Q11. Robots on Mars (60 marks):

Several robots have landed on Mars and are about to perform a mission. Scientists have marked various areas of Mars with capital letters, and these areas have been verified to be safe. Each robot lands in a different area and must travel to another area. Each area is small and can only accommodate one robot.

Besides, some pathways have also been discovered among these areas. If a robot is assigned to move from area A to area B, there must be a pathway that directly connects these two areas. However, the path is so small that no two robots can pass through it at the same time.

Moreover, the network connection on Mars is very unstable. Therefore, only one robot can move at a time to avoid potential collisions. Furthermore, the pathway on Mars is relatively dangerous and might damage robots; therefore, once a robot leaves its initial area, it needs to move to the target area as quickly as possible and cannot stop on the pathway between those areas. Only when the robot arrives at the target area, then it can stop and stay safely in that area. As a result, when a robot moves from one area to another, both areas and the pathway between the areas can only have one robot, which is the moving robot; otherwise one of the robots might be in danger.

Scientists do not know if the Mars mission will be successful because they do not know if all the robots will reach their respective destinations under the above constraints. If there is a way to get all the robots to complete the mission, then the Mars mission can be a success. Any robot that fails to reach its destination will fail the overall mission. Now, scientists need your help to check if robots are up to the task of Mars.

Example 1:

The first robot plans to move from A to B, while the second robot plans to move from B to A. The Mars mission will fail - there is no way for those robots to reach their destinations without violating the constraints mentioned.

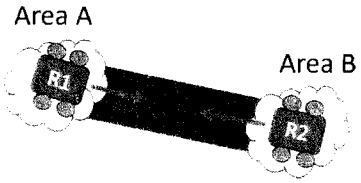

Figure 11(a): Mission fails because some robot(s) cannot reach the destination(s)

Example 2:

The first robot plans to move from A to B, while the second robot plans to move from B to C. The second robot can move first to vacant Area B, then the first robot can move from A to B. Since no constraint will be violated, the Mars mission can be successful.

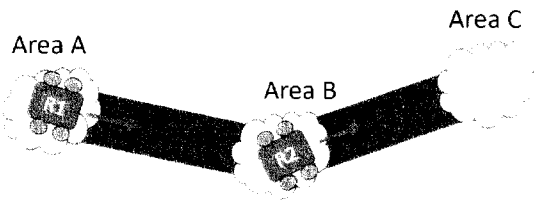

Figure 11(b): Mission succeeds because all robot(s) can reach the destination(s)

Write a programme to

Input, in sequence,

(1) The first line is the number of robots, $\breve{K}$, where $1 \leq \breve{K} \leq 8$.

(2) Each of the following $\breve{K}$ lines consists of information on how the corresponding robot should travel on Mars. That is, for line i, where $1 \leq i \leq \breve{K}$

a. There is an integer $\breve{A}_i$, which indicates how many areas that robot i needs to travel, from the starting area to the destination area, where $2 \leq \breve{A}_i \leq 3$. Note that after robot i has left an area, it may re-visit the area afterwards if there is a need.

b. In the same line, the next are $\breve{A}_i$ characters, separated with spaces, and each character represents a specific area; thus the sequence of these characters represents the sequence of areas that the robot i needs to visit from the starting area to the destination area. Note that a character may appear more than once in the sequence but no similar characters can be placed next to each other.

Output:

Display "0" if the Mars Mission fails; display "1" if it can be successful.

试题 11. 火星上的机器人 (60 分):

在一项火星任务中，几个机器人被派往并已经登陆了火星。科学家用大写字母标记了火星的各个安全区，而每个机器人都降落在不同的安全区，并且被指示前往另一个安全区。每个安全区都很小，最多只能容纳一个机器人。

此外，科学家也在安全区之间发现了一些路径。如果一个机器人被指示从区域 A 移动到区域 B，则必然有一条路径直接连接这两个区域。然而，路径的宽度也很小，只能最多容纳一个机器人通过。

另一方面，火星上的无线通讯很不稳定。因此，科学家一次只能控制一个机器人以避免发生碰撞。同时，火星上的路径也有些危险，可能会损坏机器人；有鉴于此，一旦机器人离开其初始区域，它需要尽快移动到目标区域，并且不能在这些区域之间的路径上停下来。只有在抵达安全区后，机器人才能停留。因此，当机器人从一个区域移动到另一个区域时，两个区域以及区域之间的路径只能有一个机器人，即移动中机器人，要不然其中一个机器人就可能发生危险。

科学家们不知道火星任务是否会成功，因为他们不知道所有机器人是否会在上述限制下到达各自的目的地。如果有办法让所有机器人完成任务，那么火星任务就可以成功。然而只要任何一个机器人未能到达目的地，这都将导致整个任务失败。现在，科学家需要你的帮助来推算是否所有机器人都能够顺利完成这一项火星任务。

示例 1:

第一个机器人计划从 A 移动到 B，而第二个机器人计划从 B 移动到 A。火星任务将失败 - 这些机器人无法在不违反上述限制的情况下到达目的地。

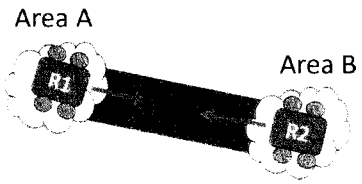

图 11(a): 任务失败，因为某些机器人无法到达目的地

示例 2:

第一个机器人计划从 A 移动到 B，而第二个机器人计划从 B 移动到 C。第二个机器人可以先移动，接着第一个机器人移动。这不会违反任何限制；所以火星任务可以成功。

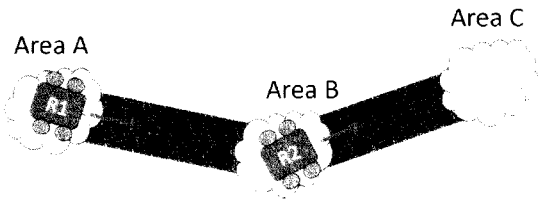

图 11(b)：任务成功，因为所有机器人都可以顺利到达目的地

试写一程式以

依序输入：

（1） 第一行是机器人的数量，$\check{K}$，其中 $1 \leqslant \check{K} \leqslant 8$。

（2） 接着是 $\check{K}$ 行的输入，每一行包含了有关机器人应如何在火星上移动的信息。也就是说，令 $1 \leqslant i \leqslant \check{K}$，第 i 行包含了：

a. 首先是一个整数 $\check{A}_i$，表示机器人 i 需要经过多少个安全区，这也包括了起始和终点安全区，且已知 $2 \leqslant \check{A}_i \leqslant 3$。值得注意的是，机器人 i 在离开一个区域后，如有需要的话，它是有可能再重访这个区域的。

b. 在同一行中，接下来是以空格分隔的 $\check{A}_i$ 个字符，而每个字符代表了一个特定的区域；因此这些字符的顺序就代表了机器人 i 从起始区域到终点区域、所到访区域的顺序。请注意，一个字符可能在序列中出现多次，但相同的字符不能彼此相邻。

输出：

如果火星任务失败则显示 “0”； 反之，若任务可以成功则显示 “1”。

Example (例子)

Input (輸入)	Output (輸出)
2 2 A B 2 B A	0
2 2 A B 2 B C	1
2 3 A B D 3 C B A	1
8 3 E D B 3 C B A 3 B D C 3 F C G 3 G K F 3 H I E 3 L M N 3 N M O	1
8 3 A B D 3 B C D 3 C D E 3 D E F 3 E F G 3 F G H 3 H I J 3 I J K	0
3 3 A B C 3 D C B 2 E F	0