

Problem 3 – Message Sharing

A **social network** consists of **people** and some of them are **friends**. Initially a **message** is shared with some of the people. At each step, each person who knows the message, shares it with all of his friends. Calculate the **number of steps** needed for the message **reach all the people** in the network or find that some people are **unreachable**.

Input

- The input data should be read from the console. It consists of exactly 3 lines, described below.
- Line #1** holds the people names in format **"People: person1, person2, person3, ..."**
- Line #2** holds the people's connections in format **"Connections: personA - personB, personC - personD, personE - personF, ..."**.
- Line #3** holds the people who initially receive the message in format **"Start: person1, person2, ..."**.
- Line #2 and Line #3 can hold only persons mentioned at Line #1. Person names are unique (no duplicates).

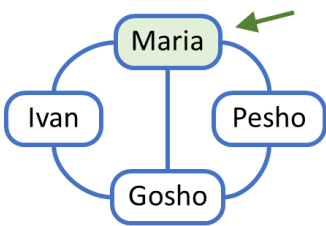
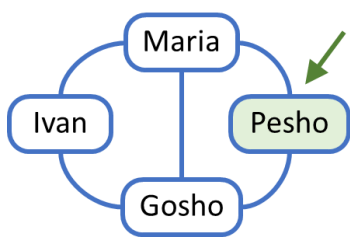
Output

- In case all people are **reachable**
 - Print at the first line at the console the **minimum number of steps** needed to reach all people in format **"All people reached in X steps"**, where **X** is the number of steps.
 - Print at the next line at the console the **people who received the message at the last step** in alphabetical order in format **"People at last step: person1, person2, ..."**.
- In case some people are **unreachable**, print them at the console in **alphabetical order** in format **"Cannot reach: person1, person2, ..."**.

Constraints

- The number of **people** is in range [1 ... 500].
- The number of **connections** is in the range [1 ... 10 000].
- The number of **initial people** who receive the message is in the range [1 ... 500].
- Person names** consist of Latin letters and digits and are case-sensitive. Examples of **valid** names: **"Nakov"**, **"SoftUni"**, **"nakov"**, **"nak2"**. Examples of **invalid** names: **"Svetlin Nakov"**, **"bat_pesho"**, **"one,two"**.
- Time limit: **150 ms**. Allowed memory: **24 MB**.

Examples

Input	The Network	Explanation
People: Pesho, Maria, Ivan, Gosho Connections: Pesho - Gosho, Maria - Ivan, Ivan - Gosho, Pesho - Maria, Maria - Gosho Start: Maria		At step #0 Maria receives the message. At step #1 Maria tells the message to her direct friends Ivan, Pesho and Gosho. The message reaches the entire network in just 1 step.
Output		
All people reached in 1 steps People at last step: Gosho, Ivan, Pesho		
Input	The Network	Explanation
People: Pesho, Maria, Ivan, Gosho Connections: Pesho - Gosho, Maria - Ivan, Ivan - Gosho, Pesho - Maria Start: Pesho		At step #1 Pesho tells the message to his friends Maria and Gosho. At step #2 Maria and Gosho tell the message to Ivan. The message reaches the entire network in just 2 steps.
Output		
All people reached in 2 steps People at last step: Ivan		

Input	The Network	Explanation
People: Kiril, Stefan, Ivan, Mridul, Arif, Sahil, Steve, Prakash, Misho, Didi, Maria, Diana, Petya, Katya Connections: Mridul - Arif, Steve - Prakash, Steve - Kiril, Kiril - Stefan, Stefan - Ivan, Misho - Ivan, Didi - Misho, Stefan - Didi, Maria - Didi, Petya - Katya, Katya - Didi, Petya - Didi, Diana - Petya, Diana - Maria, Maria - Stefan, Diana - Didi Start: Petya, Arif, Sahil, Steve	<pre> graph TD Sahil --> Arif Arif --> Mridul Arif --> Steve Steve --> Prakash Steve --> Kiril Kiril --> Stefan Stefan --> Ivan Ivan --> Misho Misho --> Didi Didi --> Stefan Didi --> Maria Didi --> Petya Petya --> Katya Katya --> Diana Diana --> Petya Diana --> Maria Maria --> Stefan Maria --> Didi </pre>	Step #0: Petya, Arif, Sahil and Steve receive the message. Step #1: Arif tells to Mridul; Steve tells to Prakash and Kiril; Petya tells to Diana, Katya and Didi. Step #2: Diana and Didi tell to Maria, Kiril and Didi tell to Stefan; Didi tells to Misho. Step #3: Stefan and Misho tell the message to Ivan. Ivan is alone at the last step.
Output		
All people reached in 3 steps People at last step: Ivan		

Input	The Network	Explanation
People: Pesho, Ivan, Maria Connections: Ivan - Maria Start: Maria	<pre> graph TD Ivan --- Maria Pesho </pre>	At step #1 Maria tells the message to Ivan. Maria and Ivan have no more friends to share the message with. Pesho cannot be reached.
Output		
Cannot reach: Pesho		

Input	The Network	Explanation
People: Pesho2, Ivan, Maria Connections: Maria - Ivan Start: Pesho2	<pre> graph TD Ivan --- Maria Pesho2 </pre>	At step #0 Pesho2 receives the message. He has no friends and the message is not shared at all. Ivan and Maria cannot be reached.
Output		
Cannot reach: Ivan, Maria		

Input	The Network	Explanation
People: Pesho, Ivan, Maria Connections: Maria - Ivan Start: Maria, Pesho, Ivan	<pre> graph TD Ivan --- Maria Pesho </pre>	All people in the network initially receive the message. There is no need to share the message, everyone have it. The message reaches all people in the network in 0 steps.
Output		
All people reached in 0 steps People at last step: Ivan, Maria, Pesho		