) {
        out << vertices[i] << "\n";
    }
    return out;
}

void Serialize(std::ofstream &os) const override{
    FigureType type = RECTANGLE;
    os.write((char *) &type, sizeof(type));
    os.write((char *) &Id, sizeof(Id));
    for (int i = 0; i < 4; i++) {
        os.write((char *) &(vertices[i].first),
            sizeof(vertices[i].first));
        os.write((char *) &(vertices[i].second),
            sizeof(vertices[i].second));
    }
}

```

```
}
```

```
void Deserialize(std::ifstream &is) override {
```

```
    is.read((char *) &Id, sizeof(Id));
```

```
    for (int i = 0; i < 4; i++) {
```

```
        is.read((char *) &(vertices[i].first),
```

```
            sizeof(vertices[i].first));
```

```
        is.read((char *) &(vertices[i].second),
```

```
            sizeof(vertices[i].second));
```

```
    }
```

```
}
```

```
int getId() const override {
```

```
    return Id;
```

```
}
```

```
};
```

```
class Factory {
```

```
public:
```

```
    using Vertex = std::pair<double, double>;
```

```
    virtual std::shared_ptr<Figure> FigureCreate() const = 0;
```

```
    virtual std::shared_ptr<Figure> FigureCreate(Vertex *vertices, int id)
```

```
        const = 0;
```

```
};
```

```
class TriangleFactory : public Factory {
```

```
public:
```

```
    std::shared_ptr<Figure> FigureCreate() const override {
```

```
        return std::shared_ptr<Figure>(new Triangle{});
```

```
    }
```

```

std::shared_ptr<Figure> FigureCreate(Vertex *vertices, int id) const
                                override {
    return std::shared_ptr<Figure>(new Triangle{vertices[0], vertices[1],
        vertices[2], id});
}
};

```

```

class SquareFactory : public Factory {
public:
    std::shared_ptr<Figure> FigureCreate() const override {
        return std::shared_ptr<Figure>(new Square{});
    }

    std::shared_ptr<Figure> FigureCreate(Vertex *vertices, int id) const
                                override {
        return std::shared_ptr<Figure>(new Square{vertices[0], vertices[1],
            vertices[2], vertices[3], id});
    }
};

```

```

class RectangleFactory : public Factory {
public:
    std::shared_ptr<Figure> FigureCreate() const override {
        return std::shared_ptr<Figure>(new Rectangle{});
    }

    std::shared_ptr<Figure> FigureCreate(Vertex *vertices, int id) const
                                override {
        return std::shared_ptr<Figure>(new Rectangle{vertices[0], vertices[1],
            vertices[2], vertices[3], id});
    }
}

```

```
};
```

```
#endif // FIGURES_H
```

editor.h:

```
#ifndef EDITOR_H
```

```
#define EDITOR_H
```

```
#include "document.h"
```

```
#include "command.h"
```

```
#include <stack>
```

```
class Editor {
```

```
public:
```

```
    Editor() : Doc(nullptr), History() {};
```

```
    void CreateDocument(const std::string &name) {  
        Doc = std::make_shared<Document>(name);  
    }
```

```
    void InsertPrimitive(FigureType type, std::pair<double, double> *vertices) {  
        std::shared_ptr<Command> command = std::shared_ptr<Command>(  
            new InsertCommand(type, vertices));  
        command->SetDocument(Doc);  
        command->Execute();  
        History.push(command);  
    }
```

```
    void RemovePrimitive(int id) {  
        try {  
            std::shared_ptr<Command> command = std::shared_ptr<Command>(new  
RemoveCommand(id));  
            command->SetDocument(Doc);  
            command->Execute();  
            History.push(command);  
        } catch (std::exception &err) {  
            std::cout << err.what() << "\n";  
            throw;  
        }  
    }
```

```
    void SaveDocument(const std::string &filename) {  
        Doc->Save(filename);  
    }
```

```
    void LoadDocument(const std::string &filename) {  
        Doc = std::make_shared<Document>(filename);  
        Doc->Load(filename);  
    }
```

```

void Undo() {
    if (History.empty()) {
        throw std::logic_error("History is empty");
    }
    std::shared_ptr<Command> lastCommand = History.top();
    lastCommand->UnExecute();
    History.pop();
}

```

```

void PrintDocument() {
    Doc->Print();
}

```

```

bool DocumentExist() {
    return Doc != nullptr;
}

```

```

~Editor() = default;

```

```

private:
    std::shared_ptr<Document> Doc;
    std::stack<std::shared_ptr<Command>> History;
};

```

```

#endif //EDITOR_H

```

command.h:

```

#ifndef COMMAND_H
#define COMMAND_H 1

```

```

#include "document.h"
#include <stack>

```

```

class Command {
protected:
    std::shared_ptr<Document> Doc;
public:
    virtual void Execute() = 0;
    virtual void UnExecute() = 0;
    virtual ~Command() = default;

    void SetDocument(std::shared_ptr<Document> doc) {
        Doc = doc;
    }
};

```

```

class InsertCommand : public Command {
public:
    InsertCommand(FigureType type, std::pair<double, double> *vertices) :
        Type{type}, Vertices{vertices} {};

    void Execute() override {

```

```

        Doc->InsertPrimitive(Type, Vertices);
    }

    void UnExecute() override {
        Doc->RemoveLastPrimitive();
    }

private:
    FigureType Type;
    std::pair<double, double> *Vertices;
};

class RemoveCommand : public Command {
public:
    RemoveCommand(int id) : Id(id), Pos(0), figure(nullptr) {};

    void Execute() override {
        if (Id > Doc->Id || Id < 1 || (Id == Doc->Id && Id == 1)) {
            throw std::out_of_range("Invalid id");
        }
        figure = Doc->GetFigure(Id);
        Pos = Doc->GetPos(Id);
        Doc->RemovePrimitive(Id);
    }

    void UnExecute() override {
        Doc->InsertPrimitive(Pos, figure);
    }

private:
    int Id;
    int Pos;
    std::shared_ptr<Figure> figure;
};

#endif // COMMAND_H

```

document.h:

```

#ifndef DOCUMENT_H
#define DOCUMENT_H 1

#include <fstream>
#include <list>
#include <stdexcept>
#include <string>
#include <algorithm>

```



```

#include <utility>

#include "figures.h"

class Document {
public:
    Document() : Id(1), Name(""), Buffer(0), triangleFactory(),
                squareFactory(), rectangleFactory() {};

    Document(std::string name) : Id(1), Name(std::move(name)), Buffer(0),
                triangleFactory(), squareFactory(), rectangleFactory() {};

    ~Document() = default;

    void Rename(const std::string &newName) {
        Name = newName;
    }

    void Save(const std::string &filename) {
        SerializeImpl(filename);
    }

    void Load(const std::string &filename) {
        DeserializeImpl(filename);
    }

    void Print() {
        std::for_each(Buffer.begin(), Buffer.end(), [](std::shared_ptr<Figure>
                shape) {
            shape->Print(std::cout) << "\n";
        });
    }
}

```

```
void RemovePrimitive(int id) {  
    auto it = std::find_if(Buffer.begin(), Buffer.end(),  
        [id](std::shared_ptr<Figure> shape) -> bool {  
            return id == shape->getId();  
        });  
  
    if (it == Buffer.end()) {  
        throw std::logic_error("Figure with this id doesn't exist");  
    }  
  
    Buffer.erase(it);  
}  
  
void InsertPrimitive(FigureType type, std::pair<double, double> *  
                    vertices) {  
    switch (type) {  
        case TRIANGLE:  
            Buffer.push_back(triangleFactory.FigureCreate(vertices,  
                                                            Id++));  
            break;  
        case SQUARE:  
            Buffer.push_back(squareFactory.FigureCreate(vertices,  
                                                         Id++));  
            break;  
        case RECTANGLE:  
            Buffer.push_back(rectangleFactory.FigureCreate(vertices,  
                                                             Id++));  
            break;  
    }  
}
```

private:

int Id;

std::string Name;

std::list<std::shared_ptr<Figure>> Buffer;

TriangleFactory triangleFactory;

SquareFactory squareFactory;

RectangleFactory rectangleFactory;

friend class InsertCommand;

friend class RemoveCommand;

```
void Serializelmpl(const std::string &filename) const {
    std::ofstream os(filename, std::ios::binary | std::ios::out);
    if (!os) {
        throw std::runtime_error("File is not opened");
    }
    size_t nameLen = Name.size();
    os.write((char *) &nameLen, sizeof(nameLen));
    os.write((char *) Name.c_str(), nameLen);
    for (const auto &shape : Buffer) {
        shape->Serialize(os);
    }
}
```

```
void Deserializelmpl(const std::string &filename) {
    std::ifstream is(filename, std::ios::binary | std::ios::in);
    if (!is) {
        throw std::runtime_error("File is not opened");
    }
    size_t nameLen;
```

```

is.read((char *) &nameLen, sizeof(nameLen));

char *name = new char[nameLen + 1];

name[nameLen] = 0;

is.read(name, nameLen);

Name = std::string(name);

delete [] name;

FigureType type;

while (true) {

    is.read((char *) &type, sizeof(type));

    if (is.eof()) {

        break;

    }

    switch (type) {

        case TRIANGLE:

            Buffer.push_back(triangleFactory.FigureCreate());

            break;

        case SQUARE:

            Buffer.push_back(squareFactory.FigureCreate());

            break;

        case RECTANGLE:

            Buffer.push_back(rectangleFactory.FigureCreate());

            break;

    }

    Buffer.back()->Deserialize(is);

}

Id = Buffer.size();

}

```

```

std::shared_ptr<Figure> GetFigure(int id) {

    /*if (id > Id || id == 0) {

        throw std::runtime_error("Invalid id");

    }

```

```

    */
    auto it = std::find_if(Buffer.begin(), Buffer.end(),
        [id](std::shared_ptr<Figure> shape) -> bool {
            return id == shape->getId();
        });
    return *it;
}

```

```

int GetPos(int id) {
    auto it = std::find_if(Buffer.begin(), Buffer.end(),
        [id](std::shared_ptr<Figure> shape) -> bool {
            return id == shape->getId();
        });
    return std::distance(Buffer.begin(), it);
}

```

```

void InsertPrimitive(int pos, std::shared_ptr<Figure> figure) {
    auto it = Buffer.begin();
    std::advance(it, pos);
    Buffer.insert(it, figure);
}

```

```

void RemoveLastPrimitive() {
    if (Buffer.empty()) {
        throw std::logic_error("Document is empty");
    }
    Buffer.pop_back();
}

```

```

};

```

```

#endif //DOCUMENT_H

```

3. Ссылка на репозиторий на GitHub.

https://github.com/SergeiPetrin/OOP/tree/master/oop_exercise_07

4. Набор testcases.

test_01.test:

Menu
Create newDoc
Add T 0 0 0 1 1 1
Add S 0 0 1 1 0 1 1 0
Add R 2 2 0 0 0 2 2 0
Print
Remove 1
Print
Remove 2
Print
Remove 1
Print

test_02.test:

Create p
Add T -1 -1 0 0 0 -1
Add S 0 0 0 1 1 1 1 0
Add R 0 0 0 2 4 0 4 2
Print
Save newFile
Undo
Undo
Print
load
No
newFile

5. Результаты выполнения тестов.

Test_01.test:

Menu

Create

Load

Save <fileName>

Add <figureType>

Remove <figure ID>

Undo

Print

Document newDoc is created

Primitive is added

Primitive is added

Primitive is added

Id: 1

Figure: Triangle

Coords:

(0, 0)

(0, 1)

(1, 1)

Id: 2

Figure: Square

Coords:

(0, 0)

(0, 1)

(1, 1)

(1, 0)

Id: 3

Figure: Rectangle

Coords:

(2, 2)

(0, 2)

(0, 0)

(2, 0)

ERROR

Add primitive at id: 1

Id: 1

Figure: Triangle

Coords:

(0, 0)

(0, 1)

(1, 1)

Id: 2

Figure: Square

Coords:

(0, 0)

(0, 1)

(1, 1)

(1, 0)

Id: 3

Figure: Rectangle

Coords:

(2, 2)

(0, 2)

(0, 0)

(2, 0)

Add primitive at id: 2

Id: 1

Figure: Triangle

Coords:

(0, 0)

(0, 1)

(1, 1)

Id: 3

Figure: Rectangle

Coords:

(2, 2)

(0, 2)

(0, 0)

(2, 0)

ERROR

Add primitive at id: 1

Id: 1

Figure: Triangle

Coords:

(0, 0)

(0, 1)

(1, 1)

Id: 3

Figure: Rectangle

Coords:

(2, 2)

(0, 2)

(0, 0)

(2, 0)

test_02.txt:

Document p is created

Primitive is added

Primitive is added

Primitive is added

Id: 1

Figure: Triangle

Coords:

(-1, -1)

(0, 0)

(0, -1)

Id: 2

Figure: Square

Coords:

(0, 0)

(0, 1)

(1, 1)

(1, 0)

Id: 3

Figure: Rectangle

Coords:

(0, 2)

(0, 0)

(4, 0)

(4, 2)

Document save if file newFile

OK

OK

Id: 1

Figure: Triangle

Coords:

(-1, -1)

(0, 0)

(0, -1)

6. Объяснение результатов работы программы.

В проекте есть 6 файлов. Файл document.h, в котором реализован класс Document, содержащий следующие методы-члены:

- Конструкторы
- Деструктор
- Переименование
- Сохранение файла в бинарном виде
- Загрузка бинарного файла
- Добавление примитива в документ
- Удаление примитива из документа

И следующие переменные:

- Id документа. Нужен для удаления примитивов.
- Name. Имя документа.

- Buffer. Буфер для хранения указателей на фигуры.

Файл figures.h используется для представления фигур.

Файл factory.h необходим для создания графических примитивов.

Файл editor.h содержит основной функционал редактора.

Файл command.h содержит команды добавления и удаления.

Файл main.cpp основной файл, в котором находится функция main.

7. Вывод.

Выполняя данную лабораторную, я получил практические навыки в проектировании структуры классов приложения. На мой взгляд умение правильно проектировать классы приложения — это очень нужный навык, т. к. правильно структурированные классы, на мой взгляд, добавляют гибкости программе, её гораздо легче будет исправлять.