



USACO 2021 JANUARY CONTEST, PLATINUM PROBLEM 1. SUM OF DISTANCES

[Return to Problem List](#)

Contest has ended.

[Log in to allow submissions in analysis mode](#)

English (en) ▾

Bessie has a collection of connected, undirected graphs G_1, G_2, \dots, G_K ($2 \leq K \leq 5 \cdot 10^4$). For each $1 \leq i \leq K$, G_i has exactly N_i ($N_i \geq 2$) vertices labeled $1 \dots N_i$ and M_i ($M_i \geq N_i - 1$) edges. Each G_i may contain self-loops, but not multiple edges between the same pair of vertices.

Now Elsie creates a new undirected graph G with $N_1 \cdot N_2 \dots N_K$ vertices, each labeled by a K -tuple (j_1, j_2, \dots, j_K) where $1 \leq j_i \leq N_i$. In G , two vertices (j_1, j_2, \dots, j_K) and (k_1, k_2, \dots, k_K) are connected by an edge if for all $1 \leq i \leq K$, j_i and k_i are connected by an edge in G_i .

Define the *distance* between two vertices in G that lie in the same connected component to be the minimum number of edges along a path from one vertex to the other. Compute the sum of the distances between vertex $(1, 1, \dots, 1)$ and every vertex in the same component as it in G , modulo $10^9 + 7$.

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains K , the number of graphs.

Each graph description starts with N_i and M_i on a single line, followed by M_i edges.

Consecutive graphs are separated by newlines for readability. It is guaranteed that $\sum N_i \leq 10^5$ and $\sum M_i \leq 2 \cdot 10^5$.

OUTPUT FORMAT (print output to the terminal / stdout):

The sum of the distances between vertex $(1, 1, \dots, 1)$ and every vertex that is reachable from it, modulo $10^9 + 7$.

SAMPLE INPUT:

```
2
2 1
1 2
```

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

SAMPLE OUTPUT:

```
4
```

G contains $2 \cdot 4 = 8$ vertices, 4 of which are not connected to vertex $(1, 1)$. There are 2 vertices that are distance 1 away from $(1, 1)$ and 1 that is distance 2 away. So the answer is $2 \cdot 1 + 1 \cdot 2 = 4$.

SAMPLE INPUT:

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

3 4

6 5

1 2

2 3

3 4

4 5

5 6

7 7

1 2

2 3

3 4

4 5

5 6

6 7

7 1

SAMPLE OUTPUT:

706

G contains $4 \cdot 6 \cdot 7 = 168$ vertices, all of which are connected to vertex $(1, 1, 1)$. The number of vertices that are distance i away from $(1, 1, 1)$ for each $i \in [1, 7]$ is given by the i -th element of the following array: $[4, 23, 28, 36, 40, 24, 12]$.

SCORING:

- Test cases 3-4 satisfy $\prod N_i \leq 300$.
- Test cases 5-10 satisfy $\sum N_i \leq 300$.
- Test cases 11-20 satisfy no additional constraints.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.