Question 0 – Hello World

(30 points)

Introduction

YTP Contest has started!

Let's verify everything first.
Is the internet setting correct?
Is the answer submit working well?
Did you use STDOUT to output your answers?

If everything is ready, 30 points are yours! Go! Go! Go!

Description

Please write a program to output Hello World!

Input Format

This problem requires no input.

Output Format

[A~Z][a~z], space, and common English punctuation.

Data Range

[A~Z][a~z], space, and exclamation mark "!".

Data Examples

Input Example 1
(no input)

Output Example 1
Hello World!

Example Explanation

Input Example 1 has no input, simply output Hello World!

送分題 – Hello World

(30 分)

前言
比賽開始了！

趕快驗證一下，
網路是否設定正確?
上傳競賽程式是否順利?
程式解答是否用 STDOUT 輸出？

都沒問題，30 分就到手了！ 繼續 … 衝！衝！衝！

問題描述
請寫一個程式輸出 Hello World!

輸入格式
本題無需輸入值

輸出格式
[A~Z][a~z], 空格, 以及及常用英文符號 。

資料範圍
[A~Z][a~z], 空格, 以及驚嘆號 “!”

資料範例
輸入範例 1
(無輸入值)

輸出範例 1
Hello World!

範例解釋
輸入範例 1, 無輸入值，簡單而快樂的輸出 Hello World!

Q1: Hello? Hallo?

(5 points)

Description

You encounter a person. You think that he must be either an American or a German, but you can not so sure. With the greeting he says to you, please reply to him in the same language.

Input Format

There is only one line.
If he is an American, he will say “I am *Name*”, where *Name* is his name.
If he is a German, he will say “Ich bin *Name*”, where *Name* is his name.

Output Format

You should print only one line.
If he is an American, you should reply “Hello,” and “*Name*” separated by a space, where *Name* is his name.
If he is a German, you should reply “Hallo, ” and “*Name*” separated by a space, where *Name* is his name.

Data Range

The length of *Name* will be at least 1 and not exceed 10. *Name* will only contain English alphabet.

Input Example 1

Ich bin V

Output Example 1

Hallo, V

Input Example 2

I am y

Output Example 2

Hello, y

Input Example 3

Ich bin fk

Output Example 3

Hallo, fk

Example Explanation:

Notice that there's difference between **Hello** and **Hallo.**
In Example 1 and Example 3, he is a German.
In Example 2, he is an American.

問題 1 – Hello? Hallo?

(5 分)

問題敘述

你遇到了一個人。你認為他不是美國人就是德國人，但是你無法確定是哪個。請根據他問候你的話，用相同的語言回應他。

輸入格式

輸入只有一行
如果他是美國人，他會說 “I am *Name*” ，其中 *Name* 是他的名字。
如果他是德國人，他會說 “Ich bin *Name*” ，其中 *Name* 是他的名字。

輸出格式

輸出只有一行
如果他是美國人，請回應 “Hello, *Name*” ，其中 *Name* 是他的名字。“Hello,”與”Name”之間以空白間隔。
如果他是德國人，請回應 “Hallo, *Name*” ，其中 *Name* 是他的名字。“Hallo,”與”Name”之間以空白間隔。

資料範圍

Name 的長度至少有 1 並且不會超過 10 。*Name* 只會包含英文字母。

輸入範例 1

Ich bin V

輸出範例 1

Hallo, V

輸入範例 2

I am y

輸出範例 2

Hello, y

輸入範例 3

Ich bin fk

輸出範例 3

Hallo, fk

範例說明

注意到 **Hello** 和 **Hallo** 是不同的。
在第一筆與第三筆範例中，他是德國人。
在第二筆範例中，他是美國人。

Q2: Monster Hunter Stories II

(10 points)

Description

"Monster Hunter Stories II" is a turn-based RPG game just released this summer. Its wonderful story and interesting battle attract people's attention. Arvin is also attracted and bought the game recently. However, he's unfamiliar with the battle system, and he wants you to write a program for him to indicate him how to battle.

During the battle, the player controls the role "rider" and battle against other monsters with the his "monsties". Similar to other turn-based games, both sides decide one action on the beginning of each turn, and the damages are finalized afterwards. For simplicity of this problem, we use the simplified rules as below:

1. There're three types of attacks: Power, Speed and Technical. Speed beats Power, Technical beats Speed and Power beats Technical. On the image below, the red symbol represents Power, the blue one represents Speed, and the green one represents Technical.

2. Both sides can choose only from the three attack types above.
3. After both sides decide their attack types, a winner is selected by the types they play. The winner can cause damage to the loser. If a tie occurs, nothing happens.

With the help of "Navirou" (a Felyne), you already know the attacking types the opposite is going to use for the N-turns battle. However, only when you play a "wonderful play" --- you win on all the turns --- will the prediction be useful. Therefore, please determine which types you need to play to achieve the "wonderful play".

Input Format

The input contains two lines.
On the first line, there's an integer *N* indicating the number of rounds.
On the second line, there're *N* strings separated by spaces. Each string is one of *{"Power", "Speed", "Technical"}*.

Output Format

Please output one line of *N* strings, separated by spaces, representing the type of attack you're going to use during the game. There should NOT be additional space at the end of the line. Also, you need to output a newline character at the end of the line.

Data Range

$1 \le N \le 10^5$

Input Example 1

```
1
Power
```

Output Example 1

```
Speed
```

Input Example 2

```
3
Power Speed Technical
```

Output Example 2

```
Speed Technical Power
```

Input Example 3

```
6
Speed Speed Technical Speed Power Technical
```

Output Example 3

```
Technical Technical Power Technical Speed Power
```

Example Explanation

1. There are only 1 round. The opposite uses "Power", and we respond with a "Speed" to win the battle.
2. There are 3 rounds. The opposite uses "Power, Speed, Technical", and we respond with "Speed, Technical, Power" to win the battle.
3. There are 6 rounds. The opposite uses "Speed, Speed, Technical, Speed, Power, Technical", and we respond with "Technical, Technical, Power, Technical, Speed, Power" to win the battle.

問題 2 – 魔物獵人－物語 II

(10 分)

問題敍述

《魔物獵人－物語 II》是一款今年夏天發行的回合制 RPG 遊戲，其豐富的主線劇情和有趣的戰鬥方式深受大家的喜歡。主要遊玩平台有 PC 和 Nintendo Switch，該作品在兩者的銷量皆有不錯的表現。看到這款遊戲的 Arvin 也立刻下單開始玩，然而他十分不擅長這款遊戲的戰鬥系統，想要請你幫忙撰寫一支程式告訴他要如何戰鬥。

戰鬥時，玩家會操作「騎手」角色與自己的隨行獸挑戰不同的魔物。和其他的回合制 RPG 遊戲類似，雙方會在每一輪選擇一種攻擊方式，之後再進行傷害的結算。為求題目簡單，請以以下規則為主：

4. 總共有三種攻擊型態：力量 (Power)、速度 (Speed)、技巧 (Technical)，其中速度勝過力量、技巧勝過速度、力量勝過技巧。下圖中，紅色代表力量、藍色代表速度、綠色代表技巧，箭頭代表勝過。

5. 每個回合騎手與對方魔物各自選取一個攻擊型態。
6. 雙方決定後，判定輸贏狀態，勝者可以攻擊敗方、平手則沒有攻擊發生。

有了「納比路」（一隻艾路）的幫忙，你已經在戰鬥發生之前就得到對方接下來 N 個回合的攻擊型態。然而，只有在「每個回合都是勝利的情形下」該預測才會是有用的，玩家也才能獲得勝利。因此，請幫忙計算必勝玩法！

輸入格式

輸入總共有兩行。
第一行有一個整數 *N*，代表對決回合的數量。
第二行有一個 *N* 個字串，每個字串代表該回合對手使用的攻擊型態，攻擊型態只會是 *{“Power”, “Speed”, “Technical”}* 其中一種。

輸出格式

請輸出一行，包含 *N* 個攻擊型態。所有輸出兩兩之間使用空格隔開，行尾不能有多餘空格、需換行。

資料範圍

$1 \le N \le 10^5$

輸入範例 1

```
1
Power
```

輸出範例 1

```
Speed
```

輸入範例 2

```
3
Power Speed Technical
```

輸出範例 2

```
Speed Technical Power
```

輸入範例 3

```
6
Speed Speed Technical Speed Power Technical
```

輸出範例 3

```
Technical Technical Power Technical Speed Power
```

範例說明

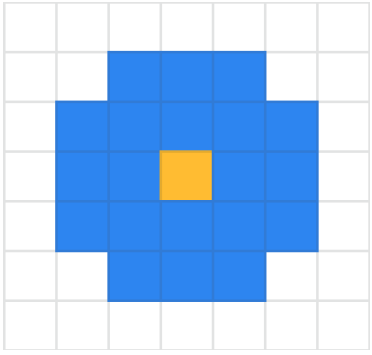
1. 對戰只有一個回合，對方使用「力量」，我方使用「速度」即可全勝。
2. 對戰共有三個回合，對方依序使用「力量、速度、技巧」，我方使用「速度、技巧、力量」即可全勝。
3. 對戰共有六個回合，對方依序使用「速度、速度、技巧、速度、力量、技巧」，我方使用「技巧、技巧、力量、技巧、速度、力量」即可全勝。

Q3: Lightning Spell

(15 points)

Description

Clash of Clans is a real war game. The goal of this game is to destroy all the opponent's buildings. Today, Mr. D and Mr. N are discussing what the optimal strategy to cast the lightning spell is. In order for you to join the discussion, they decided to explain the rules of the game to you. In the game, every clan owns a $N \times N$ village, in which they build M non-overlapping buildings in their village. Each building occupies a 3×3 square. The attacker can cast spells to destroy the buildings. The spell they brew today is the lightning spell. A lightning spell will destroy all the buildings in the area of a 5×5 square with the corners removed (as the following image shows: the orange square is where the lightning spell is cast, and the blue + orange squares are where the lightning spell can hit buildings)



When a lightning spell is cast, any buildings covered by the area will be destroyed. The greedy Mr. D and Mr. N want you to calculate how many buildings they can destroy with a single lightning spell.

(The buildings and the center of the cast spell can't be outside of the village, but the affected area of the lightning spell can lie beyond the boundary)

Input Format

The first line contains two integers N and M — the width of the village and the number of villages.
Next M lines contain buildings — one per line.
Each building contains two integers X and Y — the location of the building.

It's guaranteed that the buildings do not exceed the boundary and do not overlap each other.

Output Format

Print an integer — the most buildings you can destroy with a lightning spell

Data Range

- $1 \leq N \leq 10000$

- $1 \leq M \leq 1000$
- $1 \leq X_i, Y_i \leq N$

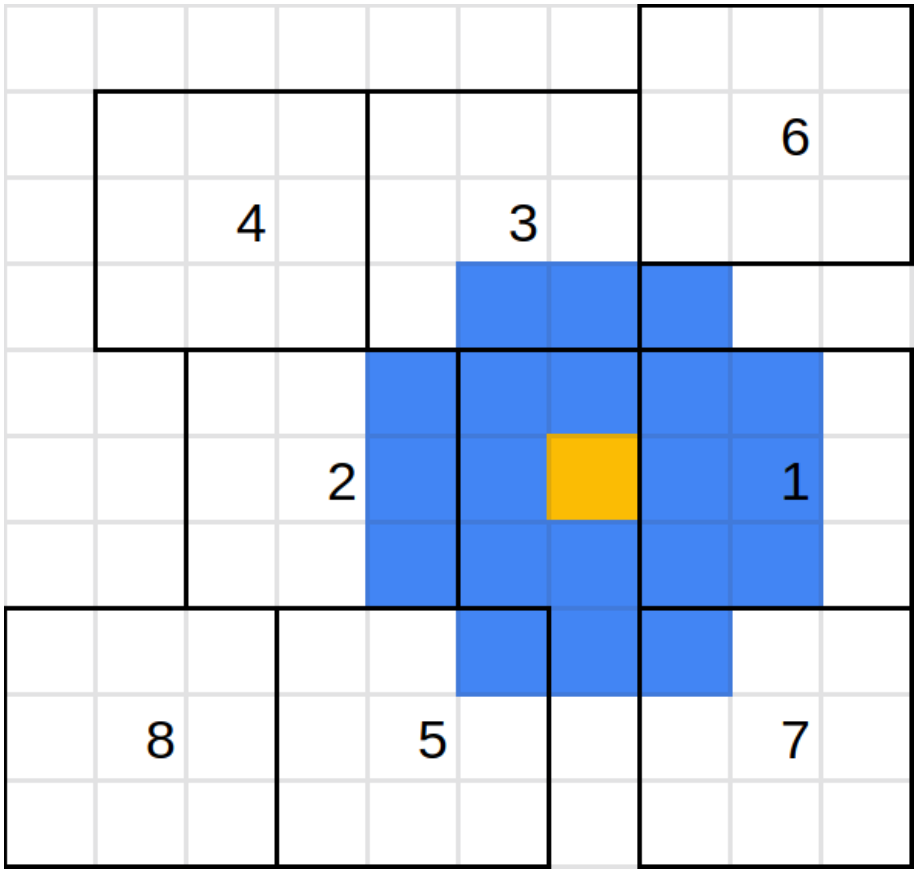
Input Example 1

```
10 8
6 9
6 4
3 6
3 3
9 5
2 9
9 9
9 2
```

Output Example 1

5

Example Explanation:



Input Example 2

```
10 3
8 3
5 2
4 6
```

Output Example 2

```
3
```

Input Example 3

```
10 4
6 8
5 4
3 7
2 4
```

Output Example 3

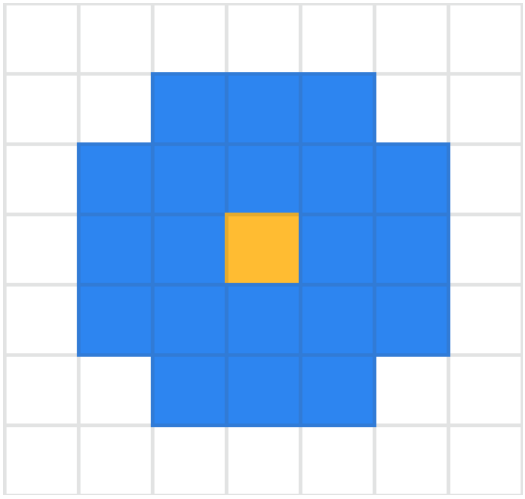
```
4
```

問題 3 – 閃電閃電 (Lightning Spell)

(15 分)

問題敘述

部落衝突是一款真正的戰爭遊戲。這個遊戲的目標是摧毀對手的所有建築物。今天小 D 和小 N 在討論如何施放閃電法術。為了想請你幫忙一起擬定策略，他們決定把遊戲的規則也告訴你。這個遊戲中一個部落是在一個 $N \times N$ 的方格領土上，可以設置 M 個不重疊的建築物，每個建築物都會佔據 3×3 的正方形。在進攻時可以使用法術摧毀建築物，今天小 D 和小 N 想使用閃電法術。閃電法術的作用是摧毀一個去掉四個角落的 5×5 正方內覆蓋到的所有建築物。作用範圍如下圖：



施放法術時，一個建築只要和法術範圍有重疊，就會被摧毀。今天貪心的小 D 和小 N 想要問你，在這個有 M個建築物的部落，施放一次閃電法術最多可以摧毀幾個建築物。

（建築物和法術中心不能超出地圖，但法術範圍「可以」超出地圖）

輸入格式

第一行有兩個正整數 N, M分別代表地圖寬度，和建築物數量
接下來 M 行，每行有兩個整 X_i, Y_i 代表第 i 個建築物的中心

保證建築物不會超出地圖，也不會彼此重疊。

輸出格式

輸出一個正整數代表最多可以摧毀多少建築物。

資料範圍

- $1 \leq N \leq 10000$
- $1 \leq M \leq 1000$
- $1 \leq X_i, Y_i \leq N$

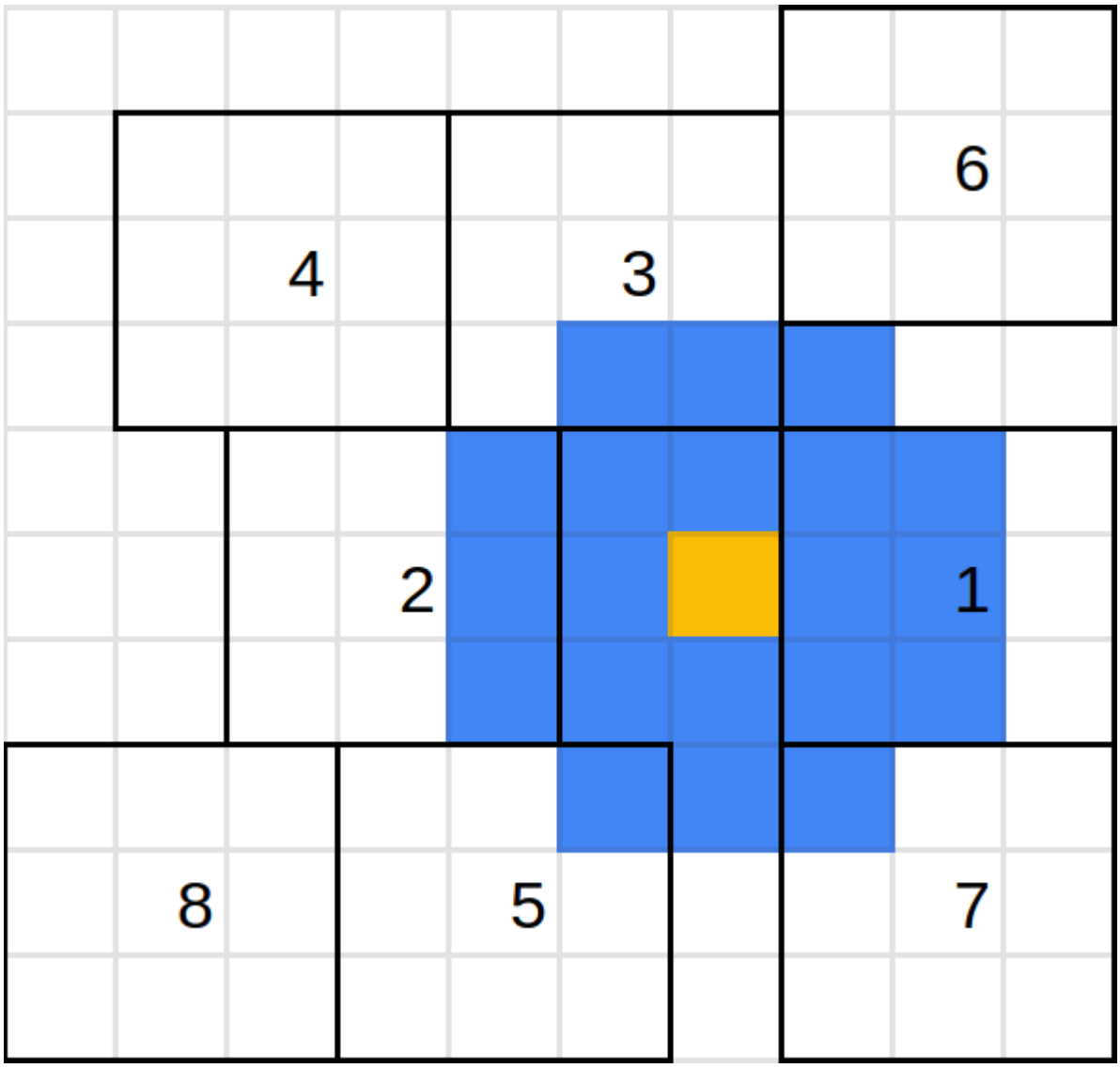
輸入範例 1

```
10 8
6 9
6 4
3 6
3 3
9 5
2 9
9 9
9 2
```

輸出範例 1

```
5
```

範例說明



輸入範例 2

```
10 3
8 3
5 2
4 6
```

輸出範例 2

```
3
```

輸入範例 3

```
10 4
6 8
5 4
3 7
2 4
```

輸出範例 3

```
4
```

Q4: Virus

(15 points)

Description

There is a special virus that divides rapidly every day. There are also k levels of the virus, starting with level 1 and increasing each day until it becomes a level k virus. The speed of virus division can also be distinguished according to the level of the virus.

Specifically, for a level x virus, on the next day the virus will produce x level 1 viruses, and the original virus with level x will become a virus with level $min(x+1, k)$.

So if there are only 1 viruses with level 1 on the first day, how many viruses will be there in total after n days?

Since the exact number of viruses becomes meaningless when the number of viruses is large, if the total number of viruses exceeds $9876543212345678 9$ after n days, the answer is just $9876543212345678 9$.

Input Format

The first line has a positive integer T representing the total number of questions.

In the next T rows, each row has two non-negative integers n_i, k_i representing the number of days asked in this question and the maximum level of the virus.

Output Format

Please output T lines, representing the answers to each question in order.

Data Range

$1 \leq T \leq 300$
$0 \leq n_i \leq 10^9$
$1 \leq k_i \leq 10^9$

Input Example 1

```
2
3 1
2 2
```

Output Example 1

```
8
5
```

Input Example 2

```
2
1 1
1 1
```

Output Example 2

```
2
2
```

Input Example 3

```
1
1000000000 1000000000
```

Output Example 3

```
98765432123456789
```

Example Explanation:

The following numbers are used to indicate the level of the virus. For example, (112) means there are 3 viruses in total, which are level 1, level 1, and level 2 respectively.

The first example has two problems, the first problem has viruses (1) -> (11) -> (1111) -> (11111111) on each day, so there are 8 viruses after 3 days. The second problem has viruses (1) -> (12) -> (11122) on each day, so there are 5 viruses after 2 days.

The second example has two problems, the first problem has viruses (1) -> (11) on each day, so there are 2 viruses after 1 day; and the second problem is the same as the previous one.

The third example has one question. After 1000000000 days, the number of viruses will become very large and much more than 98765432123456789, so the answer is 98765432123456789.

問題 4 – 病毒 (Virus)

(15 分)

問題敘述

有一種特別的病毒，每一天都能夠快速地進行分裂。同時這種病毒還有分等級，等級一共有 k 等，一開始的病毒是 1 等，等級會隨著每天逐漸增加直到成為 k 等的病毒。而根據病毒的等級還可以區分出病毒分裂的速度。

具體來說，對於一個等級 x 等的病毒，到了下一天時這個病毒便會產生出 x 隻等級 1 等的病毒，並且原先這個等級 x 等的病毒將會變成等級 $min(x+1, k)$ 等的病毒。

那麼如果第一天只有 1 隻等級 1 的病毒，經過 n 天後總共會有多少的病毒呢？

由於當病毒的數量很多時，具體有多少病毒也變得沒有意義，因此如果經過 n 天後總共的病毒數量超過 9876543212345678 9 隻的話，直接以 9876543212345678 9 做為答案即可。

輸入格式

第一行有一個正整數 T 代表接下來一共會有 T 個問題。
接下來的 T 行，每行會有兩個非負整數 n_i, k_i 代表在這個問題中詢問的天數以及病毒的最大等級。

輸出格式

請一共輸出 T 行，依序代表每一個問題的答案。

資料範圍

$1 \le T \le 300$
$0 \le n_i \le 10^9$
$1 \le k_i \le 10^9$

輸入範例 1

```
2
3 1
2 2
```

輸出範例 1

```
8
5
```

輸入範例 2

```
2
1 1
1 1
```

輸出範例 2

```
2
2
```

輸入範例 3

```
1
1000000000 1000000000
```

輸出範例 3

```
98765432123456789
```

範例說明

以下分別用數字表示病毒的等級藉此說明，譬如 (112) 代表一共有 3 個病毒，分別是等級 1、等級 1、等級 2。

第一個範例一共有兩個問題，第一個問題中病毒在每一天依序為 (1) -> (11) -> (1111) -> (11111111)，因此三天後一共有 8 隻病毒；第二個問題中病毒在每一天依序為 (1) -> (12) -> (11122)，因此兩天後一共有 5 隻病毒。

第二個範例一共有兩個問題，第一個問題中病毒在每一天依序為 (1) -> (11)，因此一天後一共有 2 隻病毒；而第二個問題則與第一個問題相同。

第三個範例一共有一個問題，在經過 1000000000 天後，病毒已經變得非常非常的多，遠超過 98765432123456789 隻，因此答案是 98765432123456789。

Q5: Olympics

(20 points)

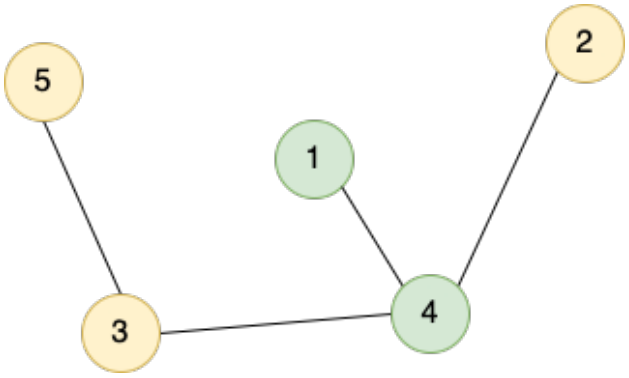
Description

The Olympics are international sporting events where the best players from different countries compete for glory.

This year, Turing Nation is participating in the Olympics. Turing Nation is comprised of N islands, numbered 1 to N, and N-1 bridges connecting the island, in a way that each island can follow a unique path to reach every other island in the nation.

Turing nation is planning to build some players villages and training centers for the players. Each island can be turned into either a players village or a training center. There will be k players participating the Olympics, so Turing nation will build k players villages, one for each player, and build training centers on the rest of the islands.

Now, the k players will leave their village and gather at island 1 to leave for the Olympics. For each training center on their way to island 1 (including island 1 if it is a training center), they will do some training there and gain one point of experience. Turing nation wants to arrange the location of the player villages and the training centers such that when all players reach island 1, the total point of experience of the players is maximized. Can you help them find this value?



The figure above demonstrates the situation in input example 3 (see below). There are three players located on island 2, 3 and 5, which are colored in yellow. As they move to island 1, they all go through the training centers on island 1 and 4, colored in green.

Input Format

The first line of the input contains two positive integers N and K, indicating the number of islands and the number of players.

Each of the following N-1 line contains two integers A and B, indicating a bridge between island A and island B.

Output Format

The maximum total point of experience the players can get.

Data Range

- $1 \leq N \leq 10^5$
- $1 \leq K \leq N$
- $1 \leq A, B \leq N$

Input Example 1

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

Output Example 1

```
1
```

Input Example 2

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

Output Example 2

```
4
```

Input Example 3

```
5 3
2 4
5 3
3 4
1 4
```

Output Example 3

```
6
```

Example Explanation:

In example 1, the players village can be built on island 2 or 3. The player will train at the training center on island 1 and gain one point of experience.

In example 2, the players villages should be built on island 2 and 3. The two players will both have training at the training centers on island 1 and 4, gaining two points of experience each. That results in four points in total.

In example 3, the players villages should be built on island 2, 3 and 5. The three players will have training at the training centers on island 1 and 4, resulting in a total of 6 points of experience.

問題 5 – 奧林匹克 (Olympics)

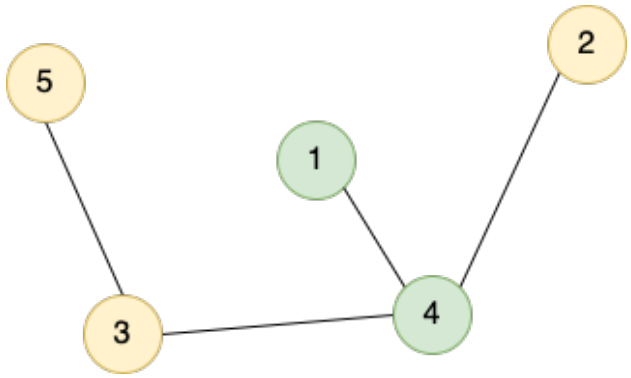
(20 分)

問題敍述

奧林匹克是國際的重大體育競賽活動，各國都會派出最頂尖的好手來爭取榮耀。今年，「圖靈國」也派出了體育好手準備參賽。

圖靈國由 `N` 個島嶼組成，分別編號 `1` 到 `N`，並且有 `N-1` 條橋樑連接著這些島嶼，使得任何一個島嶼都可以透過橋樑到達其他所有島嶼，並且任兩座島嶼之間的路線是唯一的。

圖靈國派出了 `K` 位選手參加奧林匹克，因此圖靈國準備將 `K` 座島嶼建設為選手村，供每位選手一人一間，並將其他所有島嶼建設為訓練中心，讓選手們可以進行訓練。為了出發前往比賽會場，所有選手必須到 `1` 號島嶼集合（這個島嶼可以是選手村也可以是訓練中心），每位選手從各自的選手村出發，沿途經過訓練中心就會進行訓練並獲得一點經驗值。圖靈國相信團結力量大，因此希望所有選手到達 `1` 號島嶼時，他們的經驗值總和越多越好，你可以幫圖靈國規劃每座島嶼的使用方式，使得每位選手的經驗值總和越多越好嗎？



上圖為輸入範例 `3` （見下）的情形。三位選手分別從 `2`、`3`、`5` 號島嶼（塗以黃色者）出發前往 `1` 號島嶼。他們都會經過 `1` 號與 `4` 號島嶼上的訓練中心（塗以綠色者）。

輸入格式

第一行有兩個正整數 `N` 與 `K`，分別代表總共有幾座島嶼與有幾位選手。每做島嶼分別編號 `1` 到 `N`。
接下來的 `N-1` 行，每一行有兩個正整數 `A B`，代表有一座橋連接編號為 `A` 與 `B` 的島嶼。

輸出格式

輸出一個整數代表經驗值總和的最大值。

資料範圍

- $1 \leq N \leq 10^5$
- $1 \leq K \leq N$
- $1 \leq A, B \leq N$

輸入範例 1
```
3 1
3 1
1 2
```

輸出範例 1
```
1
```

輸入範例 2
```
4 2
3 2
1 4
4 2
```

輸出範例 2
```
4
```

輸入範例 3
```
5 3
2 4
5 3
3 4
1 4
```

輸出範例 3
```
6
```

範例說明
在第一個範例中，選擇將選手村蓋在 2 號或是 3 號島嶼，並且讓 1 號島嶼是訓練中心，那麼選手會在 1 號島嶼獲得一點經驗值。

在第二個範例中，將 2 號與 3 號島嶼建為選手村，那麼這兩位選手都分別會經過 1 號與 4 號島嶼的訓練中心，獲得兩點經驗值，達到總和四點經驗值。

在第三個範例中，將 2,3,5 號島嶼建為選手村，則這三位選手都會經過 1 號與 4 號的訓練中心，獲得兩點經驗值。