

# Assignment 1

COMP9021, Trimester 1, 2019

## 1. GENERAL MATTERS

1.1. **Aim.** The purpose of the assignment is to:

解析

- let you design a solution to a problem that requires to parse and analyse text and perform logical computations; 逻辑计算
- let you implement this solution in the form of a short Python program;
- practice reading from a file and making use of, in particular, tests, repetitions, lists, sets, strings, Boolean operators. 练习从文件中读取并使用测试、重复、列表、集合、字符串和布尔运算符

1.2. **Submission.** Your program will be stored in a file named `knights_and_knaves.py`. After you have developed and tested your program, upload it using Ed (unless you worked directly in Ed). Assignments can be submitted more than once; the last version is marked. Your assignment is due by March 31, 11:59pm.

1.3. **Assessment.** The assignment is worth 10 marks. It is going to be tested against a number of input files. For each test, the automarking script will let your program run for 30 seconds.

自动标记脚本

Late assignments will be penalised: the mark for a late submission will be the minimum of the awarded mark and 10 minus the number of full and partial days that have elapsed from the due date.

The outputs of your programs should be **exactly** as indicated.

1.4. **Reminder on plagiarism policy.** You are permitted, indeed encouraged, to discuss ways to solve the assignment with other people. Such discussions must be in terms of algorithms, not code. But you must implement the solution on your own. Submissions are routinely scanned for similarities that occur when students copy and modify other people's work, or work very closely together on a single implementation. Severe penalties apply.

骑士总是讲真话，而骗子总是说谎。我们把骑士和无赖称为先生。  
谜语是一组英语句子，包含有限数量的Sirs。解谜意味着

## 2. GENERAL DESCRIPTION

智力游戏

骑士和无赖

Raymond Smullyan has designed many puzzles involving Knights and Knaves. Knights always tell the truth, whereas Knaves always lie. We refer to Knights and Knaves as Sirs. A puzzle, which is a set of English sentences, involves a finite number of Sirs. Solving the puzzle means:

确定所有参与谜题的先生的名字

- determining the names of all Sirs involved in the puzzle; 确定谜题的解，其中一个解将每个Sir限定为骑士或无赖
- determining solutions to the puzzle, where a solution qualifies each Sir as either a Knight or a Knave.

有些谜题没有解，有些只有唯一解，而有些至少有两个解

Some puzzles have no solution, others have a unique solution, and others have at least 2 solutions. The following is an example of a puzzle with a unique solution.

One evening as you are out for a stroll, you walk by a doorway labeled no normals allowed. Some people are talking inside. Curious, you listen, and you hear Sir Paul who says: "all of us are Knaves." "Exactly one of us is a Knight," replies Sir Jenny. As for Sir John, who is also inside, he just keeps quiet. Who is a Knight, and who is a Knave?

The Sirs involved in this puzzle are Sir Jenny, Sir John, and Sir Paul. The unique solution is given by Sir Jenny being a Knight, Sir John being a Knave, and Sir Paul being a Knave.

一个句子以大写字母开头，以句号结尾，感叹号，或者一个问号，后面可能跟双引号。先生，先生，先生的名字，骑士和无赖总是以大写字母开头，句子中没有其他单词大写。字谜中的句子包含最多是双引号之间的一部分。当一个句子包含一个包含在double之间的部分引号，双引号之外的部分包含Sir Sir\_Name形式的单次出现，以及Sir Sir之间的双引号之间的内容。不包含在双引号之间的部分的句子可能引用一些Sirs，总是采用Sir Sir\_Name或Sirs Sir\_Name\_1的形式。并且Sir\_Name\_2，或Sirs Sir\_Name\_1, Sir\_Name\_2, ...和Sir\_Name\_n，其中n ≥ 3, Sir\_Name\_1, ..., Sir\_Name\_n是成对不同的

3. DETAILED DESCRIPTION 详细描述

3.1. **Syntax of puzzles.** A sentence starts with a capital letter and ends in a full stop, an exclamation mark, or a question mark, possibly followed by closing double quotes. Sir, Sirs, Sir names, Knight and Knave always start with a capital letter, and no other word inside a sentence is capitalised. A sentence in a puzzle contains at most one part enclosed between double quotes. When a sentence contains one part enclosed between double quotes, the part outside the double quotes contains a single occurrence of the form *Sir Sir\_Name*, and what occurs between the double quotes is something said by *Sir Sir\_Name*. A sentence that contains no part enclosed between double quotes might refer to a number of Sirs, always in the form *Sir Sir\_Name*, or *Sirs Sir\_Name\_1 and Sir\_Name\_2*, or *Sirs Sir\_Name\_1, Sir\_Name\_2, ...and Sir\_Name\_n*, where  $n \geq 3$ , and *Sir\_Name\_1*, ..., *Sir\_Name\_n* are pairwise distinct.

What is between double quotes is a sentence in one of the following forms, ending in either a comma, a full stop, an exclamation mark, or a question mark: 双引号之间的内容是下列形式之一的句子，以逗号，句号，感叹号或问号结尾

- At/at least one of *Conjunction\_of\_Sirs*/us is a Knight/Knave
- At/at most one of *Conjunction\_of\_Sirs*/us is a Knight/Knave
- Exactly/exactly one of *Conjunction\_of\_Sirs*/us is a Knight/Knave
- All/all of us are Knights/Knaves
- I am a Knight/Knave
- Sir *Sir\_Name* is a Knight/Knave
- *Disjunction\_of\_Sirs* is a Knight/Knave
- *Conjunction\_of\_Sirs* are Knights/Knaves

分离

where: 结合

- *Disjunction\_of\_Sirs* is in one of the following forms:
  - *Sir\_1* or *Sir\_2*
  - *Sir\_1, Sir\_2, ... or Sir\_n* ( $n \geq 3$ )
- *Conjunction\_of\_Sirs* is in one of the following forms:
  - *Sir\_1* and *Sir\_2*
  - *Sir\_1, Sir\_2, ... and Sir\_n* ( $n \geq 3$ )
- *Sir\_1*, ..., *Sir\_n* are pairwise distinct expressions of the form *Sir Sir\_Name* or I.  
Sir\_1, ..., Sir\_n是Sir SirName或I先生形式的成对不同表达

3.2. **Input and output of programs.** Your program will prompt the user for a text file, assumed to be stored in the working directory, that stores the sentences that make up a puzzle. No assumption should be made on the number of English sentences provided as input, nor on the length of a sentence, nor on the length of a Sir name, nor on the number of Sirs involved in the puzzle.

您的程序将提示用户输入文本文件，假设存储在工作目录中，存储构成谜语的句子。不应假设作为输入提供的英语句子数量，也不应假设句子的长度，也不应假设爵士名称的长度，也不应假设参与拼图的先生数量。

- Your program should:
- output the Sirs involved in the puzzle in lexicographic order;
  - output whether or not there is a solution, and in case there is one, whether the solution is unique;
  - output the solution in case a unique solution exists, with all Sirs being qualified as either Knight or Knave in alphabetical order.

你的程序应该：

- 以词典顺序输出参与谜语的先生；
- 输出是否有解决方案，如果有解决方案，解决方案是否唯一；
- 输出解决方案，以防存在独特的解决方案，所有先生都被认定为骑士或按字母顺序编织。

**3.3. Sample outputs.** Here are a few tests together with the expected outputs. The outputs of your program should be exactly in accordance with the following outputs. Outputs of your program will be matched against expected outputs line for line.

```
$ cat test_1.txt
I have just seen Sirs Sanjay and Eleonore!
"I am a Knave," whispered Sir Eleonore.
Who is a Knight and who is a Knave?
$ python3 knights_and_knaves.py
Which text file do you want to use for the puzzle? test_1.txt
The Sirs are: Eleonore Sanjay
There is no solution.

$ cat test_2.txt
I have just met Sirs Frank, Paul and Nina.
Sir Nina said: "I am a Knight," but I am not sure
if that is true. What do you think?
$ python3 knights_and_knaves.py
Which text file do you want to use for the puzzle? test_2.txt
The Sirs are: Frank Nina Paul
There are 8 solutions.

$ cat test_3.txt
Yesterday, I visited Sirs Andrew and Nancy. I asked Sir Andrew
who he was, and he answered impatiently: "Sir Nancy and I
are Knaves!" Then I met Sir Bill who introduced me to his wife
and told me: "at least one of Sir Hilary
and I is a Knave." Should I trust them?
$ python3 knights_and_knaves.py
Which text file do you want to use for the puzzle? test_3.txt
The Sirs are: Andrew Bill Hilary Nancy
There is a unique solution:
Sir Andrew is a Knave.
Sir Bill is a Knight.
Sir Hilary is a Knave.
Sir Nancy is a Knight.
```