



De La Salle University - Manila

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MCO2 Report: Chatbot

**Introduction to Intelligent Systems**

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## I. Introduction

## II.

The project aims to create a chatbot specified by the design specifications given. It is a logic-based chatbot that infers the relationship between family members. The chatbot talks through prompts that the user asks and the chatbot returns the answer to the prompts asked.

## III. Knowledge Base

The main goal of the knowledge base is to represent family relationships using PROLOG. The Knowledge Base was designed with the assumption that no half-siblings exist, such that so long that they have at least 1 same parent, they will be siblings. In addition, it includes dynamic predicates for parent, grandparents, child, siblings, and aunt/uncle relationships. In fact, the group used dynamic instead of static to impose a flexible representation. The following are our formulas for each statement input.

```
(ill just add for reference muna)
```

```
parent(X,Y):-son(Y,X);daughter(Y,X).  
parent(X,Y):-father(X,Y);mother(X,Y).  
grandfather(X,Z):-father(X,Y),parent(Y,Z).  
grandmother(X,Z):-mother(X,Y),parent(Y,Z).  
child(X,Y):-parent(Y,X).  
aunt(X,Y):-sister(X,A),parent(A,Y).  
uncle(X,Y):-brother(X,A),parent(A,Y).  
siblings(X,Y):-parent(Z,X),parent(Z,Y).
```

#### IV. Chatbot Implementation

The chatbot implementation uses Python as its source code and PROLOG as its inference engine. PROLOG is used for the logic-side of the code while Python was used as an interface between the user and the inference engine. The PROLOG code consists of determining the relationship between family members and which family member they are. The Python code was used to ask for facts or queries from the user as a prompt for the inference engine and then once given a prompt, it will convert it to its PROLOG syntax equivalent.

The chatbot has the ability to distinguish between statements and queries based on user input. For instance, if the input ends with a period, it is considered a statement. On the other hand, if the input ends with a question mark, it is considered a query.

#### V. Results

| Statement                        | Query                                 | Output | PASS/FAIL            |
|----------------------------------|---------------------------------------|--------|----------------------|
| <b>Parent-Child Relationship</b> |                                       |        |                      |
| > Alice is the mother of James.  | > Is Alice the mother of James?       | Yes!   | PASS                 |
| > Bob is the father of James.    | > Is Bob the father of James?         | Yes!   | PASS                 |
|                                  | > Is Alice the father of James?       | No!    | PASS                 |
| <b>Grandparents Relationship</b> |                                       |        |                      |
| > Lolita is the mother of Alice. | > Is Lolita the grandmother of James? | Yes!   | PASS                 |
| > Juan is the father of Alice.   | > Is Juan the grandfather of James?   | Yes!   | PASS                 |
|                                  | > Is Lolita the grandmother of Alice? | No!    | PASS                 |
| <b>Sibling Relationship</b>      |                                       |        |                      |
| > Alice is the mother of Mary.   | > Are James and Mary siblings?        | Yes!   | PASS                 |
| > Lia is a sister of Mary.       | > Is Lia a sister of Mary?            | Yes!   | PASS                 |
|                                  | > Are Lia and Mary siblings?          | No!    | FAIL (should be yes) |
| <b>Aunt/Uncle Relationship</b>   |                                       |        |                      |
| > Peter is an uncle of           | > Is Peter an uncle of                | Yes!   | PASS                 |

|   |                               |                          |                                    |
|---|-------------------------------|--------------------------|------------------------------------|
| James.  | James?                        |                          |                                    |
| > Emily is an aunt of James.  | > Is Emily an aunt of James?  | Yes!                     | <b>PASS</b>                        |
| > Jacob is a brother of Bob.  | > Is Jacob an uncle of James? | Yes!                     | <b>PASS</b>                        |
| <b>Others (Impossibilities)</b>   |                               |                          |                                    |
| > Alice is the mother of Alice.   |                               | That's impossible!       | <b>PASS</b>                        |
| > Juan is the father of Liam.<br><b>Ok! I learned something.</b><br>> Liam is the father of Ronald.<br><b>Ok! I learned something.</b><br>> Ronald is the father of Juan. |                               | Ok! I learned something. | <b>FAIL (should be impossible)</b> |
| > Juan is the father of Alice.<br><b>Ok! I learned something.</b><br>> Juan is a daughter of Rob.   |                               | Ok! I learned something. | <b>FAIL (should be impossible)</b> |

<Brief Explanation of the Results>

## VI. Limitations and Challenges

The chatbot showcases several limitations, most notably its lack of Natural Language Processing (NLP) capabilities. Compared to its Large Language Model (LLM) based counterparts such as ChatGPT, it lacks the ability to understand the complexity of the human language due to its predetermined rules and prompts. Its reliance on prompts in a specific and structured format restricts its ability to engage with the users freely.

In addition, the group has encountered stack overflow issues. Given that PROLOG has a certain characteristic that uses infinite recursion, it could lead to infinite loops resulting in a stack overflow. This could mean that there is an oversight in the rules; thus, a more efficient implementation is recommended.

## VII. Conclusion

## VIII. Table of Contributions:

| Member                      | Contribution            |
|-----------------------------|-------------------------|
| Campos, Annika Dominique S. | Report                  |
| Chan, Rizza Mikaella C.     | Knowledge Base Designer |

|                              |                                      |
|------------------------------|--------------------------------------|
| Clemente, Daniel Gavrie Y.   | Assistant Programmer and Report      |
| Isolan, Jewel Claire M.      | Report                               |
| Lingat, Carl Vincent Blix P. | Programmer & Knowledge Base Designer |

Acknowledgement:

ChatGPT was used as an assistive tool for the following purposes:

1. Knowing and understanding the features of the Python programming language and PySWIP.
2. To help debug what is the cause of the error in the program.

Reference List:

<https://www.swi-prolog.org/pldoc/man?predicate=dynamic/1>

<https://stackoverflow.com/questions/2426678/dynamic-predicate-in-prolog>

[https://www.tutorialspoint.com/prolog/prolog\\_relations.htm](https://www.tutorialspoint.com/prolog/prolog_relations.htm)