

CCC '24 S4 - Painting Roads

Time limit: 3.0s **Memory limit:** 1G

Canadian Computing Competition: 2024 Stage 1, Senior #4

Alanna, the mayor of Kitchener, has successfully improved the city's road plan. However, a travelling salesperson from the city of RedBlue complained that the roads are not colourful enough. Alanna's second job is to paint some of the roads.

Kitchener's road plan can be represented as a collection of N intersections with M roads, where the i^{th} road connects intersections u_i and v_i . All roads are initially grey. Alanna would like to paint some of the roads in red or blue such that the following condition is satisfied:

- Whenever there is a grey road that connects u_i and v_i , there is also a path of roads from u_i to v_i such that the roads on the path alternate between red and blue, without any of the roads on this path being grey.

To lower the city's annual spending, Alanna would like to minimize the number of painted roads. Can you help Alanna design a plan that meets all the requirements?

Input Specification

The first line contains two integers N and M ($1 \leq N, M \leq 2 \cdot 10^5$).

The i^{th} of the next M lines contains two integers u_i and v_i , meaning that there exists a road from intersection u_i to intersection v_i ($1 \leq u_i, v_i \leq N, u_i \neq v_i$).

There is at most one road between any unordered pair of intersections.

The following table shows how the available 15 marks are distributed:

Marks	Additional Constraints
2	There is a road connecting intersection i with intersection $i + 1$ for all $1 \leq i < N$ (and possibly other roads).
3	We can reach any intersection from any other intersection, and $N = M$.
3	No road belongs to two or more simple cycles (see Definition below).
7	None

Definition: if we denote a road between intersections u and v as $u \leftrightarrow v$, then a *simple cycle* is a sequence $w_1 \leftrightarrow w_2 \leftrightarrow \dots \leftrightarrow w_k \leftrightarrow w_1$ where $k \geq 3$ and all w_i are distinct.

Output Specification

Output a string of M characters, representing the paint plan. The i^{th} character should be **R** if the i^{th} road is to be painted red, **B** if i^{th} road is to be painted blue, or **G** (for "grey") if the i^{th} road is to be left unpainted.

Remember that you must minimize the number of painted roads while satisfying the condition. If there are multiple possible such plans, output any of them.

Sample Input 1

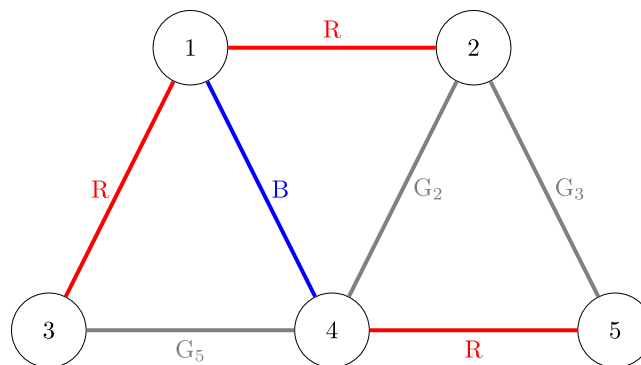
```
5 7
1 2
2 4
5 2
4 5
4 3
1 3
1 4
```

Output for Sample Input 1

```
RGGRGRB
```

Explanation of Output for Sample Input 1

A diagram of the intersections along with a valid paint plan that minimizes the number of painted roads is shown below. Note that the colours are shown on each road as **R** (red), **B** (blue), or **G** (grey).



All the unpainted roads satisfy the condition:

- The 2nd road, labelled G_2 , connects intersection 2 with intersection 4. The path through intersections 2, 1, 4 alternates red, blue.
- The 3rd road, labelled G_3 , connects intersection 5 with intersection 2. The path through intersections 5, 4, 1, 2 alternates red, blue, red.

- The 5th road, labelled G_5 , connects intersection 4 with intersection 3. The path through intersections 4, 1, 3 alternates blue, red.

Sample Input 2

```
4 2
1 2
3 4
```

Output for Sample Input 2

```
BB
```

Explanation of Output for Sample Input 2

Note that it is possible for Kitchener to be disconnected.