

Московский Авиационный Институт  
(Национальный исследовательский Университет)

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

**Лабораторная работа  
по курсу «ООП»**

**Тема:  
Операторы, литералы.**

Студент:	Касимов М.М.
Группа:	М80-206Б-18
Преподаватель:	Журавлев А.А.
Вариант:	6
Оценка:	
Дата:	

Москва  
2019

## 1. Код программы на языке C++:

**bits.h:**

```
//  
// Created by magom on 17.09.2019.  
//  
  
#ifndef OOP_EXERCISE_02_BITS_H  
#define OOP_EXERCISE_02_BITS_H  
  
#include <iostream>  
#include <string>  
#include <vector>  
  
class bit {  
private:  
    unsigned long long a;  
    unsigned int b;  
public:  
    bit();  
  
    bit(unsigned long long a1, unsigned int b1) {  
        a = a1;  
        b = b1;  
    };  
  
    void ShiftLeft(int i);  
  
    void ShiftRight(int i);  
  
    int Inclusion(const bit &other) const;  
  
    void Get(unsigned long long i, unsigned int j);  
  
    unsigned long long Hight() const;  
  
    unsigned int Low() const;  
  
    bit operator&(const bit &other) const;  
  
    bit operator|(const bit &other) const;  
  
    bit operator^(const bit &other) const;  
  
    bit operator~() const;  
  
    int operator<=(const bit &other) const;  
  
    int operator>=(const bit &other) const;
```

```

int operator==(const bit &other) const;

int operator<(const bit &other) const;

int operator>(const bit &other) const;

friend std::ostream &operator<<(std::ostream &os, const bit &other);

friend std::istream &operator>>(std::istream &is, bit &other);
};

```

```

#endif //OOP_EXERCISE_02_BITS_H

```

**bits.cpp:**

```

//
// Created by magom on 17.09.2019.
//

```

```

#include "bits.h"
#include <sstream>
int number(unsigned long long m) {
    int i = 0;
    while (m > 0) {
        i += m % 2;
        m = m / 2;
    }
    return i;
}

```

```

void to2(unsigned long long a, std::ostream &os, int *Count, bool flag) {
    if (a == 0)
        return;
    if (a % 2 == 1 && flag) {
        *Count += 1;
        flag = false;
    }
    to2(a / 2, os, Count, flag);
    std::cout << a % 2;
}

```

```

void Count0(unsigned long long a, std::ostream &os, int *Count, bool flag) {
    if (a == 0)
        return;
    Count0(a / 2, os, Count, flag);
    *Count+=1;
}

```

```

bit bit::operator&(const bit &other) const {
    unsigned long long temp_a = a & other.Hight();
    unsigned int temp_b = b & other.Low();
    bit temp(temp_a, temp_b);
    return temp;
}

```

```
}
```

```
bit bit::operator|(const bit &other) const {  
    unsigned long long temp_a = a | other.Hight();  
    unsigned int temp_b = b | other.Low();  
    bit temp(temp_a, temp_b);  
    return temp;  
}
```

```
bit bit::operator^(const bit &other) const {  
    unsigned long long temp_a = a ^ other.Hight();  
    unsigned int temp_b = b ^ other.Low();  
    bit temp(temp_a, temp_b);  
    return temp;  
}
```

```
bit bit::operator~() const {  
    bit other(~a, ~b);  
    return other;  
}
```

```
void bit::ShiftLeft(int i) {  
    int k = 0;  
    while (k < i) {  
        if (b >= (1u << 31u)) {  
            a = a << 1;  
            ++a;  
            b = b << 1;  
            ++k;  
        } else {  
            a = a << 1;  
            b = b << 1;  
            ++k;  
        }  
    }  
}
```

```
void bit::ShiftRight(int i) {  
    unsigned int k = 0, f = (1u << 31u);  
    while (k < i) {  
        if (a % 2 == 1) {  
            a = a >> 1;  
            b = b >> 1;  
            b = b | f;  
            ++k;  
        } else {  
            a = a >> 1;  
            b = b >> 1;  
            ++k;  
        }  
    }  
}
```

```
void bit::Get(unsigned long long i, unsigned int j) {  
    a = i;  
    b = j;  
}
```

```
unsigned long long bit::Hight() const {  
    return a;  
}
```

```
unsigned int bit::Low() const {  
    return b;  
}
```

```
int bit::operator==(const bit &other) const {  
    int i1 = number(a) + number(b);  
    int i2 = number(other.a) + number(other.b);  
    return i1 == i2;  
}
```

```
int bit::operator<=(const bit &other) const {  
    int i1 = number(a) + number(b);  
    int i2 = number(other.a) + number(other.b);  
    return i1 <= i2;  
  
}
```

```
int bit::operator>=(const bit &other) const {  
    int i1 = number(a) + number(b);  
    int i2 = number(other.a) + number(other.b);  
    return i1 >= i2;  
  
}
```

```
int bit::operator<(const bit &other) const {  
    int i1 = number(a) + number(b);  
    int i2 = number(other.a) + number(other.b);  
    return i1 < i2;  
  
}
```

```
int bit::operator>(const bit &other) const {  
    int i1 = number(a) + number(b);  
    int i2 = number(other.a) + number(other.b);  
    return i1 > i2;  
}
```

```
int bit::Inclusion(const bit &other) const {  
    if ((a & other.a) == a && (b & other.b) == b)  
        return 1;  
    else  
        return 0;
```

```
}
```

```
bit::bit() {  
    a = 0;  
    b = 0;  
}
```

```
std::ostream &operator<<(std::ostream &os, const bit &other) {  
    bool flag = true;  
    int aCount = 0, bCount = 0;  
    os << other.a << " " << other.b << std::endl;  
    Count0(other.a, os, &aCount, flag);  
    for (int i = 0; i < 64 - aCount; ++i) {  
        os << 0;  
    }  
    to2(other.a, os, &aCount, flag);  
    os << " ";  
    flag = true;  
    Count0(other.b, os, &bCount, flag);  
    for (int i = 0; i < 32 - bCount; ++i) {  
        os << 0;  
    }  
    to2(other.b, os, &bCount, flag);  
    os << std::endl;  
    return os;  
}
```

```
std::istream &operator>>(std::istream &is, bit &other) {  
    std::string s;  
    is >> s;  
    int n = s.size();  
    std::string t(n, '0');  
    std::vector<int> v;  
    while (s != t) {  
        int d = 0;  
        for (int i = 0; i < s.size(); i++) {  
            d *= 10;  
            d += (s[i] - 48);  
            s[i] = char(48 + d / 2);  
            d %= 2;  
        }  
        v.push_back(d);  
    }  
}
```

```
unsigned int b_step = 1;  
for (int i = 0; i < 32 && i < v.size(); i++) {  
    other.b += v[i] * b_step;  
    b_step *= 2;  
}  
unsigned long long a_step = 1;  
for (int i = 32; i < v.size(); i++) {  
    other.a += v[i] * a_step;
```

```

        a_step *= 2;
    }
    return is;
}

bit operator ""_sr(const char *st, size_t siz) {
    std::istringstream is(st);
    bit val;
    is >> val;
    return val;
}

```

### **main.cpp:**

```

#include <iostream>
#include <sstream>
#include "bits.h"

```

```

int main() {
    bit a;
    std::cin>>a;
    std::cout<<a;
    bit b;
    std::cin>>b;
    std::cout<<b;
    a.ShiftLeft(1);
    bit f = a & b;
    std::cout<<f;
    f = a|b;
    std::cout<<f;
    f = ~a;
    std::cout<<f;
    return 0;
}

```

### **CmakeLists.txt:**

```

cmake_minimum_required(VERSION 3.10.2)
project(oop_exercise_02)

```

```

set(CMAKE_CXX_STANDARD 14)

```

```

add_executable(oop_exercise_01 main.cpp bits.h bits.cpp)

```

### **test.sh:**

```

executable=$1

```

```

for file in test_?.test
do
    $executable < $file > tmp
    if cmp tmp ${file%%.test}.result
    then

```

```
    echo Test "$file": SUCCESS
else
    echo Test "$file": FAIL
fi
rm tmp
done
```

## 2. Ссылка на репозиторий на GitHub.

[https://github.com/magomed2000kasimov/oop\\_exercise\\_02](https://github.com/magomed2000kasimov/oop_exercise_02)

### 3. Набор тестов.

```
test_01.test:
2147483648
8589934591
```

```
test_02.test:
1
0
```

#### 4. Результаты выполнения тестов.

[illegible][illegible]



