CS152 LBA:

Expert System Design using Prolog

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1. Expert System Introduction

Our expert system focuses on providing appropriate advice for Minerva students in Berlin, who are wondering what actions they should take based on the updated COVID regulations in Berlin. Our advice range from PCR or antigen testing, visiting the nearest testing center or buying a home-kit, contacting insurance providers or our Berlin city manager Barbara, starting quarantine etc. There are total 9 askables in our expert system:

- Intentions for COVID testing (response options: COVID symptoms, travel, contact with COVID patient, curiosity)
- Whether student lives in Berlin (response options: yes, no)
- Residence location (response options: A&O residence hall, independent housing)
- Insurance status (response options: Cigna, no)
- Testing location preference (response options: home, center)
- Urgency (response options: yes, no)
- Whether COVID test results were negative (response options: yes, no)
- Quarantine status (response options: yes, no)
- COVID symptoms (response options: yes, no)

Based on the different responses for these askables, each student will receive advice on what they should do next, according to Berlin and Minerva community rules on COVID. Thus, our expert system aims to aid individuals to easily make optimal decisions based on their situation and preferences, and moreover assist the Minerva community to quickly and efficiently deal with any unexpected COVID outbreaks. Some potential improvements for this solution to fully achieve this goal include adding askables such as being an initial or secondary contact, how many days of experiencing quarantine, what kinds of COVID symptoms the user is experiencing etc. and improving the user interface so Minerva students could more easily navigate through the expert system.

2. Relevant Resources

The 9 askables were mainly chosen by gathering messages related to Berlin's COVID measures in our Telegram chat and categorizing them into major discussion topics, such as quarantine, location of nearest COVID test center, being in contact with a COVID patient, experiencing COVID symptoms etc. The correct steps individuals in various circumstances should take were written based on the restriction guides posted by the Berlin government, including *Measures against Corona Virus In Berlin* (https://www.berlin.de/corona/en/measures/) and *Coronavirus in Berlin: rules, quarantine, tests, and vaccines* (https://allaboutberlin.com/guides/coronavirus).

3. Expert system logic

The full logic for the system is shown in this decision tree table spreadsheet. First, users have the option to choose the reason why they want to take the COVID test (experiencing COVID symptoms, testing before travel, coming in contact with someone who has COVID, and just testing to be safe). We then determine relevant information, such as whether the user is currently in Berlin or another city, whether they live in the res hall or independent housing, whether they are insured by CIGNA and so on. The following figures demonstrate three different test cases resulting from our expert system.

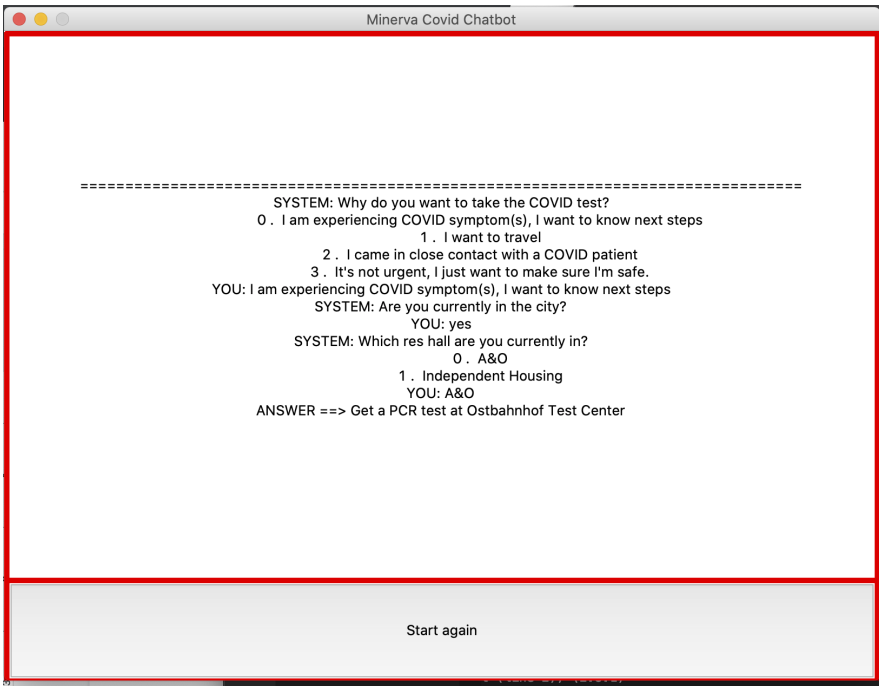

Figure 1: expert system advised the user to get a PCR test at Ostbahnhof Test Center, after receiving responses that the user is experiencing COVID symptoms, currently at Berlin, and living in A&O residential hall.

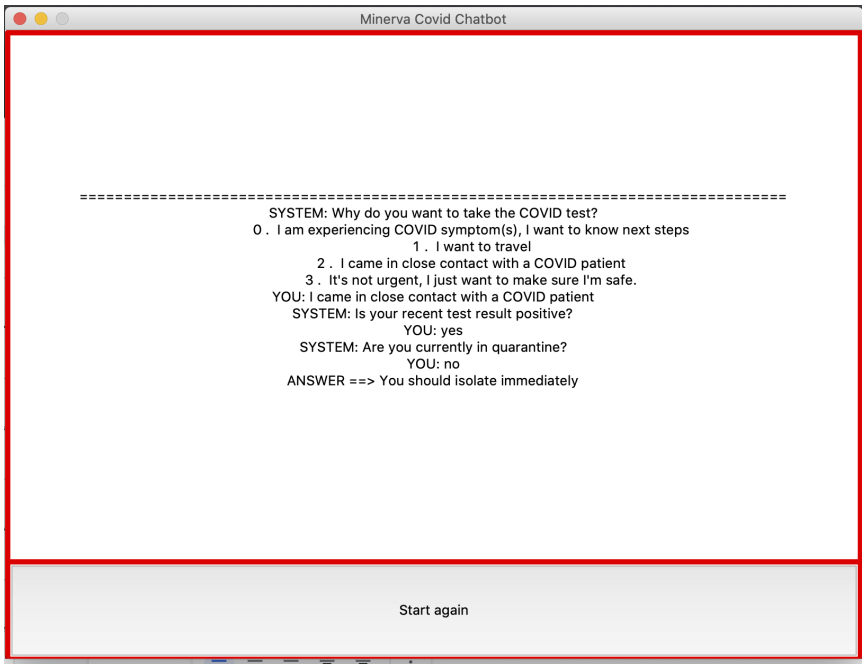

Figure 2: expert system advised the user to isolate immediately, after receiving responses that the user closely contacted a COVID patient, recently tested positive, and is currently not in quarantine.

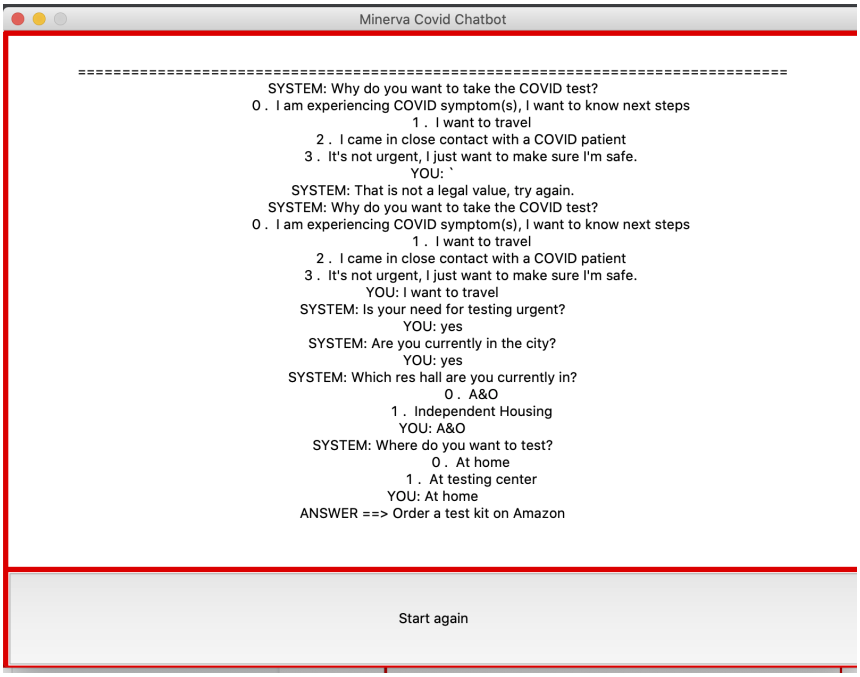

Figure 3: expert system advised the user to order a test kit, after receiving responses that the user wants to travel, has urgent need for testing, currently in Berlin, and living in A&O residential hall, and wants to get tested at home.

4. Appendix

A. Contribution from each member:
    a. Ga Eun Lee: documented the project including its introduction and relevant resources and put the HC and LO applications in writing
    b. Ha: debugged Philip's code and improved upon the code by adding more necessary askables
    c. Philip Boakye: provided framework for Prolog and Python code and suggested the initial idea for our expert system

B. HC and LO applications:
    a. #rightproblem: accurately identifies the problem of Minervan students having difficulty deciding what actions to take according to updated COVID regulation rules in Berlin through categorizing Telegram chat discussions, effectively explains how our expert system could help solve the problem for both individuals and the Minerva community as a whole, suggests potential improvements to solving the problem
    b. #evidencebased: justifies our expert system logic based on Berlin regulation guides from the Berlin government and Telegram chat discussions that manifest Minerva student's need for an accurate and efficient guide for COVID safety measures in Berlin
    c. #sourcequality: uses appropriate, reliable, and highest quality sources directly from the Berlin state government to suggest the proper instructions to Minerva students
    d. #ailogic: clearly defines predicates and rules on the knowledge base that enables the expert system to serve its goal of advising Minerva students in all kinds of different individual circumstances
    e. #aicoding: implements Prolog efficiently with well-written comments, including graphical user interface, menu-based options, and natural language queries for the user's convenience
    f. #modeling: identifies the decision tree model for Minerva students deciding what steps to take next according to COVID regulations in Berlin based on reliable evidence such as government regulation guides, develops the model using Prolog and Python into an expert system, interprets the three different test cases shown in the figures, suggests potential improvements on the expert system model

C. Github link to Python and Prolog code:
    https://github.com/sherlockieee/cs152lba