G - Count Cycles

Editorial (/contests/abc411/tasks/abc411_g/editorial)

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Time Limit: 6 sec / Memory Limit: 1024 MiB

Score : 600 points

Problem Statement

There is an undirected graph G with N vertices and M edges. G does not contain self-loops, but may contain multi-edges. Vertices are numbered from 1 to N, and edges are numbered from 1 to M, with edge i connecting vertices U_i, V_i.

Find the number, modulo 998244353, of cycles contained in G.

More formally, find the number, modulo 998244353, of subsets $\{e_1, e_2, \ldots, e_k\} \subseteq \{1, 2, \ldots, M\}$ $(k \geq 2)$ of the given edge set that satisfy the following condition.

- There exists a permutation $(e'_1, e'_2, \ldots, e'_k)$ of $(e_1, e_2, \ldots, e_k)$ and a vertex sequence $(v_1, v_2, \ldots, v_k)$ such that all of the following hold:
  - $v_1, v_2, \ldots, v_k$ are pairwise distinct;
  - For all j $(1 \leq j \leq k)$, edge e'_j connects vertices $v_j, v_{(j \bmod k)+1}$.

Constraints

- $2 \leq N \leq 20$
- $2 \leq M \leq 2 \times 10^5$
- $1 \leq U_i < V_i \leq N$
- All input values are integers.

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Input

The input is given from Standard Input in the following format:

$$
\begin{array}{ll}
N & M \\
U_1 & V_1 \\
U_2 & V_2 \\
\vdots & \\
U_M & V_M
\end{array}
$$

Output

Output the answer.

Sample Input 1 Copy

Copy

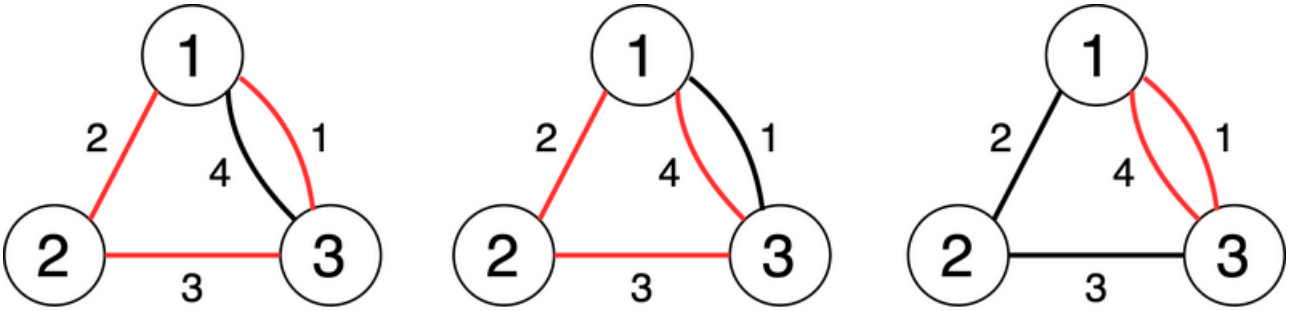
```
3 4
1 3
1 2
2 3
1 3
```

Sample Output 1 Copy

Copy

```
3
```

As shown in the figure below, there are a total of 3 cycles. The numbers inside the circles and the numbers next to the lines represent vertex numbers and edge numbers, respectively. Red lines represent edges included in cycles, and black lines represent the other edges.



From left to right, these correspond to choosing edge sets $\{1, 2, 3\}$, $\{2, 3, 4\}$, $\{1, 4\}$, respectively.

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Sample Input 2 Copy

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

Sample Output 2 Copy

```
0
```

Sample Input 3 Copy

```
5 15
1 5
3 4
2 3
2 4
3 5
4 5
2 5
2 3
1 3
4 5
2 5
4 5
1 2
3 4
1 5
```

Sample Output 3 Copy

```
166
```

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