

## Problem Description:

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### Introduction

To check the spread of the infectious disease Ebola, the National Center for Epidemic Control (NCEC) is preparing a large taskforce in identifying early symptoms of the disease. After a series of meetings with the experts, the NCEC has concluded that a practical way to set forth would be to train the taskforce in using a medical knowledge base for early identification of symptoms and infected people. This would allow expert knowledge to be widely available through the knowledge base and minimize human error.

You have been hired by the NCEC to facilitate the training of the taskforce in using the knowledge base. Each trainee is presented with disease related information in form of first order logic clauses. The trainee can read the clauses in the knowledge base and provide a logical conclusion that is provable from the clauses. You are required to develop a program that can check the conclusion made by the trainee and provide a quick feedback about whether the conclusion is right or not. The trainee can thus be trained to make conclusions using the knowledge base.

### Problem

You are given a knowledge base and a query sentence, and you need to determine if the query can be inferred from the information given in the knowledge base.

### Input:

You will be given the knowledge base and the query in a text file called **input.txt**.

The first line of the input file contains the query. The second line contains an integer  $n$  specifying

the number of clauses in the knowledge base. The remaining lines contain the clauses in the knowledge base, **one per line**. Each clause is written in one of the following forms:

1) as an *implication* of the form  $p1 \wedge p2 \wedge \dots \wedge pn \Rightarrow q$ , whose premise is a conjunction of atomic sentences and whose conclusion is a **single** atomic sentence.

2) as a *fact* with a **single** atomic sentence:  $q$

Each atomic sentence is a predicate applied to a certain number of arguments. Note that negation is not used in this homework.

### Output:

If the query sentence can be inferred from the knowledge base, your output should be TRUE, otherwise, FALSE. Your answer (TRUE/FALSE) should be made available in the file **output.txt**.

### Sample:

The input file will be formatted as below:

Diagnosis(John,Infected)

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HasSymptom(x,Diarrhea) $\Rightarrow$ LostWeight(x)

LostWeight(x)&Diagnosis(x,LikelyInfected) $\Rightarrow$ Diagnosis(x,Infected)

HasTraveled(x,Tiberia)&HasFever(x) $\Rightarrow$ Diagnosis(x,LikelyInfected)

HasTraveled(John,Tiberia)

HasFever(John)

HasSymptom(John,Diarrhea)

Note:

1. & denotes the AND operator.
  2. => denotes the implication operator.
  3. No other operators besides & and => are used.
  4. Variables are denoted by a single lower case letter (For this homework, you can assume that only variable x will be used. No other variables are used.)
  5. All predicates (such as HasFever) and constants (such as John) begin with uppercase letters.
  6. You can assume that all predicates have at least one and at most two arguments.
  7. You can assume that there will be no more than 10 clauses in the knowledge base.
- Since the query can be inferred from the given clauses in the sample input file, the output file will mention TRUE.