Московский Авиационный Институт (Национальный исследовательский Университет)

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

Лабораторная работа по курсу «ООП»

Тема: Асинхронное программирование.

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Вариант:	22
Оценка:	
Дата:	

Москва 2019

```
1.Код на С++:
point.h:
#ifndef D_POINT_H_
#define D_POINT_H_
#include <iostream>
struct point{
    double x,y;
};
std::istream& operator>>(std::istream& is, point& p);
std::ostream& operator<<(std::ostream& os,const point& p);</pre>
point operator+(point x1,point x2);
point& operator/= (point& x1, int number);
#endif
point.cpp:
#include <iostream>
#include "point.h"
std::istream& operator>> (std::istream& is, point& p) {
    is >> p.x >>p.y;
    return is;
std::ostream& operator<< (std::ostream& os, const point& p) {</pre>
    os << p.x << " " << p.y;
    return os;
point operator+(point x1,point x2) {
    point x3;
    x3.x=x1.x+x2.x;
    x3.y=x1.y+x2.y;
    return x3;
point& operator/= (point& x1, int number) {
    x1.x=x1.x/number;
    x1.y=x1.y/number;
   return x1;
}
figure.h:
#ifndef D FIGURE H
#define D_FIGURE_H_
#include <iostream>
#include "point.h"
struct figure{
    virtual point center() const = 0;
    virtual void print(std::ostream &os) const = 0;
    virtual void help print(std::ostream &os) const = 0;
    virtual double square() const = 0;
    virtual ~figure() {};
};
```

```
five_angles.h:
#ifndef D FIVE ANGLES H
#define D FIVE ANGLES H
#include <iostream>
#include "figure.h"
struct five angles : figure{
    five angles(std::istream &is);
    point center() const override;
    void print(std::ostream &os) const override;
    void help_print(std::ostream &os) const override;
    double square() const override;
private:
point one, two, three, four, five;
};
#endif
five_angles.cpp:
#include <iostream>
#include "five_angles.h"
five angles::five angles(std::istream &is) {
    is >> one >> two >> three >> four >> five;
point five angles::center() const {
   point p;
   p=one+two+three+four+five;
   p/=5;
    return p;
}
void five_angles::print(std::ostream &os) const {
   os << one << " " << two << " " << three << " " << four << " " << five
<<"\n";
}
void five angles::help print(std::ostream &os) const {
   os << "five angles" << one << " " << two << " " << three << " " << four
<< " " << five <<"\n";
double five_angles::square() const {
    double s=0;
    s = (one.x*two.y+two.x*three.y+three.x*four.y+four.x*five.y+five.x*one.y-
two.x*one.y-
            three.x*two.y-four.x*three.y-five.x*four.y-one.x*five.y)/2;
    if(s<0){
        return -s;
    }else {
        return s;
}
```

```
six_angles.h:
#ifndef D SIX ANGLES H
#define D SIX ANGLES H
#include <iostream>
#include "figure.h"
struct six angles : figure{
    six angles(std::istream &is);
    point center() const override;
    void print(std::ostream &os) const override;
    void help_print(std::ostream &os) const override;
    double square() const override;
private:
    point one, two, three, four, five, six;
};
#endif
six_angles.cpp:
#include <iostream>
#include "six_angles.h"
six angles::six angles(std::istream &is){
   is >> one >> two >> three >> four >> five >>six;
point six angles::center() const {
   point p;
   p=one+two+three+four+five+six;
   p/=6;
   return p;
}
void six angles::print(std::ostream &os) const {
   os << one << " " << two << " " << three << " " << four << " " << five <<
" " << six <<"\n";
void six angles::help print(std::ostream &os) const {
  os <<"six angles " << one << " " << two << " " << three << " " << four <<
" " << five << " " << six <<"\n";
double six angles::square() const {
    double s=0;
s = (\texttt{one.x*two.y+two.x*three.y+three.x*four.y+four.x*five.y+five.x*six.y+six.x*})
one.y-two.x*one.y-
       \verb|three.x*two.y-four.x*three.y-five.x*four.y-six.x*five.y-|\\
one.x*six.y)/2;
    if(s<0){
        return -s;
    }else {
        return s;
}
```

```
eight_angles.h:
#ifndef D EIGHT ANGLES H
#define D EIGHT ANGLES H
#include <iostream>
#include "figure.h"
struct eight angles : figure{
    eight angles(std::istream &is);
    point center() const override;
    void print(std::ostream &os) const override;
    void help print(std::ostream &os) const override;
    double square() const override;
private:
    point one, two, three, four, five, six, seven, eight;
};
#endif
eight_angles.cpp:
#include <iostream>
#include "eight angles.h"
eight angles::eight angles(std::istream &is) {
    is >> one >> two >> three >> four >> five >>six >>seven >>eight;
point eight angles::center() const {
    point p;
    p=one+two+three+four+five+six+seven+eight;
    p/=8;
    return p;
void eight angles::print(std::ostream &os) const {
   os << one << " " << two << " " << three << " " << four << " " << five <<
" " << six << " " << seven
    << " " << eight<<"\n";
void eight_angles::help_print(std::ostream &os) const {
   os <<"eight angles " << one << " " << two << " " << three << " " << four</pre>
<< " " << five << " " << six << " " << seven
      << " " << eight<<"\n";
}
double eight angles::square() const {
    double s=0;
s=(one.x*two.y+two.x*three.y+three.x*four.y+four.x*five.y+five.x*six.y+six.x*
seven.y+seven.x*eight.y+
            eight.x*one.y-two.x*one.y-three.x*two.y-four.x*three.y-
five.x*four.y-six.x*five.y-seven.x*six.y
             -eight.x*seven.y-one.x*eight.y)/2;
    if(s<0){
        return -s;
    }else {
        return s;
```

```
}
}
processor.h:
#ifndef D PROCESSOR H
#define D_PROCESSOR_H_
#include <iostream>
#include <memory>
#include <vector>
#include <fstream>
struct processor {
    virtual void process(const std::vector<std::unique ptr<figure>> &data)
const = 0;
};
struct screen writer : processor {
    void process(const std::vector<std::unique ptr<figure>> &data) const {
        for (size t i=0;i<data.size();++i) {</pre>
            data[i]->print(std::cout);
    }
};
struct file writer : processor {
    void process(const std::vector<std::unique ptr<figure>> &data) const {
        std::ofstream os(std::to string(file id)+".txt");
        file id += 1;
        for (size t i=0;i<data.size();++i) {</pre>
            data[i]->help print(os);
    mutable int file_id = 0;
};
#endif
executor.h:
#ifndef D_EXECUTOR_H_
#define D EXECUTOR H
#include <iostream>
#include <vector>
#include <memory>
#include <thread>
#include <mutex>
#include <condition variable>
#include "figure.h"
#include "processor.h"
inline std::mutex mut;
inline std::condition variable con;
struct exec{
    exec(){
        screen writer pp1;
        file writer pp2;
```

```
std::unique ptr<screen writer>
p1=std::make unique<screen writer>(pp1);
        std::unique ptr<file writer> p2=std::make unique<file writer>(pp2);
        processors.push back(std::move(p1));
        processors.push back(std::move(p2));
    }
    void exec set(std::vector<std::unique ptr<figure>> data);
    static void worker(exec* one);
    std::thread work{worker,this};
    bool working=false;
    bool doing=false;
private:
    std::vector<std::unique ptr<figure>> data;
    std::vector<std::unique ptr<pre>processor>> processors;
#endif
executor.cpp:
#include <iostream>
#include "executor.h"
void exec::worker(exec *one){
  while(!one->working) {
    std::unique_lock<std::mutex> lock(mut);
    con.wait(lock);
    if(one->doing) {
      std::cout << "\n";
      for (size_t i = 0; i < one->processors.size(); ++i) {
        one->processors[i]->process(one->data);
      con.notify_one();
  }
}
void exec::exec_set(std::vector<std::unique_ptr<figure>> data1){
  data=std::move(data1);
main.cpp:
#include <iostream>
#include "five_angles.h"
#include "six_angles.h"
#include "eight_angles.h"
#include "processor.h"
#include <vector>
#include <string>
#include <thread>
#include <fstream>
#include <memory>
#include <mutex>
```

```
#include <condition variable>
#include "executor.h"
int main(int argc, char *argv[]) {
    if (argc != 2) {
        std::cerr << "ERROR" << "\n";</pre>
        return 1;
    size t buffer size = (size t)std::stoi(argv[1]);
    std::vector<std::unique ptr<figure>> buffer;
   buffer.reserve(buffer size);
    exec make;
    std::unique ptr<figure> value;
    std::string figures;
    while (std::cin >> figures) {
        std::unique lock<std::mutex> lock(mut);
        if(figures == "five angles"){
            std::unique ptr<figure> new figure;
            new figure=std::make unique<five angles>(five angles(std::cin));
            buffer.push back(std::move(new figure));
        }else if(figures == "six angles") {
            std::unique ptr<figure> new figure;
            new figure=std::make unique<six angles>( six angles(std::cin));
            buffer.push back(std::move(new figure));
        }else if(figures == "eight angles"){
            std::unique ptr<figure> new figure;
            new figure=std::make unique<eight angles>(
eight angles(std::cin));
            buffer.push back(std::move(new figure));
        make.doing= true;
        if (buffer.size() != buffer size) {
            continue;
        }else {
            make.exec_set(std::move(buffer));
            con.notify one();
            buffer.clear();
        }
   make.doing= false;
   make.working = true;
    con.notify one();
   make.work.join();
    return 0;
```

2. Ссылка на репозиторий в GitHub:

https://github.com/Suvorova-Sofya/oop_exercise_08

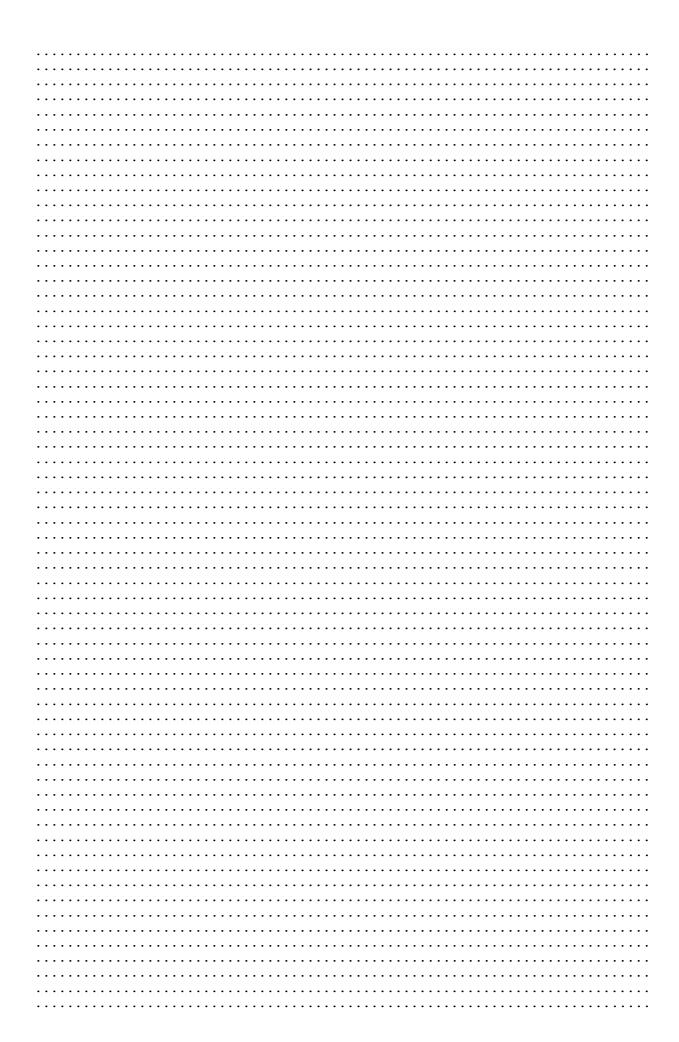
3. Habop testcases:

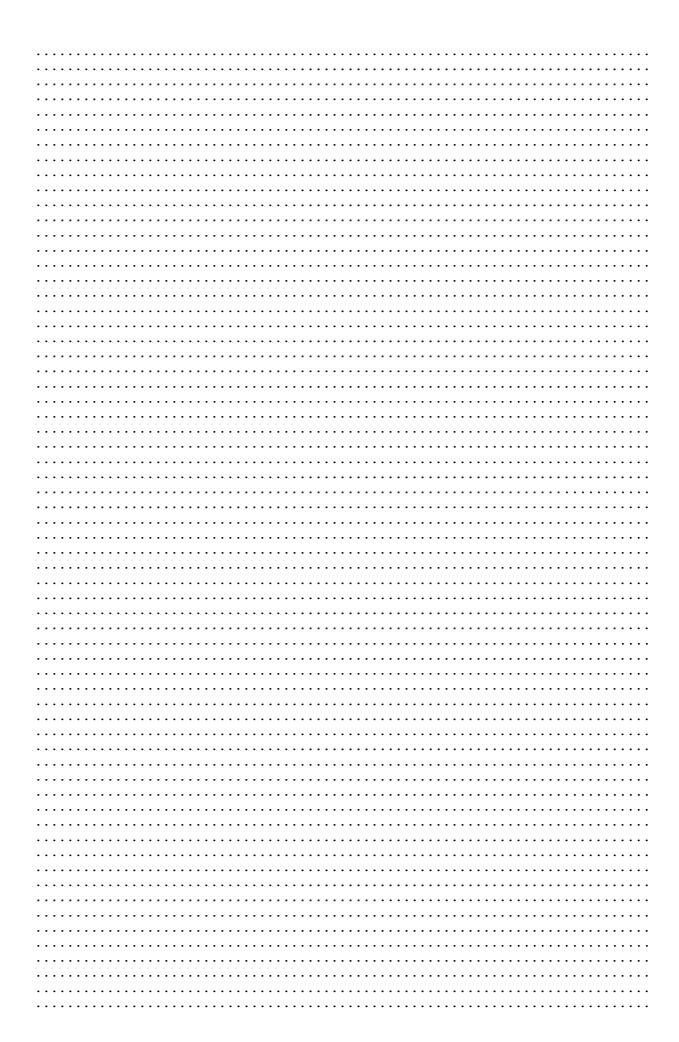
test1:

```
test2:
```

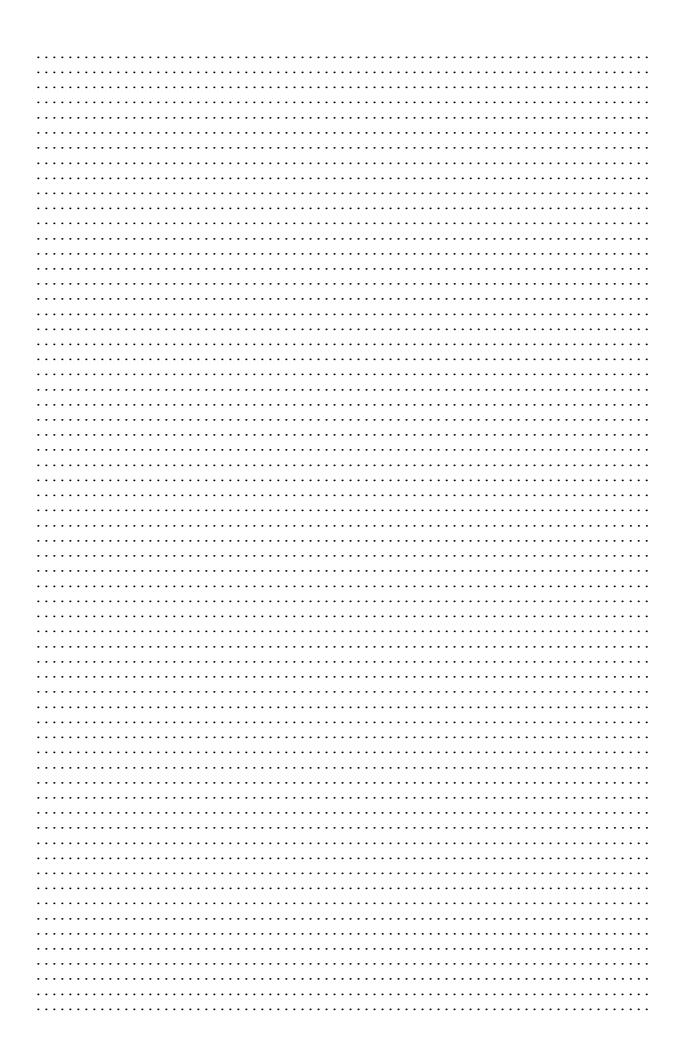
```
five angles 1 1 2 2 3 3 4 4 5 5
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five_angles 1 1 2 2 3 3 4 4 5 5
five angles 1 1 2 2 3 3 4 4 5 5
five angles 1 1 2 2 3 3 4 4 5 5
```

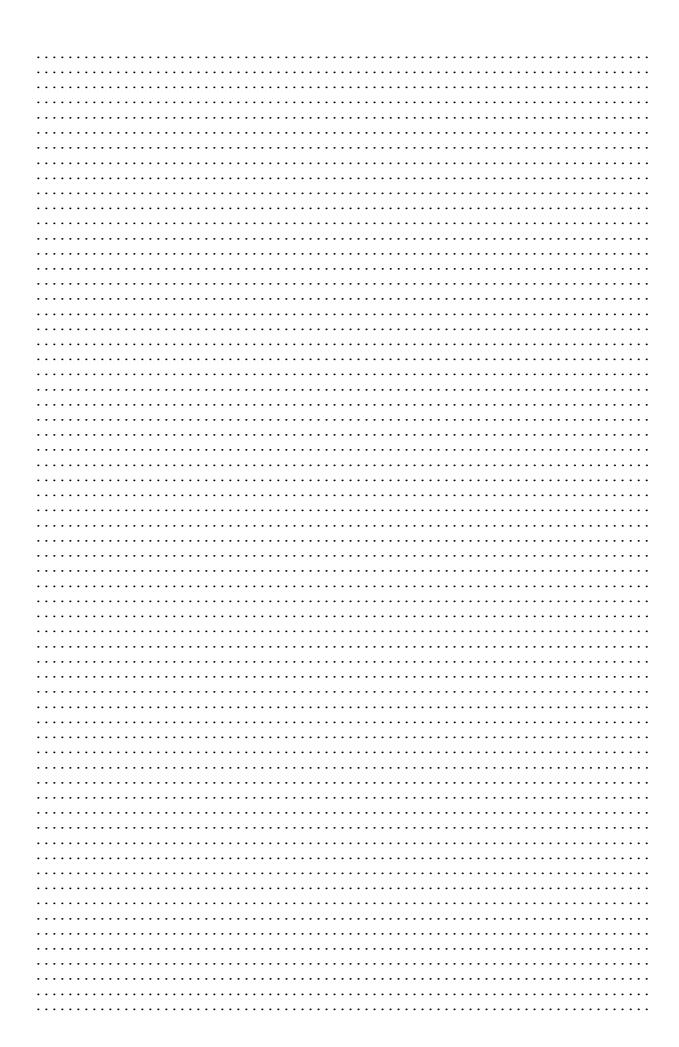
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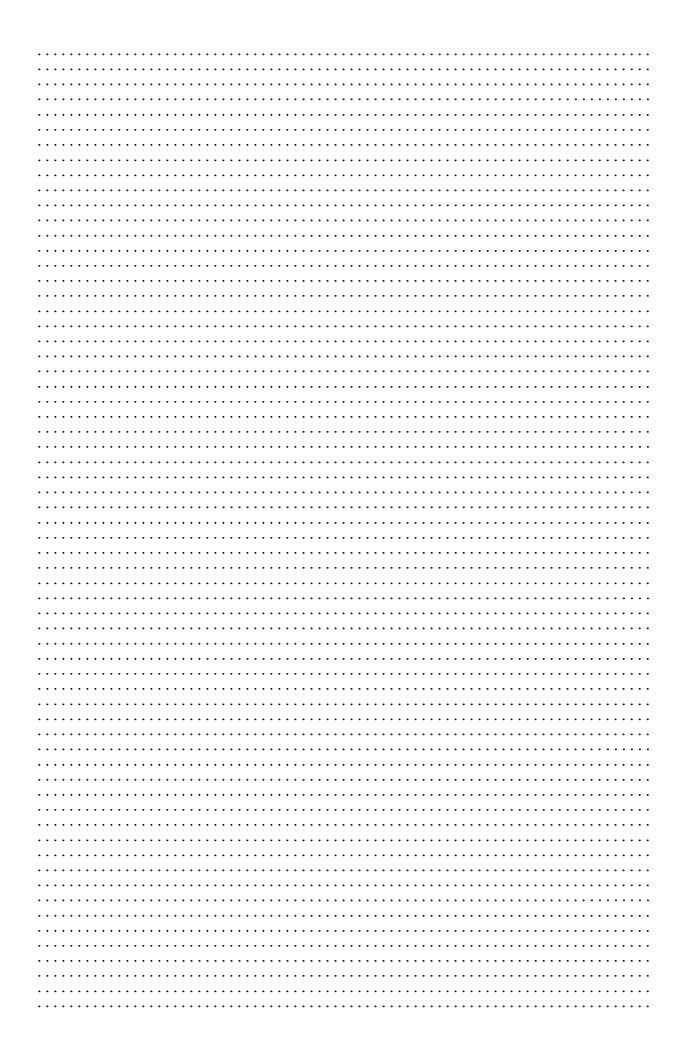


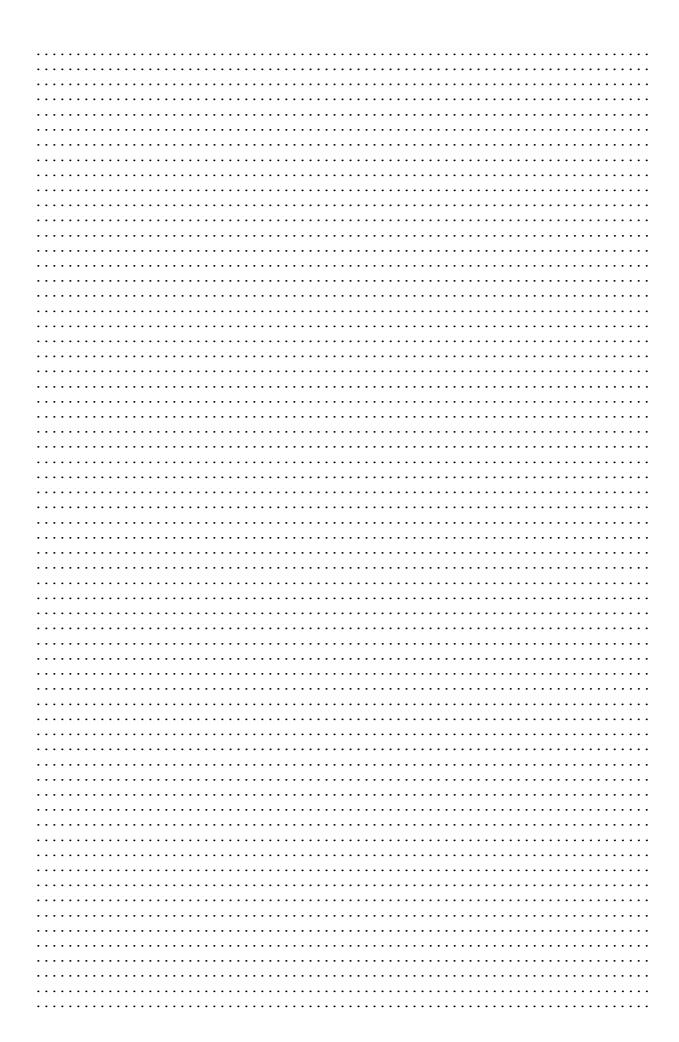


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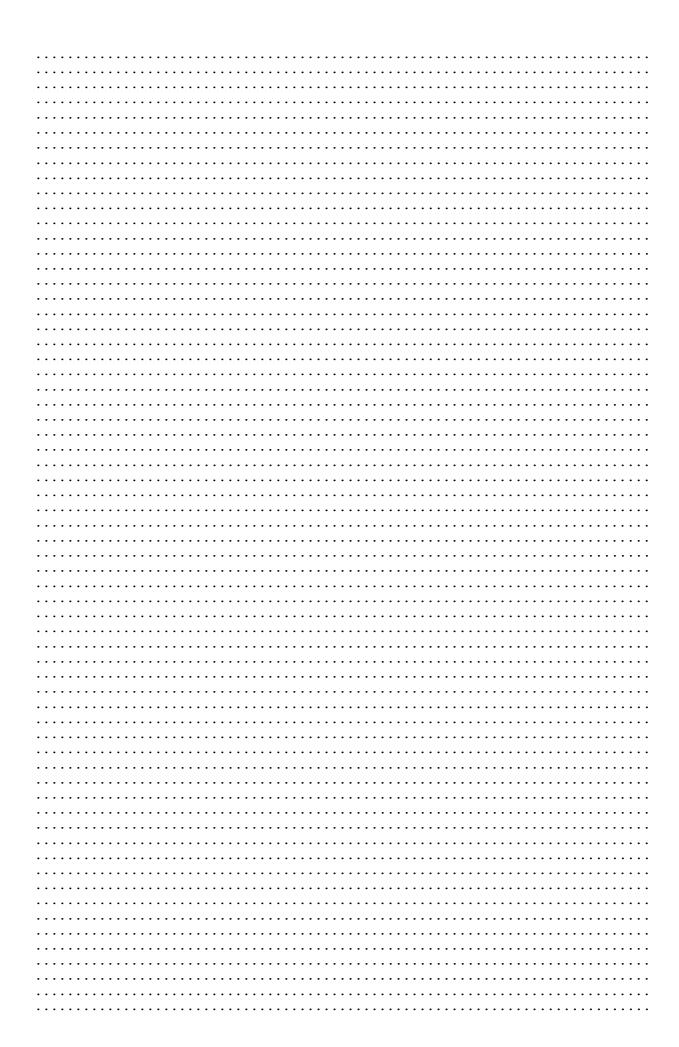


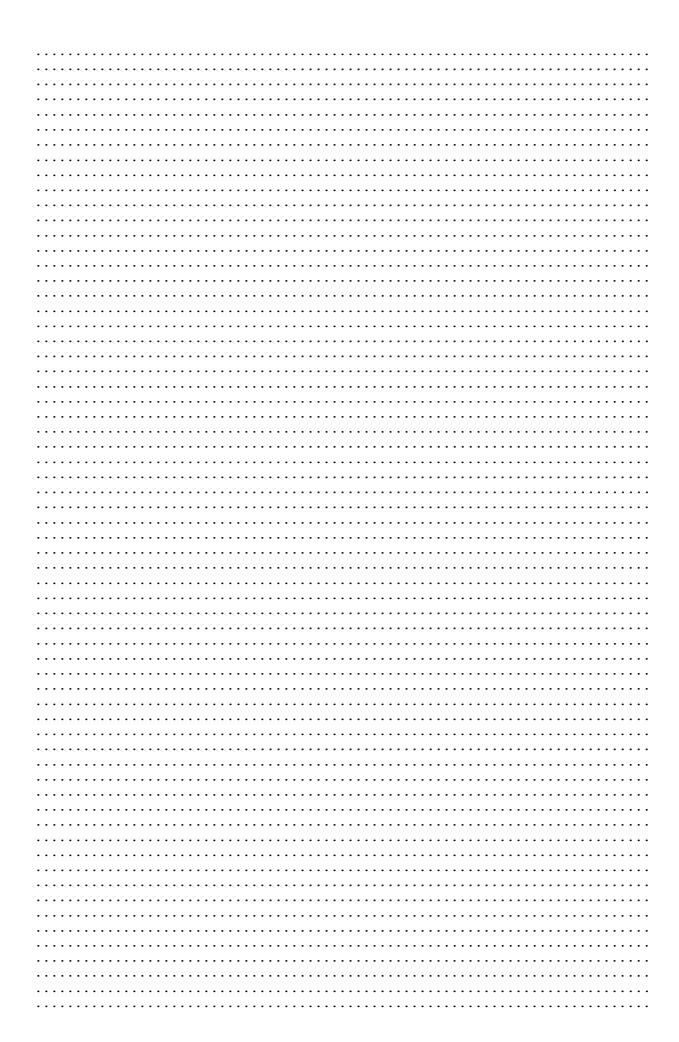


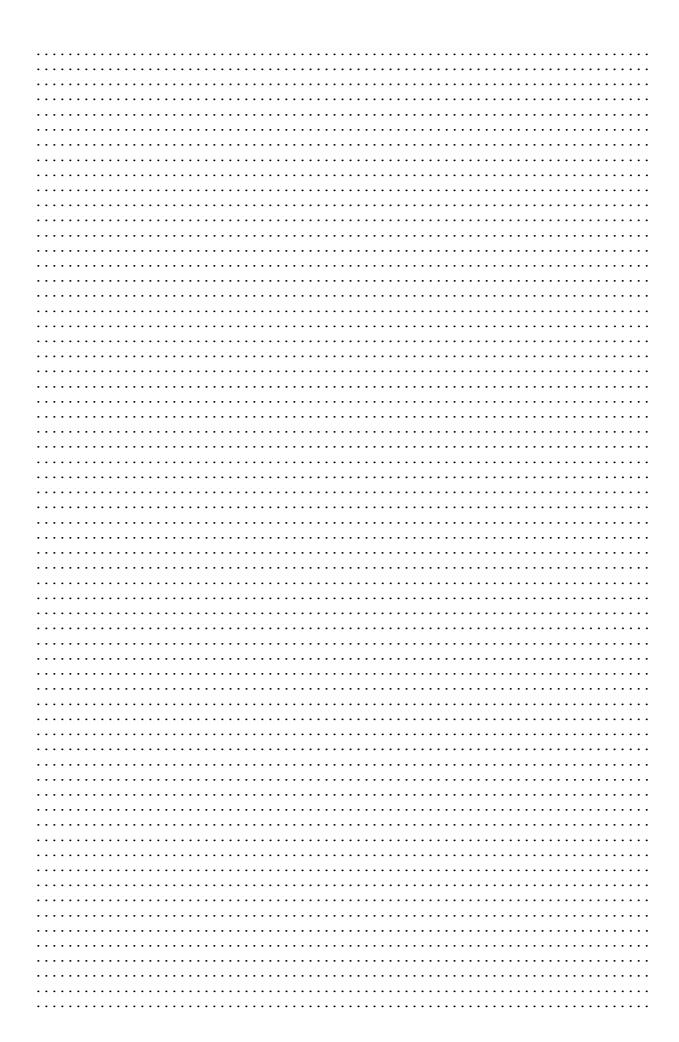




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5. Объяснение результатов работы программы:

Пользователь вводит фигуры и их координаты. Когда буфер будет заполнен данными фигурами, запустится обработчик, выполняющийся в отдельном потоке, который выведет всё содержимое буфера на экран и в файл.

6.Вывод:

В данной программе показывается ,каким образом можно производить асинхронную обработку данных, используя потоки, для уменьшения времени работы программы.