Микропроект №2

Задача о читателях и писателях

Вариант 3

Пояснительная записка

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Содержание

Постановка задачи

Согласно выданному заданию было необходимо реализовать следующий проект:

Задача о читателях и писателях. Базу данных разделяют два типа процессов – читатели и писатели. Читатели выполняют транзакции, которые просматривают записи базы данных, транзакции писателей и просматривают и изменяют записи. Предполагается, что в начале БД находится в непротиворечивом состоянии (т.е. отношения между данными имеют смысл). Каждая отдельная транзакция переводит БД из одного непротиворечивого состояния в другое. Для предотвращения взаимного влияния транзакций процесс-писатель должен иметь исключительный доступ к БД. Если к БД не обращается ни один из процессов-писателей, то выполнять транзакции могут одновременно сколько угодно читателей. Создать многопоточное приложение с потоками-писателями и потоками-читателями. Реализовать решение, используя семафоры.

Область допустимых входных данных

Программа принимает на вход 3 целых числа, передаваемых как аргументы командной строки при запуске программы.

- Первый аргумент – количество потоков-писателей. Ожидается целое положительное число, принадлежащее отрезку [1; 100].
- Второй аргумент – количество потоков-читателей. Ожидается целое положительное число, принадлежащее отрезку [1; 100].
- Третий аргумент – время выполнения программы в секундах. Ожидается целое положительное число, принадлежащее отрезку [5; 120].

Выходные данные

В ходе выполнения программы выводится следующая информация:

1. Информация об ошибке в случае некорректных входных данных.
2. Результат записи в базу данных новой информации потоком-писателем. Результат представляется в виде строки следующего вида для каждого действия любого из потоков-писателей:
   `At %time %writer_name added to the library book named: %book_name.`
3. Результат чтения из базы информации потоком-читателем. Результат представляется в виде строки следующего вида для каждого действия любого из потоков-читателей:
   `At %time %reader_name readed the book named: %book_name.`

Описание взаимодействия субъектов

В приведенном решении реализованы следующие сущности:

1) База данных – переменная типа `std::vector<std::string>` - коллекция строк-записей (на момент запуска программы она содержит в себе одну запись – «Welcome!»).
2) Поток-писатель – поток, добавляющий в базу данных новые записи (посредством метода вектора `push_back`).
3) Поток-читатель – поток, читающий из базы некоторую запись (обращение к записи происходит по индексу, индекс генерируется случайно – гарантируется, что такой элемент есть).

Каждый поток повторяет свои действия с некоторой периодичностью в течение всего времени работы программы. Время между последовательными действиями одного потока генерируется случайно.

В программе используются следующие одноместные семафоры:

1) `writing_semaphore` – семафор для потоков-писателей – если ненулевой, то можно писать в базу данных
2) `available_everyone` – семафор для всех потоков – если ненулевой, кто-то обращается к базе данных для чтения или записи
3) `change_read_count` и `change_write_count` – семафоры, обеспечивающие доступ в определенный момент не более чем одному потоку к счетчикам читателей и писателей соответственно
4) `output_semaphore` – семафор для синхронизации вывода действий в консоль

Взаимодействие сущностей осуществляется следующим образом.

1) Поток-писатель
Поток-писатель решает осуществить запись в базу данных. Для этого он с помощью счетчика писателей удостоверяется, что является первым потоком-писателем в очереди. Если это действительно так, то он ожидает завершения работы потоков-читателей (с помощью одноместного семафора `available_everyone`), затем занимает коллекцию сам (с помощью семафоров `available_everyone` и `writing_semaphore`), тем самым блокируя к ней доступ и для читателей, и для писателей, пока не запишет данные. После этого он освобождает семафор `writing_semaphore`, а также, если был последним потоком-писателем в очереди (то есть без него счетчик писателей равен 0), и семафор `available_everyone`.
2) Поток-читатель
Поток-читатель решает прочесть запись из базы данных. Для этого он вызывает wait для семафора `available_everyone`. Если он является первым потоком-читателем в очереди (проверяется с помощью счетчика читателей), то он вызывает wait для семафора `writers_semaphore`, чтобы удостовериться, что в базу не

производится запись. После этого он отправляет сигнал семафору `available_everyone`, чтобы открыть доступ другим потокам-читателям (напомним, что количество читающих потоков подсчитывается). После осуществления чтения, если завершивший чтение поток является последним потоком-читателем в очереди, он освобождает семафор `writers_semaphor`, тем самым позволяя потокам-писателям осуществить запись.

Иными словами, семафоры `writers_semaphor` и `available_everyone` осуществляют следующие роли. Первый блокирует доступ к базе для всех потоков-писателей, если к базе данных кто-либо обращается. При этом как только писатель встает в очередь на запись, он ожидает освобождения этого семафора, занимая `available_everyone`, запрещая доступ к базе потокам-читателям, пока все потоки-писатели не выполнят свои записи. Второй же управляет доступом к базе для читателей – его может открыть поток-читатель, если к базе никто не обращается; в то же время его может заблокировать поток-писатель, если потребуется осуществить запись в базу данных.

Остальные семафоры выполняют служебные роли обеспечения единоличного доступа к счетчикам потоков и выводу в консоль, что было уже описано выше.

Примеры входных данных

В приведенных примерах ввод – это аргументы командной строки для запуска программы. В качестве вывода приведен лишь один из возможных примеров ответа, порядок выполнения потоков случаен.

1. **Ввод:** 100 100 5
   Пример ожидаемого вывода:

```
At 1607832131 Writer 8 added to the library book named: text_8_1.
At 1607832131 Writer 11 added to the library book named: text_11_1.
At 1607832131 Writer 8 added to the library book named: text_8_2.
At 1607832131 Writer 11 added to the library book named: text_11_2.
At 1607832131 Writer 14 added to the library book named: text_14_1.
At 1607832131 Writer 8 added to the library book named: text_8_3.
At 1607832131 Writer 17 added to the library book named: text_17_1.
At 1607832131 Writer 11 added to the library book named: text_11_3.
At 1607832131 Writer 14 added to the library book named: text_14_2.
At 1607832131 Writer 20 added to the library book named: text_20_1.
At 1607832131 Writer 8 added to the library book named: text_8_4.
At 1607832131 Writer 17 added to the library book named: text_17_2.
At 1607832131 Writer 11 added to the library book named: text_11_4.
At 1607832131 Writer 14 added to the library book named: text_14_3.
At 1607832131 Writer 20 added to the library book named: text_20_2.
At 1607832131 Writer 8 added to the library book named: text_8_5.
At 1607832131 Writer 17 added to the library book named: text_17_3.
At 1607832131 Writer 63 added to the library book named: text_63_1.
At 1607832131 Writer 11 added to the library book named: text_11_5.
At 1607832131 Writer 14 added to the library book named: text_14_4.
At 1607832131 Writer 20 added to the library book named: text_20_3.
At 1607832131 Writer 8 added to the library book named: text_8_6.
At 1607832131 Writer 69 added to the library book named: text_69_1.
At 1607832131 Writer 17 added to the library book named: text_17_4.
At 1607832131 Writer 63 added to the library book named: text_63_2.
At 1607832131 Writer 11 added to the library book named: text_11_6.
At 1607832131 Writer 14 added to the library book named: text_14_5.
At 1607832131 Writer 20 added to the library book named: text_20_4.
At 1607832131 Writer 8 added to the library book named: text_8_7.
At 1607832131 Writer 69 added to the library book named: text_69_2.
At 1607832131 Writer 17 added to the library book named: text_17_5.
At 1607832131 Writer 63 added to the library book named: text_63_3.
At 1607832131 Writer 57 added to the library book named: text_57_1.
At 1607832131 Writer 11 added to the library book named: text_11_7.
At 1607832131 Writer 14 added to the library book named: text_14_6.
```

At 1607832131 Writer 60 added to the library book named: text_60_1.
At 1607832131 Writer 20 added to the library book named: text_20_5.
At 1607832131 Writer 8 added to the library book named: text_8_8.
At 1607832131 Writer 69 added to the library book named: text_69_3.
At 1607832131 Writer 66 added to the library book named: text_66_1.
At 1607832131 Writer 17 added to the library book named: text_17_6.
At 1607832131 Writer 63 added to the library book named: text_63_4.
At 1607832131 Writer 57 added to the library book named: text_57_2.
At 1607832131 Writer 11 added to the library book named: text_11_8.
At 1607832131 Writer 14 added to the library book named: text_14_7.
At 1607832131 Writer 60 added to the library book named: text_60_2.
At 1607832131 Writer 20 added to the library book named: text_20_6.
At 1607832131 Writer 8 added to the library book named: text_8_9.
At 1607832131 Writer 69 added to the library book named: text_69_4.
At 1607832131 Writer 66 added to the library book named: text_66_2.
At 1607832131 Writer 17 added to the library book named: text_17_7.
At 1607832131 Writer 63 added to the library book named: text_63_5.
At 1607832131 Writer 57 added to the library book named: text_57_3.
At 1607832131 Writer 11 added to the library book named: text_11_9.
At 1607832131 Writer 14 added to the library book named: text_14_8.
At 1607832131 Writer 60 added to the library book named: text_60_3.
At 1607832131 Writer 20 added to the library book named: text_20_7.
At 1607832131 Writer 8 added to the library book named: text_8_10.
At 1607832131 Writer 69 added to the library book named: text_69_5.
At 1607832131 Writer 66 added to the library book named: text_66_3.
At 1607832131 Writer 17 added to the library book named: text_17_8.
At 1607832131 Writer 63 added to the library book named: text_63_6.
At 1607832131 Writer 57 added to the library book named: text_57_4.
At 1607832131 Writer 11 added to the library book named: text_11_10.
At 1607832131 Writer 14 added to the library book named: text_14_9.
At 1607832131 Writer 60 added to the library book named: text_60_4.
At 1607832131 Writer 20 added to the library book named: text_20_8.
At 1607832131 Writer 8 added to the library book named: text_8_11.
At 1607832131 Writer 69 added to the library book named: text_69_6.
At 1607832131 Writer 66 added to the library book named: text_66_4.
At 1607832131 Reader 8 readed the book named: text_60_1.
At 1607832131 Writer 17 added to the library book named: text_17_9.
At 1607832131 Writer 63 added to the library book named: text_63_7.
At 1607832131 Reader 11 readed the book named: text_69_3.
At 1607832131 Writer 57 added to the library book named: text_57_5.
At 1607832131 Writer 11 added to the library book named: text_11_11.
At 1607832131 Reader 14 readed the book named: text_69_1.
At 1607832131 Writer 14 added to the library book named: text_14_10.
At 1607832131 Writer 60 added to the library book named: text_60_5.

At 1607832131 Writer 20 added to the library book named: text_20_9.
At 1607832131 Reader 17 readed the book named: text_17_1.
At 1607832131 Writer 8 added to the library book named: text_8_12.
At 1607832131 Reader 20 readed the book named: text_69_6.
At 1607832131 Writer 69 added to the library book named: text_69_7.
At 1607832131 Writer 66 added to the library book named: text_66_5.
At 1607832131 Reader 8 readed the book named: text_20_8.
At 1607832131 Writer 17 added to the library book named: text_17_10.
At 1607832131 Writer 63 added to the library book named: text_63_8.
At 1607832131 Reader 11 readed the book named: text_69_1.
At 1607832131 Writer 57 added to the library book named: text_57_6.
At 1607832131 Writer 11 added to the library book named: text_11_12.
At 1607832131 Reader 14 readed the book named: text_69_1.
At 1607832131 Writer 14 added to the library book named: text_14_11.
At 1607832131 Writer 60 added to the library book named: text_60_6.
At 1607832131 Writer 20 added to the library book named: text_20_10.
At 1607832131 Reader 17 readed the book named: text_69_5.
At 1607832131 Writer 8 added to the library book named: text_8_13.
At 1607832131 Reader 20 readed the book named: text_20_8.
At 1607832131 Writer 69 added to the library book named: text_69_8.
At 1607832131 Writer 66 added to the library book named: text_66_6.
At 1607832131 Reader 8 readed the book named: text_17_10.
At 1607832131 Writer 17 added to the library book named: text_17_11.
At 1607832131 Writer 63 added to the library book named: text_63_9.
At 1607832131 Reader 11 readed the book named: text_14_2.
At 1607832131 Writer 57 added to the library book named: text_57_7.
At 1607832131 Writer 11 added to the library book named: text_11_13.
At 1607832131 Reader 14 readed the book named: text_8_11.
At 1607832131 Writer 14 added to the library book named: text_14_12.
At 1607832131 Writer 60 added to the library book named: text_60_7.
At 1607832131 Writer 20 added to the library book named: text_20_11.
At 1607832131 Reader 57 readed the book named: text_60_1.
At 1607832131 Reader 17 readed the book named: text_8_2.
At 1607832131 Writer 8 added to the library book named: text_8_14.
At 1607832131 Reader 20 readed the book named: text_20_1.
At 1607832131 Reader 60 readed the book named: text_11_1.
At 1607832131 Writer 69 added to the library book named: text_69_9.
At 1607832131 Writer 66 added to the library book named: text_66_7.
At 1607832131 Reader 63 readed the book named: text_14_12.
At 1607832131 Reader 8 readed the book named: text_66_4.
At 1607832131 Reader 66 readed the book named: text_20_9.
At 1607832131 Writer 17 added to the library book named: text_17_12.
At 1607832131 Writer 63 added to the library book named: text_63_10.
At 1607832131 Reader 11 readed the book named: text_69_1.

At 1607832131 Reader 69 readed the book named: text_14_3.
At 1607832131 Writer 57 added to the library book named: text_57_8.
At 1607832131 Writer 11 added to the library book named: text_11_14.
At 1607832131 Reader 14 readed the book named: text_11_3.
At 1607832131 Writer 14 added to the library book named: text_14_13.
At 1607832131 Writer 60 added to the library book named: text_60_8.
At 1607832131 Writer 20 added to the library book named: text_20_12.
At 1607832131 Reader 57 readed the book named: text_8_9.
At 1607832131 Reader 17 readed the book named: text_17_11.
At 1607832131 Writer 8 added to the library book named: text_8_15.
At 1607832131 Reader 20 readed the book named: text_14_10.
At 1607832131 Reader 60 readed the book named: text_57_8.
At 1607832131 Writer 69 added to the library book named: text_69_10.
At 1607832131 Writer 66 added to the library book named: text_66_8.
At 1607832131 Reader 63 readed the book named: text_8_1.
At 1607832131 Reader 8 readed the book named: text_60_8.
At 1607832131 Reader 66 readed the book named: text_57_1.
At 1607832131 Writer 17 added to the library book named: text_17_13.
At 1607832131 Writer 63 added to the library book named: text_63_11.
At 1607832131 Reader 11 readed the book named: text_8_10.
At 1607832131 Reader 69 readed the book named: text_63_8.
At 1607832131 Writer 57 added to the library book named: text_57_9.
At 1607832131 Writer 11 added to the library book named: text_11_15.
At 1607832131 Reader 14 readed the book named: text_8_8.
At 1607832131 Writer 14 added to the library book named: text_14_14.
At 1607832131 Writer 60 added to the library book named: text_60_9.
At 1607832131 Writer 20 added to the library book named: text_20_13.
At 1607832131 Reader 57 readed the book named: text_60_6.
At 1607832131 Reader 17 readed the book named: text_14_5.
At 1607832131 Writer 8 added to the library book named: text_8_16.
At 1607832131 Reader 20 readed the book named: text_57_6.
At 1607832131 Reader 60 readed the book named: text_8_15.
At 1607832131 Writer 69 added to the library book named: text_69_11.
At 1607832131 Writer 66 added to the library book named: text_66_9.
At 1607832131 Reader 63 readed the book named: text_60_8.
At 1607832131 Reader 8 readed the book named: text_69_9.
At 1607832131 Reader 66 readed the book named: text_20_8.
At 1607832131 Writer 17 added to the library book named: text_17_14.
At 1607832131 Writer 63 added to the library book named: text_63_12.
At 1607832131 Reader 11 readed the book named: text_17_4.
At 1607832131 Reader 69 readed the book named: text_17_12.
At 1607832131 Writer 57 added to the library book named: text_57_10.
At 1607832131 Writer 11 added to the library book named: text_11_16.
At 1607832131 Reader 14 readed the book named: text_8_14.

At 1607832131 Writer 14 added to the library book named: text_14_15.
At 1607832131 Writer 60 added to the library book named: text_60_10.
At 1607832131 Writer 20 added to the library book named: text_20_14.
At 1607832131 Reader 57 read the book named: text_66_3.
At 1607832131 Reader 17 read the book named: text_14_10.
At 1607832131 Writer 8 added to the library book named: text_8_17.
At 1607832131 Reader 20 read the book named: text_57_5.
At 1607832131 Reader 60 read the book named: text_11_6.
At 1607832131 Writer 69 added to the library book named: text_69_12.
At 1607832131 Writer 66 added to the library book named: text_66_10.
At 1607832131 Reader 63 read the book named: text_8_16.
At 1607832131 Reader 8 read the book named: text_66_6.
At 1607832131 Reader 66 read the book named: text_69_11.
At 1607832131 Writer 17 added to the library book named: text_17_15.
At 1607832131 Writer 63 added to the library book named: text_63_13.
At 1607832131 Reader 11 read the book named: text_20_11.
At 1607832131 Reader 69 read the book named: text_11_15.
At 1607832131 Writer 57 added to the library book named: text_57_11.
At 1607832131 Writer 11 added to the library book named: text_11_17.
At 1607832131 Reader 14 read the book named: text_8_17.
At 1607832131 Writer 14 added to the library book named: text_14_16.
At 1607832131 Writer 60 added to the library book named: text_60_11.
At 1607832131 Writer 20 added to the library book named: text_20_15.
At 1607832131 Reader 57 read the book named: text_63_1.
At 1607832131 Reader 17 read the book named: text_20_8.
At 1607832131 Writer 8 added to the library book named: text_8_18.
At 1607832131 Reader 20 read the book named: text_11_16.
At 1607832131 Reader 60 read the book named: text_14_7.
At 1607832131 Writer 69 added to the library book named: text_69_13.
At 1607832131 Writer 66 added to the library book named: text_66_11.
At 1607832131 Reader 63 read the book named: text_8_13.
At 1607832131 Reader 8 read the book named: text_11_5.
At 1607832131 Reader 66 read the book named: text_69_12.
At 1607832131 Writer 17 added to the library book named: text_17_16.
At 1607832131 Writer 63 added to the library book named: text_63_14.
At 1607832131 Reader 11 read the book named: text_11_14.
At 1607832131 Reader 69 read the book named: text_17_8.
At 1607832131 Writer 57 added to the library book named: text_57_12.
At 1607832131 Writer 11 added to the library book named: text_11_18.
At 1607832131 Reader 14 read the book named: text_8_11.
At 1607832131 Writer 14 added to the library book named: text_14_17.
At 1607832131 Writer 60 added to the library book named: text_60_12.
At 1607832131 Writer 20 added to the library book named: text_20_16.
At 1607832131 Reader 57 read the book named: text_8_9.

At 1607832131 Reader 17 readed the book named: text_17_11.
At 1607832131 Writer 8 added to the library book named: text_8_19.
At 1607832131 Reader 20 readed the book named: text_20_7.
At 1607832131 Reader 60 readed the book named: text_14_16.
At 1607832131 Writer 69 added to the library book named: text_69_14.
At 1607832131 Writer 66 added to the library book named: text_66_12.
At 1607832131 Reader 63 readed the book named: text_20_12.
At 1607832131 Reader 8 readed the book named: text_8_17.
At 1607832131 Reader 66 readed the book named: text_20_5.
At 1607832131 Writer 17 added to the library book named: text_17_17.
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At 1607832131 Reader 14 readed the book named: text_11_4.
At 1607832131 Writer 14 added to the library book named: text_14_18.
At 1607832131 Writer 60 added to the library book named: text_60_13.
At 1607832131 Writer 20 added to the library book named: text_20_17.
At 1607832131 Reader 57 readed the book named: text_66_9.
At 1607832131 Reader 17 readed the book named: text_20_13.
At 1607832131 Writer 8 added to the library book named: text_8_20.
At 1607832131 Reader 20 readed the book named: text_66_10.
At 1607832131 Reader 60 readed the book named: text_20_12.
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At 1607832131 Reader 8 readed the book named: text_14_12.
At 1607832131 Reader 66 readed the book named: text_14_13.
At 1607832131 Writer 17 added to the library book named: text_17_18.
At 1607832131 Writer 63 added to the library book named: text_63_16.
At 1607832131 Reader 11 readed the book named: text_8_3.
At 1607832131 Reader 69 readed the book named: text_8_3.
At 1607832131 Writer 57 added to the library book named: text_57_14.
At 1607832131 Writer 11 added to the library book named: text_11_20.
At 1607832131 Reader 14 readed the book named: text_8_14.
At 1607832131 Writer 14 added to the library book named: text_14_19.
At 1607832131 Writer 60 added to the library book named: text_60_14.
At 1607832131 Writer 20 added to the library book named: text_20_18.
At 1607832131 Reader 57 readed the book named: text_60_1.
At 1607832131 Reader 17 readed the book named: text_14_14.
At 1607832131 Writer 8 added to the library book named: text_8_21.
At 1607832131 Reader 20 readed the book named: text_14_1.
At 1607832131 Reader 60 readed the book named: text_66_4.

At 1607832131 Writer 69 added to the library book named: text_69_16.
At 1607832131 Writer 66 added to the library book named: text_66_14.
At 1607832131 Reader 63 readed the book named: text_8_1.
At 1607832131 Reader 8 readed the book named: text_17_5.
At 1607832131 Reader 66 readed the book named: text_63_16.
At 1607832131 Writer 17 added to the library book named: text_17_19.
At 1607832131 Writer 63 added to the library book named: text_63_17.
At 1607832131 Reader 11 readed the book named: text_20_18.
At 1607832131 Reader 69 readed the book named: text_20_13.
At 1607832131 Writer 57 added to the library book named: text_57_15.
At 1607832131 Writer 11 added to the library book named: text_11_21.
At 1607832131 Reader 14 readed the book named: text_8_19.
At 1607832131 Writer 14 added to the library book named: text_14_20.
At 1607832131 Writer 60 added to the library book named: text_60_15.
At 1607832131 Writer 20 added to the library book named: text_20_19.
At 1607832131 Reader 57 readed the book named: text_63_9.
At 1607832131 Reader 17 readed the book named: text_14_8.
At 1607832131 Writer 8 added to the library book named: text_8_22.
At 1607832131 Reader 20 readed the book named: text_69_15.
At 1607832131 Reader 60 readed the book named: text_57_15.
At 1607832131 Writer 69 added to the library book named: text_69_17.
At 1607832131 Writer 66 added to the library book named: text_66_15.
At 1607832131 Reader 63 readed the book named: text_8_20.
At 1607832131 Reader 8 readed the book named: text_20_10.
At 1607832131 Reader 66 readed the book named: text_8_22.
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At 1607832131 Writer 63 added to the library book named: text_63_18.
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At 1607832131 Writer 57 added to the library book named: text_57_16.
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At 1607832131 Reader 14 readed the book named: text_57_11.
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At 1607832131 Writer 60 added to the library book named: text_60_16.
At 1607832131 Writer 20 added to the library book named: text_20_20.
At 1607832131 Reader 57 readed the book named: text_66_7.
At 1607832131 Reader 17 readed the book named: text_14_12.
At 1607832131 Writer 8 added to the library book named: text_8_23.
At 1607832131 Reader 20 readed the book named: text_14_8.
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At 1607832131 Writer 69 added to the library book named: text_69_18.
At 1607832131 Writer 66 added to the library book named: text_66_16.
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At 1607832131 Reader 8 readed the book named: text_63_7.

At 1607832131 Reader 66 readed the book named: text_57_10.
At 1607832131 Writer 17 added to the library book named: text_17_21.
At 1607832131 Writer 63 added to the library book named: text_63_19.
At 1607832131 Reader 11 readed the book named: text_20_15.
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At 1607832131 Writer 14 added to the library book named: text_14_22.
At 1607832131 Writer 60 added to the library book named: text_60_17.
At 1607832131 Writer 20 added to the library book named: text_20_21.
At 1607832131 Reader 57 readed the book named: text_69_2.
At 1607832131 Reader 17 readed the book named: text_20_5.
At 1607832131 Writer 8 added to the library book named: text_8_24.
At 1607832131 Reader 20 readed the book named: text_17_5.
At 1607832131 Reader 60 readed the book named: text_8_2.
At 1607832131 Writer 69 added to the library book named: text_69_19.
At 1607832131 Writer 66 added to the library book named: text_66_17.
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At 1607832131 Reader 66 readed the book named: text_8_21.
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At 1607832131 Writer 57 added to the library book named: text_57_18.
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At 1607832131 Reader 20 readed the book named: text_20_10.
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At 1607832131 Reader 11 readed the book named: text_17_10.

At 1607832131 Reader 69 readed the book named: text_11_8.
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At 1607832131 Writer 11 added to the library book named: text_11_25.
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At 1607832131 Reader 14 readed the book named: text_8_19.

At 1607832131 Writer 14 added to the library book named: text_14_26.
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At 1607832131 Writer 66 added to the library book named: text_66_22.
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At 1607832131 Writer 17 added to the library book named: text_17_27.
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At 1607832131 Reader 17 readed the book named: text_69_7.
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At 1607832131 Reader 60 readed the book named: text_66_5.
At 1607832131 Writer 69 added to the library book named: text_69_25.
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At 1607832131 Writer 57 added to the library book named: text_57_24.
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At 1607832131 Writer 20 added to the library book named: text_20_28.
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At 1607832131 Writer 66 added to the library book named: text_66_24.
At 1607832131 Reader 63 readed the book named: text_17_2.
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At 1607832131 Reader 66 readed the book named: text_17_5.
At 1607832131 Writer 17 added to the library book named: text_17_29.
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At 1607832131 Writer 66 added to the library book named: text_66_25.
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At 1607832131 Reader 66 readed the book named: text_60_10.
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At 1607832132 Writer 5 added to the library book named: text_5_1.
At 1607832132 Writer 2 added to the library book named: text_2_1.
At 1607832132 Reader 48 readed the book named: text_11_19.

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At 1607832132 Writer 42 added to the library book named: text_42_1.
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At 1607832132 Writer 91 added to the library book named: text_91_1.
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At 1607832132 Reader 5 readed the book named: text_11_28.
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At 1607832132 Reader 97 readed the book named: text_20_20.
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At 1607832133 Writer 36 added to the library book named: text_36_1.
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At 1607832135 Reader 66 readed the book named: text_57_4.
At 1607832135 Reader 63 readed the book named: text_66_22.
At 1607832135 Writer 63 added to the library book named: text_63_30.
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At 1607832135 Writer 9 added to the library book named: text_9_1.
At 1607832135 Writer 52 added to the library book named: text_52_1.
At 1607832135 Writer 49 added to the library book named: text_49_1.
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At 1607832135 Writer 6 added to the library book named: text_6_1.
At 1607832135 Writer 0 added to the library book named: text_0_1.
At 1607832135 Writer 46 added to the library book named: text_46_1.
At 1607832135 Writer 58 added to the library book named: text_58_1.
At 1607832135 Reader 6 readed the book named: text_20_21.
At 1607832135 Writer 98 added to the library book named: text_98_1.
At 1607832135 Reader 3 readed the book named: text_66_26.
At 1607832135 Reader 0 readed the book named: text_8_16.
At 1607832135 Writer 95 added to the library book named: text_95_1.
At 1607832135 Reader 9 readed the book named: text_11_24.
At 1607832135 Reader 55 readed the book named: text_67_1.

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At 1607832135 Reader 52 readed the book named: text_11_19.
At 1607832135 Reader 49 readed the book named: text_73_1.
At 1607832135 Reader 46 readed the book named: text_69_9.
At 1607832135 Reader 58 readed the book named: text_63_15.
At 1607832135 Reader 98 readed the book named: text_66_19.
At 1607832135 Reader 95 readed the book named: text_20_6.
At 1607832136 Reader 8 readed the book named: text_11_24.
At 1607832136 Writer 57 added to the library book named: text_57_28.
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At 1607832136 Writer 40 added to the library book named: text_40_1.
At 1607832136 Writer 48 added to the library book named: text_48_2.
At 1607832136 Writer 43 added to the library book named: text_43_1.
At 1607832136 Writer 5 added to the library book named: text_5_2.
At 1607832136 Writer 31 added to the library book named: text_31_1.
At 1607832136 Writer 37 added to the library book named: text_37_1.
At 1607832136 Writer 34 added to the library book named: text_34_1.
At 1607832136 Reader 48 readed the book named: text_11_25.
```

2. **Ввод:** 1 1 5
   Пример ожидаемого вывода:

```
At 1607832313 Reader 0 readed the book named: Welcome!.
At 1607832313 Writer 0 added to the library book named: text_0_1.
```

3. **Ввод:** 1 2
   Пример ожидаемого вывода:

```
At 1607832397 Reader 0 readed the book named: Welcome!.
At 1607832397 Writer 0 added to the library book named: text_0_1.
At 1607832400 Reader 0 readed the book named: text_0_1.
At 1607832400 Reader 1 readed the book named: Welcome!.
At 1607832400 Writer 1 added to the library book named: text_1_1.
At 1607832400 Writer 0 added to the library book named: text_0_2.
```

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