Problem 8: O(ski)
12 Points

Problem ID: `skiing`
Rank: `3`

Introduction

After the tremendous success of CALICO Fall '22, the CALICO Team decides to open their own ski resort! Ski trails in the U.S. are given one of four difficulty ratings, represented by a shape and color: green circle (easy), blue square (more difficult), black diamond (most difficult), and double black diamond (experts only). The CALICO Team, always in need of the attention and approval of others, have found a way to create ski trails with difficulty ratings in the hundreds! They've already gone through and labeled all the ski trails' difficulties, but unfortunately, they've just discovered a major flaw in their rating system; each trail has a difficulty rating just based on how hard that individual trail is to ski—this means some trails might lead to places that force you to ski down a harder trail to reach the bottom of the mountain. Hope you don't get stuck!

Problem Statement

Given a mountain range with $\mathbf{N}$ checkpoints and $\mathbf{M}$ trails between them, find the **true difficulty** of each trail.

Checkpoints are numbered from 1 to $\mathbf{N}$, and trails are numbered from 1 to $\mathbf{M}$. Each trail i goes one-way from checkpoint $\mathbf{X}_i$ to checkpoint $\mathbf{Y}_i$, and requires a skill level of $\mathbf{Z}_i$ to traverse. However, the **true difficulty** of a trail is the minimum skill level required for a person to ski the trail and eventually reach a lodge.

A lodge is present at a checkpoint if there are no outgoing trails from it.

Input Format

The first line of the input contains an integer $\mathbf{T}$ denoting the number of test cases that follow.
For each test case:

- The first line contains two space-separated integers $\mathbf{N}$ $\mathbf{M}$, where:
  - $\mathbf{N}$ denotes the number of checkpoints on the mountain.
  - $\mathbf{M}$ denotes the number of available trails between checkpoints.
- The next $\mathbf{M}$ lines each contain three space-separated integers $\mathbf{X_i}$ $\mathbf{Y_i}$ $\mathbf{Z_i}$ representing trail i:
  - $\mathbf{X_i}$ denotes the checkpoint at the start of the ith trail.
  - $\mathbf{Y_i}$ denotes the checkpoint at the end of the trail.
  - $\mathbf{Z_i}$ denotes the skill level needed to traverse the trail.

Output Format

For each test case, output a space-separated list $\mathbf{M}$ integers $\mathbf{D_1}$ $\mathbf{D_2}$ … $\mathbf{D_M}$, where $\mathbf{D_i}$ is the true difficulty of trail i.

Constraints

$1 \leq \mathbf{T} \leq 100$
$2 \leq \mathbf{N} \leq 10^5$
$1 \leq \mathbf{M} \leq 10^5$
$1 \leq \mathbf{Z_i} \leq 10^3$ for all i
The sum of $\mathbf{N}$ across all test cases in an input file does not exceed 10^5.
The sum of $\mathbf{M}$ across all test cases in an input file does not exceed 10^5.
Each checkpoint is connected to at least one trail.
No more than one trail exists between any two checkpoints.
Trails will not form cycles. In other words, it will never be possible to re-enter a checkpoint once you have left it.

Sample Test Cases

Sample Input *Download*

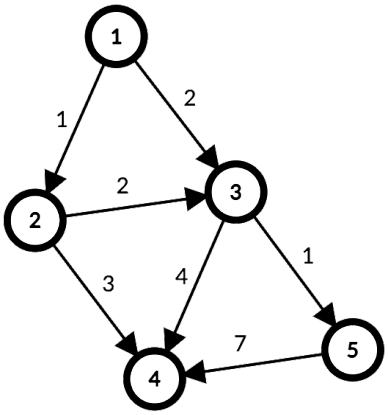
```
3
5 7
1 2 1
1 3 2
2 3 2
2 4 3
3 4 4
5 4 7
3 5 1
4 6
2 4 2
2 1 2
2 3 4
4 1 1
4 3 3
1 3 4
10 11
4 3 3
4 1 1
9 6 4
3 5 9
1 5 2
5 2 3
5 8 2
6 8 2
2 7 1
8 7 4
8 10 3
```

Sample Output *Download*

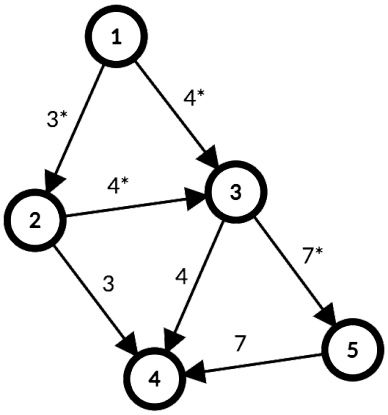
```
3 4 4 3 4 7 7
3 4 4 4 3 4
9 3 4 9 3 3 3 3 1 4 3
```

Sample Explanations

Test Set #1:
The mountain range looks like this:



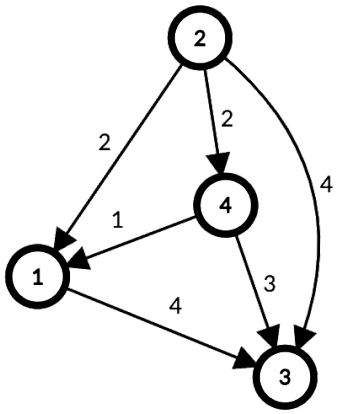
After re-labeling the trails with their true difficulties, the mountain range looks like this (re-labeled trails are followed by an asterisk):



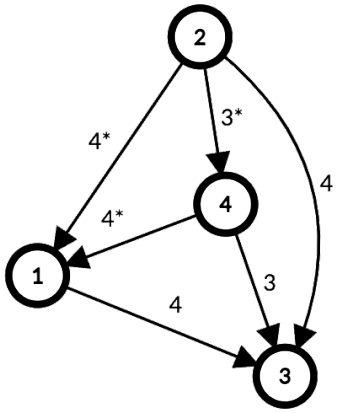
Each trail's minimum-skill path to a lodge is:
1. Trail 1 → 2: 1 → **2 → 4**
2. Trail 1 → 3: 1 → **3 → 4**
3. Trail 2 → 3: 2 → **3 → 4**
4. Trail 2 → 4: **2 → 4**
5. Trail 3 → 4: **3 → 4**
6. Trail 5 → 4: **5 → 4**
7. Trail 3 → 5: 3 → **5 → 4**

Underlined and bolded portions of paths determine the true difficulty for each trail.

Test Set #2:
The mountain range looks like this:



After re-labeling the trails with their true difficulties, the mountain range looks like this (re-labeled trails are followed by an asterisk):

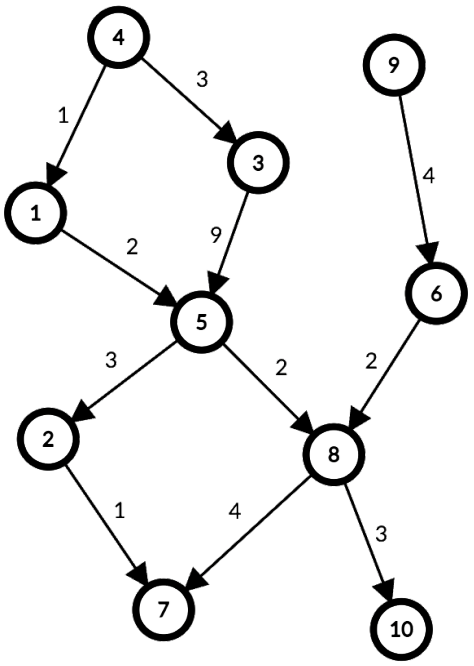


Each trail's minimum-skill path to a lodge is:
1. Trail 2 → 4: 2 → **4 → 3**
2. Trail 2 → 1: 2 → **1 → 3**
3. Trail 2 → 3: **2 → 3**
4. Trail 4 → 1: 4 → **1 → 3**
5. Trail 4 → 3: **4 → 3**
6. Trail 1 → 3: **1 → 3**

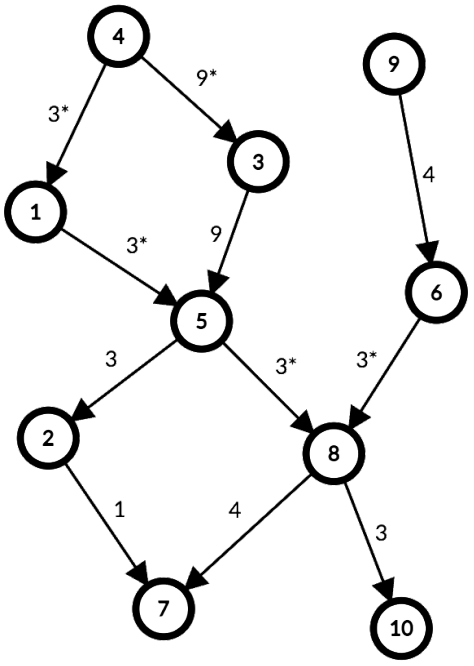
Underlined and bolded portions of paths determine the true difficulty for each trail.

Test Set #3:

The mountain range looks like this:



After re-labeling the trails with their true difficulties, the mountain range looks like this (re-labeled trails are followed by an asterisk):



Each trail's minimum-skill path to a lodge is:

1. Trail 4 → 3: 4 → **3 → 5** → 2 → 7
   4 → **3 → 5** → 8 → 7
   4 → **3 → 5** → 8 → 10
2. Trail 4 → 1: 4 → 1 → **5 → 2** → 7
   4 → 1 → 5 → **8 → 10**
3. Trail 9 → 6: **9 → 6** → **8 → 7**
   9 → 6 → 8 → 10
4. Trail 3 → 5: **3 → 5** → 2 → 7
   3 → 5 → 8 → 7
   3 → 5 → 8 → 10
5. Trail 1 → 5: 1 → **5 → 2** → 7
   1 → 5 → **8 → 10**
6. Trail 5 → 2: 5 → **2 → 7**
7. Trail 5 → 8: 5 → **8 → 10**
8. Trail 6 → 8: 6 → **8 → 10**
9. Trail 2 → 7: **2 → 7**
10. Trail 8 → 7: **8 → 7**
11. Trail 8 → 10: **8 → 10**

Underlined and bolded portions of paths determine the true difficulty for each trail.