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

**Лабораторная работа  
по курсу «ООП»**

**Тема:  
Проектирование структур классов.**

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Дата:	

Москва  
2019

## 1. Код на C++:

command.cpp

```
#include "command.hpp"
```

```
void InsertCommand::UnExecute() {  
    doc_>RemoveLast();  
}
```

```
InsertCommand::InsertCommand(std::shared_ptr<document> &doc) {  
    doc_ = doc;  
}
```

```
DeleteCommand::DeleteCommand(std::shared_ptr<figure> &newFigure, uint32_t newIndex,  
std::shared_ptr<document> &doc) {  
    doc_ = doc;  
    figure_ = newFigure;  
    index_ = newIndex;  
}
```

```
void DeleteCommand::UnExecute() {  
    doc_>InsertIndex(figure_,index_);  
}
```

command.hpp

```
#ifndef OOP7_COMMAND_HPP
```

```
#define OOP7_COMMAND_HPP
```

```
#include "document.hpp"
```

```
struct Acommand {  
    virtual ~Acommand() = default;  
    virtual void UnExecute() = 0;
```

```
protected:
```

```
    std::shared_ptr<document> doc_;  
};
```

```

struct InsertCommand : public Acommand {
public:
    void UnExecute() override;

    InsertCommand(std::shared_ptr<document>& doc);
};

```

```

struct DeleteCommand : public Acommand {
public:
    DeleteCommand(std::shared_ptr<figure>& newFigure, uint32_t
newIndex, std::shared_ptr<document>& doc);
    void UnExecute() override;
private:
    std::shared_ptr<figure> figure_;
    uint32_t index_;
};
#endif

```

document.cpp

```
#include "document.hpp"
```

```

void document::Print() const {
    {
        if (buffer_.empty()) {
            std::cout << "Buffer is empty\n";
        }
        for (auto elem : buffer_) {
            elem->print(std::cout);
        }
    }
}

```

```

void document::Insert(std::shared_ptr<figure> &ptr) {
    buffer_.push_back(ptr);
}

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

void document::Save(const std::string &filename) const {
    std::ofstream fout;
    fout.open(filename);
    if (!fout.is_open()) {
        throw std::runtime_error("File is not opened\n");
    }
    fout << buffer_.size() << '\n';
    for (auto elem : buffer_) {
        elem->printFile(fout);
    }
}

void document::Load(const std::string &filename) {
    std::ifstream fin;
    fin.open(filename);
    if (!fin.is_open()) {
        throw std::runtime_error("File is not opened\n");
    }
    size_t size;
    fin >> size;
    buffer_.clear();
    for (int i = 0; i < size; ++i) {
        buffer_.push_back(factory_.FigureCreateFile(fin));
    }
}

```

```

    name_ = filename;
}

std::shared_ptr<figure> document::GetFigure(uint32_t index) {
    return buffer_[index];
}

void document::Erase(uint32_t index) {
    if ( index >= buffer_.size()) {
        throw std::logic_error("Out of bounds\n");
    }
    buffer_[index] = nullptr;
    for (; index < buffer_.size() - 1; ++index) {
        buffer_[index] = buffer_[index + 1];
    }
    buffer_.pop_back();
}

std::string document::GetName() {
    return this->name_;
}

size_t document::Size() {
    return buffer_.size();
}

void document::RemoveLast() {
    if (buffer_.empty()) {
        throw std::logic_error("Document is empty");
    }
    buffer_.pop_back();
}

```

```
void document::InsertIndex(std::shared_ptr<figure> &newFigure, uint32_t index) {  
    buffer_.insert(buffer_.begin() + index, newFigure);  
}
```

document.hpp

```
#ifndef OOP7_DOCUMENT_HPP  
#define OOP7_DOCUMENT_HPP
```

```
#include <fstream>  
#include <cstdint>  
#include <memory>  
#include <string>  
#include <algorithm>  
#include "figure.hpp"  
#include <vector>  
#include "factory.hpp"
```

```
struct document {
```

```
public:
```

```
    void Print() const ;
```

```
    document(std::string& newName): name_(newName), factory_(), buffer_(0) {};
```

```
    void Insert(std::shared_ptr<figure>& ptr);
```

```
    void Rename(const std::string& newName);
```

```
    void Save (const std::string& filename) const;
```

```
    void Load(const std::string& filename);
```

```

std::shared_ptr<figure> GetFigure(uint32_t index);

void Erase(uint32_t index);

std::string GetName();

size_t Size();

private:
    friend class InsertCommand;
    friend class DeleteCommand;
    factory factory_;
    std::string name_;
    std::vector<std::shared_ptr<figure>> buffer_;

    void RemoveLast();

    void InsertIndex(std::shared_ptr<figure>& newFigure, uint32_t index);
};

#endif

```

editor.cpp

```
#include "editor.hpp"
```

```

void editor::PrintDocument() {
    if (doc_ == nullptr) {
        std::cout << "No document!\n";
        return;
    }
}

```

```

    }
    doc_ ->Print();
}

void editor::CreateDocument(std::string &newName) {
    doc_ = std::make_shared<document>(newName);
}

bool editor::DocumentExist() {
    return doc_ != nullptr;
}

void editor::InsertInDocument(std::shared_ptr<figure> &newFigure) {
    if (doc_ == nullptr) {
        std::cout << "No document!\n";
        return;
    }
    std::shared_ptr<Acommand> command = std::shared_ptr<Acommand>(new
InsertCommand(doc_));
    doc_ ->Insert(newFigure);
    history_.push(command);
}

void editor::DeleteInDocument(uint32_t index) {
    if (doc_ == nullptr) {
        std::cout << "No document!\n";
        return;
    }
    if (index >= doc_ ->Size()) {
        std::cout << "Out of bounds\n";
        return;
    }
}

```



```

        std::shared_ptr<figure> tmp = doc_->GetFigure(index);

        std::shared_ptr<Acommand> command = std::shared_ptr<Acommand>(new
DeleteCommand(tmp,index,doc_));

        doc_->Erase(index);

        history_.push(command);
    }

```

```

void editor::SaveDocument() {
    if (doc_ == nullptr) {
        std::cout << "No document!\nNot ";
        return;
    }

    std::string saveName = doc_->GetName();
    doc_->Save(saveName);
}

```

```

void editor::LoadDocument(std::string &name) {
    try {
        doc_ = std::make_shared<document>(name);
        doc_->Load(name);
        while (!history_.empty()){
            history_.pop();
        }
    } catch(std::logic_error& e) {
        std::cout << e.what();
    }
}

```

```

void editor::Undo() {
    if (history_.empty()) {
        throw std::logic_error("History is empty\n");
    }
}

```

```

        std::shared_ptr<Acommand> lastCommand = history_.top();
        lastCommand->UnExecute();
        history_.pop();
    }

```

editor.hpp

```

#ifndef OOP7_EDITOR_HPP
#define OOP7_EDITOR_HPP

```

```

#include "figure.hpp"
#include "document.hpp"
#include <stack>
#include "command.hpp"

```

```

struct editor {
private:
    std::shared_ptr<document> doc_;
    std::stack<std::shared_ptr<Acommand>> history_;
public:
    ~editor() = default;

    void PrintDocument();

    void CreateDocument(std::string& newName);

    bool DocumentExist();

    editor() : doc_(nullptr), history_()
    {
    }
}

```

```

void InsertInDocument(std::shared_ptr<figure>& newFigure);

void DeleteInDocument(uint32_t index);

void SaveDocument();

void LoadDocument(std::string& name);

void Undo();

};

#endif
factory.cpp

#include "factory.hpp"
std::shared_ptr<figure> factory::FigureCreate(std::istream &is) {
    std::string name;
    is >> name;
    if ( name == "pentagon" ) {
        return std::shared_ptr<figure> ( new pentagon(is));
    } else if ( name == "hexagon" ) {
        return std::shared_ptr<figure> ( new hexagon(is));
    } else if ( name == "rhombus" ) {
        return std::shared_ptr<figure> ( new rhombus(is));
    } else {
        throw std::logic_error("There is no such figure\n");
    }
}

std::shared_ptr<figure> factory::FigureCreateFile(std::ifstream &is) {

```

```

std::string name;
is >> name;
if ( name == "pentagon" ) {
    return std::shared_ptr<figure> ( new pentagon(is));
} else if ( name == "hexagon" ) {
    return std::shared_ptr<figure> ( new hexagon(is));
} else if ( name == "rhombus" ) {
    return std::shared_ptr<figure> ( new rhombus(is));
} else {
    throw std::logic_error("There is no such figure\n");
}
}

```

factory.hpp

```

#ifndef OOP7_FACTORY_HPP
#define OOP7_FACTORY_HPP

#include <memory>
#include <iostream>
#include <fstream>
#include "hexagon.hpp"
#include "rhombus.hpp"
#include "pentagon.hpp"
#include <string>

struct factory {
    std::shared_ptr<figure> FigureCreate(std::istream& is);

    std::shared_ptr<figure> FigureCreateFile(std::ifstream& is);

};

```

```
#endif
```

figure.hpp

```
#ifndef OOP7_FIGURE_HPP
```

```
#define OOP7_FIGURE_HPP
```

```
#include <iostream>
```

```
#include "point.hpp"
```

```
#include <fstream>
```

```
struct figure {
```

```
    virtual point center() const = 0;
```

```
    virtual void print(std::ostream&) const = 0 ;
```

```
    virtual void printFile(std::ofstream&) const = 0 ;
```

```
    virtual double area() const = 0;
```

```
    virtual ~figure() = default;
```

```
};
```

```
#endif
```

hexagon.cpp

```
#include "hexagon.hpp"
```

```
point hexagon::center() const {
```

```
    double x,y;
```

```
    x = (a1.x + a2.x + a3.x + a4.x + a5.x + a6.x) / 6;
```

```
    y = (a1.y + a2.y + a3.y + a4.y + a5.y + a6.y) / 6;
```

```
    point p(x,y);
```

```
    return p;
```

```

}

void hexagon::print(std::ostream& os) const {
    os << "hexagon\n" << a1 << "\n" << a2 << "\n" << a3 << "\n" << a4 << "\n" << a5 << "\n" <<
a6 << "\n";
}

```

```

void hexagon::printFile(std::ofstream &of) const {
    of << "hexagon\n" << a1 << "\n" << a2 << "\n" << a3 << "\n" << a4 << "\n" << a5 << "\n" <<
a6 << "\n";
}

```

```

double hexagon::area() const {
    return (-0.5) * ((a1.x*a2.y + a2.x*a3.y + a3.x*a4.y + a4.x*a5.y + a5.x*a6.y + a6.x*a1.y) - (
a1.y*a2.x + a2.y*a3.x + a3.y*a4.x + a4.y*a5.x + a5.y*a6.x + a6.y*a1.x ));
}

```

```

hexagon::hexagon(std::istream& is) {
    is >> a1 >> a2 >> a3 >> a4 >> a5 >> a6;
}

```

```

hexagon::hexagon(std::ifstream& is) {
    is >> a1 >> a2 >> a3 >> a4 >> a5 >> a6;
}

```

hexagon.hpp

```

#ifndef D_HEXAGON_HPP_
#define D_HEXAGON_HPP_

```

```

#include <iostream>
#include "figure.hpp"

```

```

struct hexagon : figure

```

```

{
    point center() const override ;
    void print(std::ostream&) const override ;
    void printFile(std::ofstream&) const override ;
    double area() const override ;
    hexagon() = default;
    hexagon(std::istream& is);
    hexagon(std::ifstream& is);
private:
    point a1, a2, a3, a4, a5, a6;
};

```

```

#endif

```

main.cpp

```

#include <iostream>
#include "factory.hpp"
#include "editor.hpp"

void help() {
    std::cout << "1 - help\n"
                "2 - создать\n"
                "3 - загрузить\n"
                "4 - сохранить\n"
                "5 - добавить фигуру\n"
                "6 - удалить\n"
                "7 - печать\n"
                "8 - назад\n"
                "0 - выход\n";
}

```

```
void create(editor& edit) {  
    std::string tmp;  
    std::cout << "Введите название нового документа\n";  
    std::cin >> tmp;  
    edit.CreateDocument(tmp);  
    std::cout << "Документ создан\n";  
}
```

```
void load(editor& edit) {  
    std::string tmp;  
    std::cout << "Введите название файла\n";  
    std::cin >> tmp;  
    try {  
        edit.LoadDocument(tmp);  
        std::cout << "Документ загружен\n";  
    } catch (std::runtime_error& e) {  
        std::cout << e.what();  
    }  
}
```

```
void save(editor& edit) {  
    std::string tmp;  
    try {  
        edit.SaveDocument();  
        std::cout << "Документ сохранен\n";  
    } catch (std::runtime_error& e) {  
        std::cout << e.what();  
    }  
}
```

```
void add(editor& edit) {
```



```

factory fac;

try {
    std::shared_ptr<figure> newElem = fac.FigureCreate(std::cin);
    edit.InsertInDocument(newElem);
} catch (std::logic_error& e) {
    std::cout << e.what() << '\n';
}

std::cout << "Ok\n";
}

void remove(editor& edit) {
    uint32_t index;

    std::cout << "Введите индекс фигуры которую хотите удалить\n";
    std::cin >> index;

    try {
        edit.DeleteInDocument(index);
        std::cout << "Ok\n";
    } catch (std::logic_error& err) {
        std::cout << err.what() << "\n";
    }
}

int main() {
    editor edit;

    int command;

    std::cout << "1 - help" << "\n"
        << "2 - создать файл" << "\n"
        << "3 - загрузить" << "\n"
        << "4 - сохранить" << "\n"
        << "5 - добавить фигуру" << "\n"
        << "6 - удалить фигуру из файла" << "\n"
        << "7 - печать" << "\n"

```

```

        << "8 - назад" << "\n"

        << "0 - выход" << "\n";
while (true) {
    std::cin >> command;
    if (command == 1) {
        help();
    } else if (command == 2) {
        create(edit);
    } else if (command == 3) {
        load(edit);
    } else if (command == 4) {
        save(edit);
    } else if (command == 0) {
        break;
    } else if (command == 5) {
        add(edit);
    } else if (command == 6) {
        remove(edit);
    } else if (command == 7) {
        edit.PrintDocument();
    } else if (command == 8) {
        try {
            edit.Undo();
        } catch (std::logic_error& e) {
            std::cout << e.what();
        }
    } else {
        std::cout << "ERROR\n";
    }
}
return 0;
}

```

pentagon.cpp

```
#include "pentagon.hpp"
```

```
#include <cmath>
```

```
#include "point.hpp"
```

```
point pentagon::center() const {
```

```
    double x,y;
```

```
    x = (a1.x + a2.x + a3.x + a4.x + a5.x) / 5;
```

```
    y = (a1.y + a2.y + a3.y + a4.y + a5.y) / 5;
```

```
    point p(x,y);
```

```
    return p;
```

```
}
```

```
void pentagon::print(std::ostream& os) const {
```

```
    os << "pentagon\n" << a1 << "\n" << a2 << "\n" << a3 << "\n" << a4 << "\n" << a5 << '\n';
```

```
}
```

```
void pentagon::printFile(std::ofstream& of) const {
```

```
    of << "pentagon\n" << a1 << "\n" << a2 << "\n" << a3 << "\n" << a4 << "\n" << a5 << '\n';
```

```
}
```

```
double pentagon::area() const {
```

```
    return (-0.5) * ((a1.x*a2.y + a2.x*a3.y + a3.x*a4.y + a4.x*a5.y + a5.x*a1.y) - ( a1.y*a2.x + a2.y*a3.x + a3.y*a4.x + a4.y*a5.x + a5.y*a1.x ));
```

```
}
```

```
pentagon::pentagon(std::istream& is) {
```

```
    is >> a1 >> a2 >> a3 >> a4 >> a5;
```

```
}
```

```
pentagon::pentagon(std::ifstream& is) {  
    is >> a1 >> a2 >> a3 >> a4 >> a5;  
}
```

pentagon.hpp

```
#ifndef OOP_PENTAGON_HPP  
#define OOP_PENTAGON_HPP
```

```
#include "figure.hpp"
```

```
struct pentagon : figure{  
private:  
    point a1,a2,a3,a4,a5;  
public:  
    point center() const override;  
    void print(std::ostream&) const override;  
    void printFile(std::ofstream&) const override;  
    double area() const override;  
    pentagon() = default;  
    pentagon(std::istream& is);  
    pentagon(std::ifstream& is);  
};
```

```
#endif
```

point.cpp

```
#include "point.hpp"
```

```
std::istream& operator >> (std::istream& is,point& p ) {
```

```
    return is >> p.x >> p.y;
}
```

```
std::ostream& operator << (std::ostream& os,const point& p) {
    return os << p.x << ' ' << p.y;
}
```

point.hpp

```
#ifndef OOP7_POINT_H
#define OOP7_POINT_H
```

```
#include <iostream>
```

```
struct point {
    double x, y;
    point (double a,double b) { x = a, y = b;};
    point() = default;
};
```

```
std::istream& operator >> (std::istream& is,point& p );
std::ostream& operator << (std::ostream& os,const point& p);
```

```
#endif
```

rhombus.cpp

```
#include <iostream>
#include <cmath>
```

```
#include "rhombus.hpp"
```

```

rhombus::rhombus(std::istream& is) {
    is >> a1 >> a2 >> a3 >> a4;
    double str1, str2, str3, str4;
    str1 = sqrt((a1.x - a2.x) * (a1.x - a2.x) + (a1.y - a2.y) * (a1.y - a2.y));
    str2 = sqrt((a2.x - a3.x) * (a2.x - a3.x) + (a2.y - a3.y) * (a2.y - a3.y));
    str3 = sqrt((a3.x - a4.x) * (a3.x - a4.x) + (a3.y - a4.y) * (a3.y - a4.y));
    str4 = sqrt((a4.x - a1.x) * (a4.x - a1.x) + (a4.y - a1.y) * (a4.y - a1.y));
    if (str1 != str2 || str2 != str3 || str3 != str4) {
        throw std::logic_error("Is not rhombus");
    }
}

rhombus::rhombus(const point& a1, const point& a2, const point& a3, const point& a4) {
    double str1, str2, str3, str4;
    str1 = sqrt((a1.x - a2.x) * (a1.x - a2.x) + (a1.y - a2.y) * (a1.y - a2.y));
    str2 = sqrt((a2.x - a3.x) * (a2.x - a3.x) + (a2.y - a3.y) * (a2.y - a3.y));
    str3 = sqrt((a3.x - a4.x) * (a3.x - a4.x) + (a3.y - a4.y) * (a3.y - a4.y));
    str4 = sqrt((a4.x - a1.x) * (a4.x - a1.x) + (a4.y - a1.y) * (a4.y - a1.y));
    if (str1 != str2 || str2 != str3 || str3 != str4) {
        throw std::logic_error("Is not rhombus");
    }
}

point rhombus::center() const {
    double x, y;
    x = (a1.x + a2.x + a3.x + a4.x) / 4;
    y = (a1.y + a2.y + a3.y + a4.y) / 4;
    point p(x, y);
    return p;
}

void rhombus::print(std::ostream& os) const {

```

```

        os << "rhombus\n" << a1 << "\n" << a2 << "\n" << a3 << "\n" << a4 << '\n';
    }

double rhombus::area() const {
    point v_1;
    v_1.x = a1.x - a3.x;
    v_1.y = a1.y - a3.y;
    point v_2;
    v_2.x = a2.x - a4.x;
    v_2.y = a2.y - a4.y;
    double result = 0.5 * (sqrt(v_1.x * v_1.x + v_1.y * v_1.y) * sqrt(v_2.x * v_2.x + v_2.y *
v_2.y));
    return result;
}

```

```

void rhombus::printFile(std::ofstream &of) const {
    of << "rhombus\n" << a1 << "\n" << a2 << "\n" << a3 << "\n" << a4 << '\n';
}

```

```

rhombus::rhombus(std::ifstream& is) {
    is >> a1 >> a2 >> a3 >> a4;
}

```

rhombus.hpp

```

#ifndef D_RHOMBUS_HPP_
#define D_RHOMBUS_HPP_ 1

```

```

#include <iostream>
#include "figure.hpp"

```

```

struct rhombus : figure

```

```

{
    rhombus(std::istream& is);
    rhombus(const point& a1, const point& a2, const point& a3, const point& a4);
    rhombus() = default;
    rhombus(std::ifstream& is);

    point center() const override;
    void print(std::ostream& os) const override;
    void printFile(std::ofstream&) const override ;
    double area() const override;
private:
    point a1, a2, a3, a4;
};

#endif

```

## 2. Ссылка на репозиторий в GitHub:

[https://github.com/keoni02032/oop\\_exercise\\_07](https://github.com/keoni02032/oop_exercise_07)

## 3. Набор testcases:

test\_01.test

```

2
kek.txt
5
rhombus
1 1 1 1 1 1 1
5
pentagon
1 1 2 2 3 3 4 4 5 5
5
hexagon
1 1 2 2 3 3 4 4 5 5 6 6
4
8
8
8

```



8  
0

test\_02.test

3  
kek.txt  
7  
5  
pentagon  
1 1 2 2 3 3 4 4 5 5  
5  
hexagon  
1 1 2 2 3 3 4 4 5 5 6 6  
7  
4  
8  
8  
8  
7  
0

#### 4.Результаты выполнения программы:

test\_01.result

1 - help  
2 - создать файл  
3 - загрузить  
4 - сохранить  
5 - добавить фигуру  
6 - удалить фигуру из файла  
7 - печать  
8 - назад  
0 - выход  
2  
Введите название нового документа  
kek.txt  
Документ создан  
5  
rhombus  
1 1 1 1 1 1 1  
Ok  
5  
pentagon  
1 1 2 2 3 3 4 4 5 5

Ok  
5  
hexagon  
1 1 2 2 3 3 4 4 5 5 6 6  
Ok  
4  
Документ сохранен  
8  
8  
8  
8  
History is empty  
0

test\_02.result

1 - help  
2 - создать файл  
3 - загрузить  
4 - сохранить  
5 - добавить фигуру  
6 - удалить фигуру из файла  
7 - печать  
8 - назад  
0 - ВЫХОД  
3  
Введите название файла  
kek.txt  
There is no such figure  
Документ загружен  
7  
Buffer is empty  
5  
pentagon  
1 1 2 2 3 3 4 4 5 5  
Ok  
5  
hexagon  
1 1 2 2 3 3 4 4 5 5 6 6  
Ok  
7  
a1 = 1 1 a2 = 2 2 a3 = 3 3 a4 = 4 4 a5 = 5 5  
a1 = 1 1 a2 = 2 2 a3 = 3 3 a4 = 4 4 a5 = 5 5 a6 = 6 6  
4  
Документ сохранен  
8  
8  
8  
History is empty  
7

**Buffer is empty**

**6**

**Введите индекс фигуры которую хотите удалить**

**0**

**Out of bounds**

**Ok**

**0**

## **5. Объяснение результатов работы программы:**

При вводе команды «2» – происходит создание файла, «1» – команда помощи по вводу команд, «3» – загрузить уже созданный файл, «4» – сохранить введенные фигуры, «5» – добавление фигуры (по заданию необходимо ввести одну из следующих фигур: «rhombus», «pentagon», «hexagon»), «6» – удаление фигуры из файла по индексу, «7» – напечатать все фигуры которые находятся в данный момент в буфере, «8» – откатить программу на одно действие, «0» – выход из программы.

## **6. Вывод:**

В данной лабораторной работе, я получил хороший опыт работы в проектировании структуры классов приложения. Реализовал выгрузку и загрузку в файл.