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**
  1. 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.
  2. 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

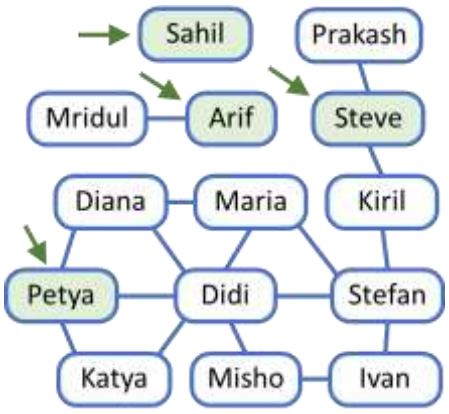
`People: Pesho, Maria, Ivan, Gosho`
`Connections: Pesho - Gosho, Maria - Ivan, Ivan - Gosho, Pesho - Maria, Maria - Gosho`
`Start: Maria`
		At step #0 Maria receives the message.
		At step #1 Maria tells the message to her direct friends Ivan, Pesho and Gosho.
		The message reaches the entire network in just 1 step.

Output		
`All people reached in 1 steps` `People at last step: Gosho, Ivan, Pesho`		

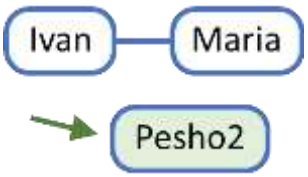
Input	The Network	Explanation

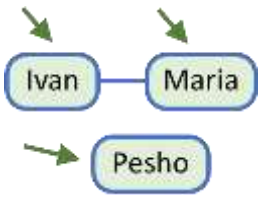
`People: Pesho, Maria, Ivan, Gosho`
`Connections: Pesho - Gosho, Maria - Ivan, Ivan - Gosho, Pesho - Maria`
`Start: Pesho`
		At step #1 Pesho tells the message to his friends Maria and Gosho.
		At step #2 Maria and Gosho tell the message to Ivan.
		The message reaches the entire network in just 2 steps.

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 **Output** All people reached in 3 steps People at last step: Ivan		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.

Input	The Network	Explanation
People: Pesho, Ivan, Maria Connections: Ivan - Maria Start: Maria **Output** Cannot reach: Pesho		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.

Input	The Network	Explanation
People: Pesho2, Ivan, Maria Connections: Maria - Ivan Start: Pesho2 **Output** Cannot reach: Ivan, Maria		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.

Input	The Network	Explanation
People: Pesho, Ivan, Maria Connections: Maria - Ivan Start: Maria, Pesho, Ivan **Output** All people reached in 0 steps People at last step: Ivan, Maria, Pesho		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.