Московский авиационный институт
(национально исследовательский университет)

Курсовая работа по курсу:
«Фундаментальная информатика»
1 семестр
Задание №3

Тема: «Программирование в алгоритмической модели Маркова»

Преподаватель: доцент кафедры 806 Никулин С.П.

Студент: Бугренков Владимир Петрович

Группа: М80-111Б-23

г. Москва

1. Постановка задачи: полная формулировка условия задачи с указанием номера варианта

Составить алгоритм вычисление троичного логического сдвига первого числа вправо на число разрядов второго числа. (Вариант №8).

2. Общий метод решения

Заменяем старшие разряды левого числа на количество разрядов правого числа, если же количество разрядов правого числа больше чем левого, то все разряды левого числа меняются на ноль. В итоге правое число полностью стирается и остается левое число с результатом логического сдвига

3. Общие сведения о программе

Логический сдвиг представляет собой перемещение всех разрядов машинного слова влево или вправо на число разрядов, заданное вторым операндом. При этом освобождающиеся при таком сдвиге свободные разряды заполняются нулями, а разряды, выходящие за пределы машинного слова, теряются. Троичным числом будем считать число, записанное в троичной системе счисления.

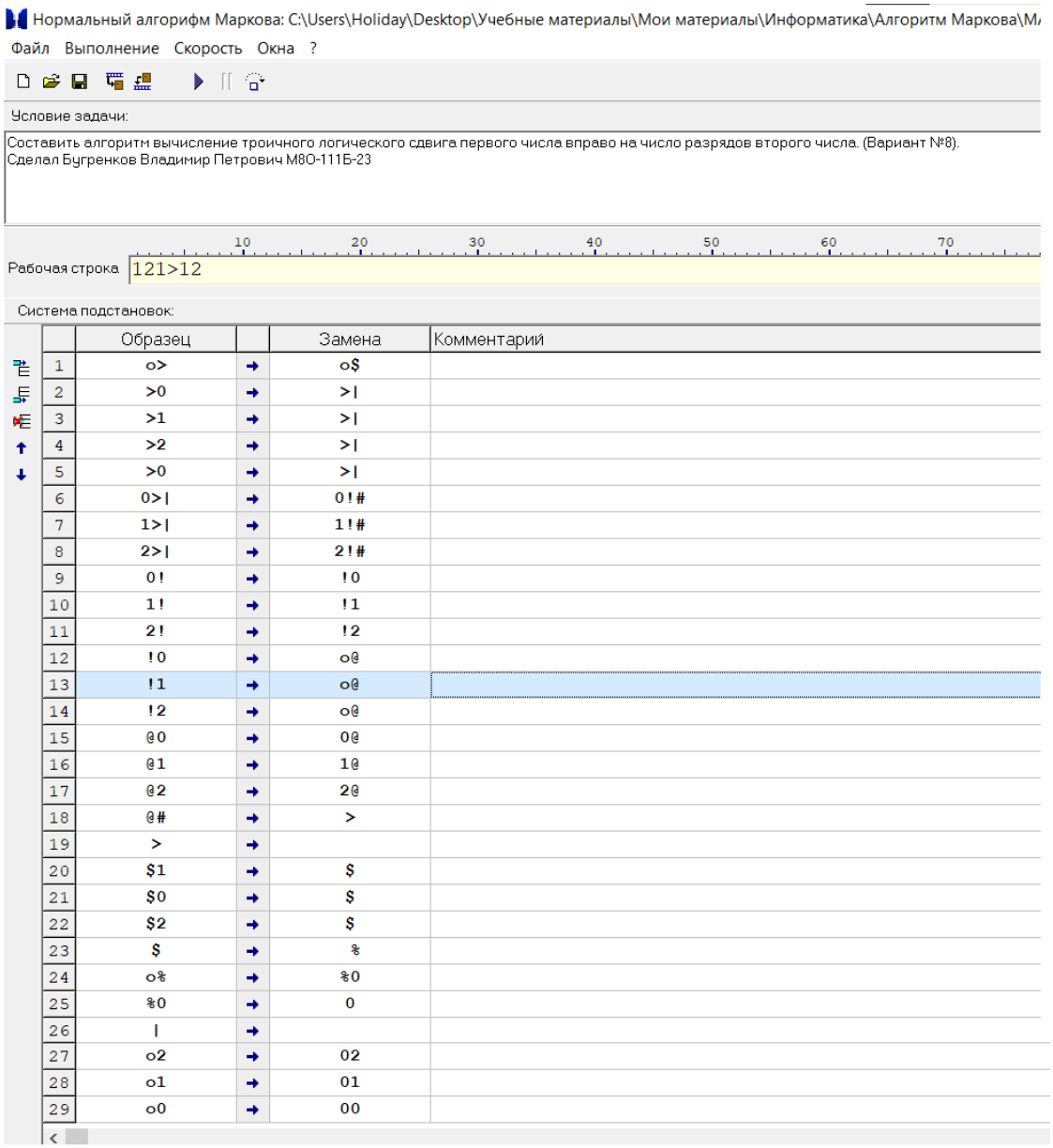
4. Ограничения на объём и величину обрабатываемых данных

Объём и величина обрабатываемых данных не ограничены. Входные данные должны быть представлены в виде двух троичных чисел, разделенных знаком «>».

5. Описание логической структуры алгоритма.

```
o>->o$
>0->>|
>1->>|
>2->>|
>0->>|
0>|->0!#
1>|->1!#
2>|->2!#
0!->!0
1!->!1
2!->!2
!0->o@
!1->o@
!2->o@
@0->0@
@1->1@
@2->2@
@#->>
>->
$1->$
```

```
$0->$
$2->$
$-> %
o%->%0
%0->0
|->
o2->02
o1->01
o0->00
```



6. Описание подпрограммы

Подпрограмм нет.

7. Входные данные

Входное слово представляет собой два троичных числа без знака, разделенных знаком «>».

8. Выходные данные

Троичное число

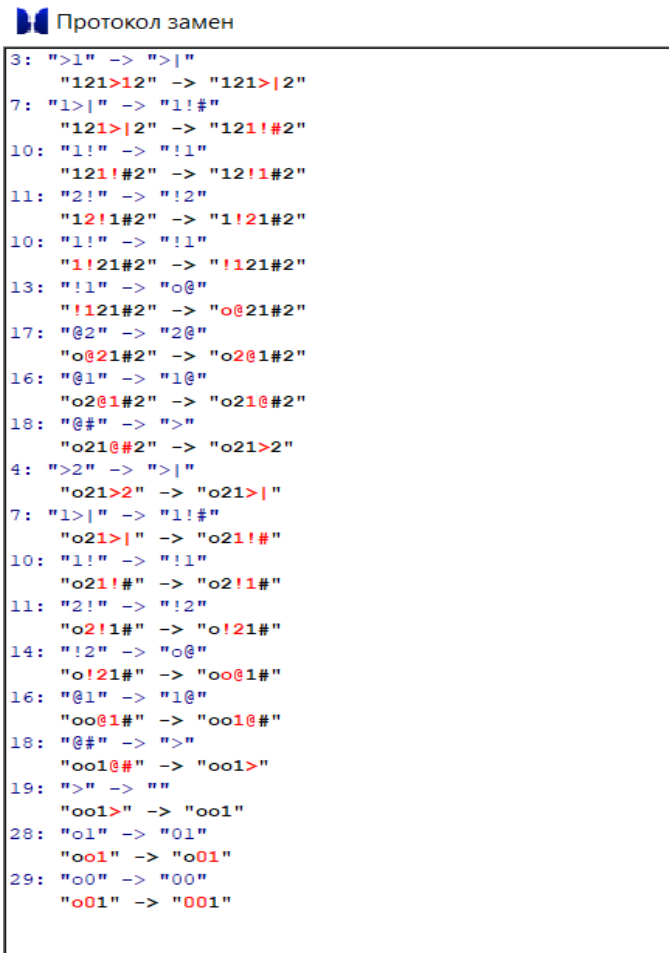
9. Тестовые примеры

Тест	Ввод	Вывод
1	121>12	001
2	12210>10	00210
3	11>1121012	00
4	12121>0	02121
5	221121>221121	000000
6	011>111	000
7	021>02	001

10. Дневник отладки

Откладку буду проводить с помощью тренажёра «Нормальные алгорифмы Маркова» с сайта Константина Полякова (https://kpolyakov.spb.ru/prog/nma.htm)

Тест 1:



Тест 2:

Протокол замен

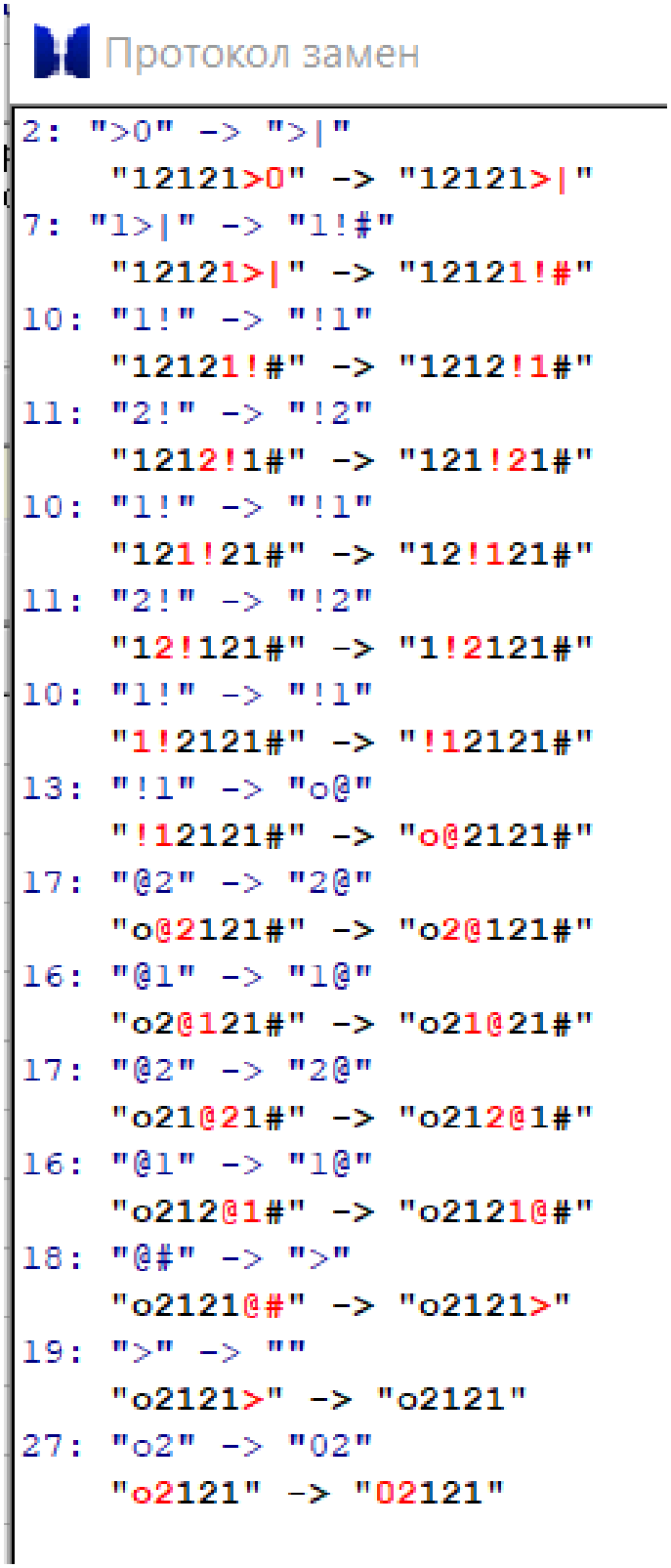
```
3: ">1" -> ">|"
    "12210>10" -> "12210>|0"
6: "0>|" -> "0!#"
    "12210>|0" -> "12210!#0"
9: "0!" -> "!0"
    "12210!#0" -> "1221!0#0"
10: "1!" -> "!1"
    "1221!0#0" -> "122!10#0"
11: "2!" -> "!2"
    "122!10#0" -> "12!210#0"
11: "2!" -> "!2"
    "12!210#0" -> "1!2210#0"
10: "1!" -> "!1"
    "1!2210#0" -> "!12210#0"
13: "!1" -> "o@"
    "!12210#0" -> "o@2210#0"
17: "@2" -> "2@"
    "o@2210#0" -> "o2@210#0"
17: "@2" -> "2@"
    "o2@210#0" -> "o22@10#0"
16: "@1" -> "1@"
    "o22@10#0" -> "o221@0#0"
15: "@0" -> "0@"
    "o221@0#0" -> "o2210@#0"
18: "@#" -> ">"
    "o2210@#0" -> "o2210>0"
2: ">0" -> ">|"
    "o2210>0" -> "o2210>|"
6: "0>|" -> "0!#"
    "o2210>|" -> "o2210!#"
9: "0!" -> "!0"
    "o2210!#" -> "o221!0#"
10: "1!" -> "!1"
    "o221!0#" -> "o22!10#"
11: "2!" -> "!2"
    "o22!10#" -> "o2!210#"
11: "2!" -> "!2"
    "o2!210#" -> "o!2210#"
14: "!2" -> "o@"
    "o!2210#" -> "oo@210#"
17: "@2" -> "2@"
    "oo@210#" -> "oo2@10#"
16: "@1" -> "1@"
    "oo2@10#" -> "oo21@0#"
15: "@0" -> "0@"
    "oo21@0#" -> "oo210@#"
18: "@#" -> ">"
    "oo210@#" -> "oo210>"
19: ">" -> ""
    "oo210>" -> "oo210"
27: "o2" -> "02"
    "oo210" -> "o0210"
29: "o0" -> "00"
    "o0210" -> "00210"
```

Тест 3:

Протокол замен

```
3: ">1" -> ">|"
    "11>1121012" -> "11>|121012"
7: "1>|" -> "1!#"
    "11>|121012" -> "11!#121012"
10: "1!" -> "!1"
    "11!#121012" -> "1!1#121012"
10: "1!" -> "!1"
    "1!1#121012" -> "!11#121012"
13: "!1" -> "o@"
    "!11#121012" -> "o@1#121012"
16: "@1" -> "1@"
    "o@1#121012" -> "o1@#121012"
18: "@#" -> ">"
    "o1@#121012" -> "o1>121012"
3: ">1" -> ">|"
    "o1>121012" -> "o1>|21012"
7: "1>|" -> "1!#"
    "o1>|21012" -> "o1!#21012"
10: "1!" -> "!1"
    "o1!#21012" -> "o!1#21012"
13: "!1" -> "o@"
    "o!1#21012" -> "oo@#21012"
18: "@#" -> ">"
    "oo@#21012" -> "oo>21012"
1: "o>" -> "o$"
    "oo>21012" -> "oo$21012"
22: "$2" -> "$"
    "oo$21012" -> "oo$1012"
20: "$1" -> "$"
    "oo$1012" -> "oo$012"
21: "$0" -> "$"
    "oo$012" -> "oo$12"
20: "$1" -> "$"
    "oo$12" -> "oo$2"
22: "$2" -> "$"
    "oo$2" -> "oo$"
23: "$" -> "%"
    "oo$" -> "oo%"
24: "o%" -> "%0"
    "oo%" -> "o%0"
24: "o%" -> "%0"
    "o%0" -> "%00"
25: "%0" -> "0"
    "%00" -> "00"
```

Тест 4:


Протокол замен
2: ">0" -> ">|"
"12121>0" -> "12121>|"
7: "1>|" -> "1!#"
"12121>|" -> "12121!#"
10: "1!" -> "!1"
"12121!#" -> "1212!1#"
11: "2!" -> "!2"
"1212!1#" -> "121!21#"
10: "1!" -> "!1"
"121!21#" -> "12!121#"
11: "2!" -> "!2"
"12!121#" -> "1!2121#"
10: "1!" -> "!1"
"1!2121#" -> "!12121#"
13: "!1" -> "o@"
"!12121#" -> "o@2121#"
17: "@2" -> "2@"
"o@2121#" -> "o2@121#"
16: "@1" -> "1@"
"o2@121#" -> "o21@21#"
17: "@2" -> "2@"
"o21@21#" -> "o212@1#"
16: "@1" -> "1@"
"o212@1#" -> "o2121@#"
18: "@#" -> ">"
"o2121@#" -> "o2121>"
19: ">" -> ""
"o2121>" -> "o2121"
27: "o2" -> "02"
"o2121" -> "02121"

Тест 5:

Протокол замен

```
4: ">2" -> ">|"
    "221121>221121" -> "221121>|21121"
7: "1>|" -> "1!#"
    "221121>|21121" -> "221121!#21121"
10: "1!" -> "!1"
    "221121!#21121" -> "22112!1#21121"
11: "2!" -> "!2"
    "22112!1#21121" -> "2211!21#21121"
10: "1!" -> "!1"
    "2211!21#21121" -> "221!121#21121"
10: "1!" -> "!1"
    "221!121#21121" -> "22!1121#21121"
11: "2!" -> "!2"
    "22!1121#21121" -> "2!21121#21121"
11: "2!" -> "!2"
    "2!21121#21121" -> "!221121#21121"
14: "!2" -> "o@"
    "!221121#21121" -> "o@21121#21121"
17: "@2" -> "2@"
    "o@21121#21121" -> "o2@1121#21121"
16: "@1" -> "1@"
    "o2@1121#21121" -> "o21@121#21121"
16: "@1" -> "1@"
    "o21@121#21121" -> "o211@21#21121"
```

```
17: "@2" -> "2@"
    "o211@21#21121" -> "o2112@1#21121"
16: "@1" -> "1@"
    "o2112@1#21121" -> "o21121@#21121"
18: "@#" -> ">"
    "o21121@#21121" -> "o21121>21121"
4: ">2" -> ">|"
    "o21121>21121" -> "o21121>|1121"
7: "1>|" -> "1!#"
    "o21121>|1121" -> "o21121!#1121"
10: "1!" -> "!1"
    "o21121!#1121" -> "o2112!1#1121"
11: "2!" -> "!2"
    "o2112!1#1121" -> "o211!21#1121"
10: "1!" -> "!1"
    "o211!21#1121" -> "o21!121#1121"
10: "1!" -> "!1"
    "o21!121#1121" -> "o2!1121#1121"
11: "2!" -> "!2"
    "o2!1121#1121" -> "o!21121#1121"
14: "!2" -> "o@"
    "o!21121#1121" -> "oo@1121#1121"
16: "@1" -> "1@"
    "oo@1121#1121" -> "oo1@121#1121"
16: "@1" -> "1@"
    "oo1@121#1121" -> "oo11@21#1121"
17: "@2" -> "2@"
    "oo11@21#1121" -> "oo112@1#1121"
16: "@1" -> "1@"
    "oo112@1#1121" -> "oo1121@#1121"
18: "@#" -> ">"
    "oo1121@#1121" -> "oo1121>1121"
```

```
3: ">1" -> ">|"
    "oo1121>1121" -> "oo1121>|121"
7: "1>|" -> "1!#"
    "oo1121>|121" -> "oo1121!#121"
10: "1!" -> "!1"
    "oo1121!#121" -> "oo112!1#121"
11: "2!" -> "!2"
    "oo112!1#121" -> "oo11!21#121"
10: "1!" -> "!1"
    "oo11!21#121" -> "oo1!121#121"
10: "1!" -> "!1"
    "oo1!121#121" -> "oo!1121#121"
13: "!1" -> "o@"
    "oo!1121#121" -> "ooo@121#121"
16: "@1" -> "1@"
    "ooo@121#121" -> "ooo1@21#121"
17: "@2" -> "2@"
    "ooo1@21#121" -> "ooo12@1#121"
16: "@1" -> "1@"
    "ooo12@1#121" -> "ooo121@#121"
18: "@#" -> ">"
    "ooo121@#121" -> "ooo121>121"
3: ">1" -> ">|"
    "ooo121>121" -> "ooo121>|21"
7: "1>|" -> "1!#"
    "ooo121>|21" -> "ooo121!#21"
10: "1!" -> "!1"
    "ooo121!#21" -> "ooo12!1#21"
11: "2!" -> "!2"
    "ooo12!1#21" -> "ooo1!21#21"
10: "1!" -> "!1"
    "ooo1!21#21" -> "ooo!121#21"
13: "!1" -> "o@"
    "ooo!121#21" -> "oooo@21#21"
17: "@2" -> "2@"
    "oooo@21#21" -> "oooo2@1#21"
16: "@1" -> "1@"
    "oooo2@1#21" -> "oooo21@#21"
18: "@#" -> ">"
    "oooo21@#21" -> "oooo21>21"
4: ">2" -> ">|"
    "oooo21>21" -> "oooo21>|1"
7: "1>|" -> "1!#"
    "oooo21>|1" -> "oooo21!#1"
10: "1!" -> "!1"
    "oooo21!#1" -> "oooo2!1#1"
11: "2!" -> "!2"
    "oooo2!1#1" -> "oooo!21#1"
14: "!2" -> "o@"
    "oooo!21#1" -> "ooooo@1#1"
16: "@1" -> "1@"
    "ooooo@1#1" -> "ooooo1@#1"
18: "@#" -> ">"
    "ooooo1@#1" -> "ooooo1>1"
```

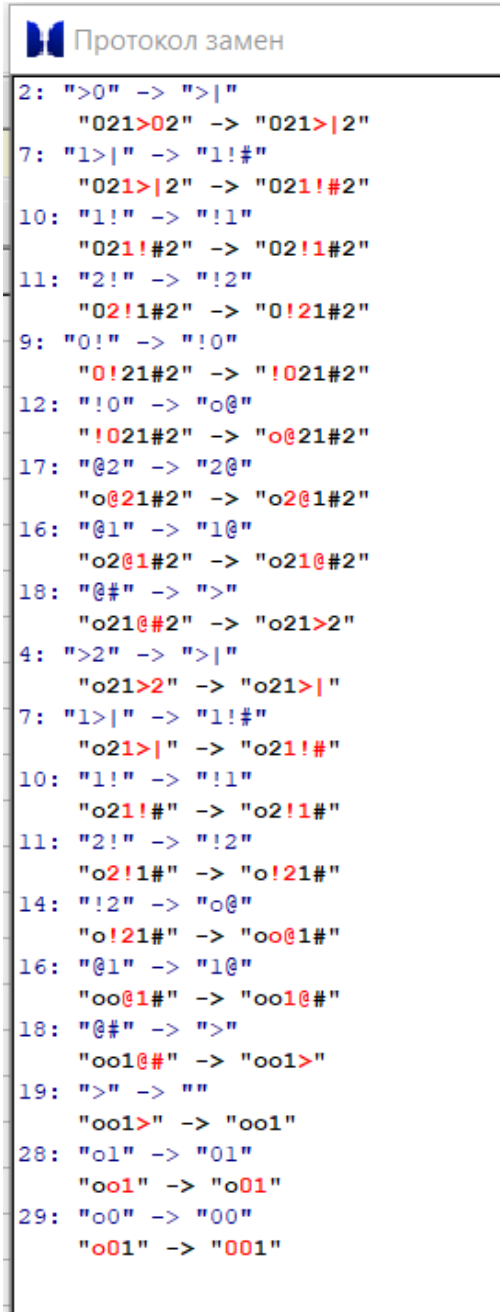
```
3: ">1" -> ">|"
    "ooooo1>1" -> "ooooo1>|"
7: "1>|" -> "1!#"
    "ooooo1>|" -> "ooooo1!#"
10: "1!" -> "!1"
    "ooooo1!#" -> "ooooo!1#"
13: "!1" -> "o@"
    "ooooo!1#" -> "oooooo@#"
18: "@#" -> ">"
    "oooooo@#" -> "oooooo>"
1: "o>" -> "o$"
    "ooooo>" -> "ooooo$"
23: "$" -> "%"
    "ooooo$" -> "ooooo%"
24: "o%" -> "%0"
    "ooooo%" -> "oooo%0"
24: "o%" -> "%0"
    "oooo%0" -> "ooo%00"
24: "o%" -> "%0"
    "ooo%00" -> "oo%000"
24: "o%" -> "%0"
    "oo%000" -> "o%0000"
24: "o%" -> "%0"
    "o%0000" -> "%00000"
25: "%0" -> "0"
    "%00000" -> "00000"
```

Тест 6:

Протокол замен

```
3: ">1" -> ">|"
    "011>111" -> "011>|11"
7: "1>|" -> "1!#"
    "011>|11" -> "011!#11"
10: "1!" -> "!1"
    "011!#11" -> "01!1#11"
10: "1!" -> "!1"
    "01!1#11" -> "0!11#11"
9: "0!" -> "!0"
    "0!11#11" -> "!011#11"
12: "!0" -> "o@"
    "!011#11" -> "o@11#11"
16: "@1" -> "1@"
    "o@11#11" -> "o1@1#11"
16: "@1" -> "1@"
    "o1@1#11" -> "o11@#11"
18: "@#" -> ">"
    "o11@#11" -> "o11>11"
3: ">1" -> ">|"
    "o11>11" -> "o11>|1"
7: "1>|" -> "1!#"
    "o11>|1" -> "o11!#1"
10: "1!" -> "!1"
    "o11!#1" -> "o1!1#1"
10: "1!" -> "!1"
    "o1!1#1" -> "o!11#1"
13: "!1" -> "o@"
    "o!11#1" -> "oo@1#1"
16: "@1" -> "1@"
    "oo@1#1" -> "oo1@#1"
18: "@#" -> ">"
    "oo1@#1" -> "oo1>1"
3: ">1" -> ">|"
    "oo1>1" -> "oo1>|"
7: "1>|" -> "1!#"
    "oo1>|" -> "oo1!#"
10: "1!" -> "!1"
    "oo1!#" -> "oo!1#"
13: "!1" -> "o@"
    "oo!1#" -> "ooo@#"
18: "@#" -> ">"
    "ooo@#" -> "ooo>"
1: "o>" -> "o$"
    "ooo>" -> "ooo$"
23: "$" -> "%"
    "ooo$" -> "ooo%"
24: "o%" -> "%0"
    "ooo%" -> "oo%0"
24: "o%" -> "%0"
    "oo%0" -> "o%00"
24: "o%" -> "%0"
    "o%00" -> "%000"
25: "%0" -> "0"
    "%000" -> "000"
```

Тест 7:



11. Вывод по работе

Поставленная задача была выполнена, в процессе выполнения работы я научился программировать в алгоритмическое модели Маркова.