MINISTRY OF EDUCATION AND TRAINING

VIETNAM NATIONAL UNIVERSITY, HO CHI MINH CITY - VNUHCM

UNIVERSITY OF SCIENCE

FACULTY OF INFORMATION TECHNOLOGY

-----ભ📖ભ -----

ARTIFICIAL INTELLIGENCE

LAB 02: PL RESOLUTION

Instructor: Bùi Tiến Lên, Trần Quốc Huy, Phạm Trọng Nghĩa

Name: Tô Khánh Linh

Identity: 21127638

class: 21CLC08

Table of Contains

I. Check list:

No.	Criteria	Degree of completion
1	Read the input data and successfully store it in some data structures.	100%
2	The output file strictly follows the lab specifications.	100%
3	Implement the propositional resolution algorithm.	100%
4	Provide a complete set of clauses and exact conclusion.	100%
5	Five test cases: both input and output files.	100%
6	Discussion on the algorithm's efffiency and suggestions.	100%

II. Brief description of main functions:

1. main()

- Enter input and output file name.
- Read the input data by call input_file() function and store it in appropriate data structures.
- Open the output file.
- Call the function PL_Resolution(), which implements the PL Resolution algorithm.

2. *input_file()*

Read the given text file and store it in appropriate data structures, remove "OR" from KB (Knowledge Base).

- Input:
  - Name of the text file.
- Output:
  - Query.
  - Knowledge Base.

3. ***negate():***

- Negate the given clause [-A] to [A], [A] to [-A], “AND” to “OR”, “OR” to “AND”. After negate the given clause we remove the “OR” and then add every character to a list: “A OR B” to [[‘A’,’B’]]. Remove the “AND” and add to every character to specific list: “A AND B” to [[‘A’] , [‘B’]].
- Input:
    - The clause to negate.
- Output:
    - The clause after negate.

4. **Resolvable():**

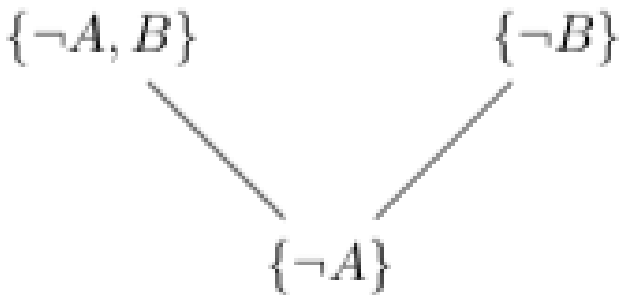
Check if a clause is resolvable. A clause is resolvable if a clause contains a literal and it negate’s form. Return true if resolvable false if not.

- Input:
    - Clause to check if resolvable.
- Output:
    - True if resolvable and False if not.

5. **PL_Resolve():**

Resolve the merge of “clause_i” and “clause_j” to a clause. Remove if clause contain similar element and remove both if 2 literal is the negate form of each other in the clause and then return the clause.

- Input:
    - Two of the clauses that you want to resolve.
- Output:
    - Clause after resolve.



6. PL_Resolution():

- Set the CNF form of the clause by negate the query merge both KB and query into a clause. Take each pair ("clause_i" and "clause_j") of the clause generated in loop and check if it is resolvable by call the Resolvable() function the pass the merge of clause_i and clause_j (clause_i+clause_j) to the function and resolve it if it is by calling PL_Resolve().
- After resolve check if resolvents is empty:

  + If yes and loop +=1 write the number of loop and remaining new clause (sort in alphabetical order) to the output file then return True

  + If not check loop+=1 and check if resolvents is resolvable or not in new clause (new) and clause or not if all no then and resolvents to new clause(new).
- After generate all of the given pair check if the new clause is empty:

  + If yes then write the No to the input file return False.

  + If no then write number of loop and the remaining new clause (sort in alphabetical order) to the output file. Add new clause (new) to the clause. Take each pair in clause and generate in loop with new_clause (new)=None and loop=0.

  Input:

  - KB: Knowledge Base.
  - Query: the alpha query.
  - The file that already opened and we use this to write to the output's file.

  Output:

  - Return true if the clause is KB entails query and False if not.

III. Discussion on the algorithm's efficiency and suggestions to improve:

- The efficiency of the algorithm depends on the size and structure of the knowledge base (KB) and the query. In the worst-case, if KB is large and complex, PL-Resolution can have a huge time complexity.
- My suggestions to improve:
    - Apply techniques to simplify the KB before running the algorithm.
    - Use heuristics to guide the resolution process and prioritize resolution steps.
    - Using an intelligent ordering of literals or clauses to prioritize resolution steps.

IV. References:

- https://www.youtube.com/watch?v=SjEQNOV5FMk&t=254s
- https://www.youtube.com/watch?v=Jj_anOkzX5A&t=136s
- Given pseudo code.

THE END