CSIS, BITS Pilani K. K. Birla Goa Campus
Artificial Intelligence (CS F407)

Programming Assignment 2
Total Marks: 12
**Submission Deadline: 9 PM on 14/11/2022 (Monday)**

Each student must individually do this programming assignment. Your program must be written in Python and should run (without errors) on Python 3.6 or later.

Any form of plagiarism (major or minor) will result in 0 marks being awarded. Students indulging in plagiarism may also receive NC grade for the course.

Note that the deadline is **9 PM** and not midnight. Five marks per day will be deducted for submissions after the deadline. It will be your responsibility to submit the assignment well in advance and avoid unforeseen problems like power failures etc.

Question 1 (12 marks)
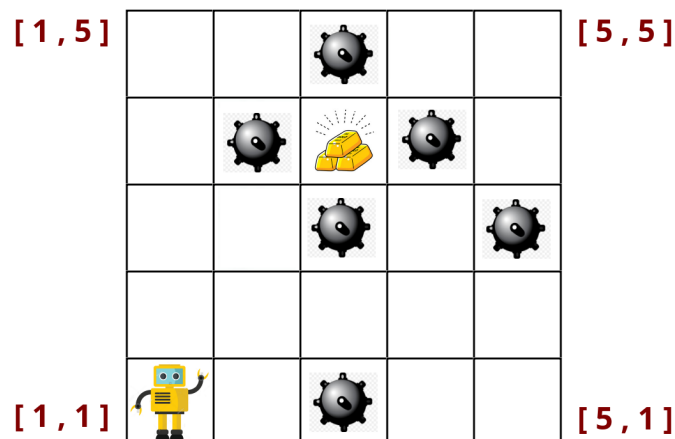
The figure above shows a Land mine world containing several land mines. There is an agent in room [1,1]. The goal of the agent is to find the location of gold in the Land mine world. The agent "knows" that gold is present in a room if and only if the room has four adjacent rooms each having a landmine (see the figure above). So, gold cannot be present in any of the rooms along the boundary of the Land mine world.

The agent is able to detect a land mine from the rooms that are adjacent to the room containing the land mine. There are four possible percepts that the agent can have: 0, 1, 2 and 3. The percept n means that n number of adjacent rooms have a land mine. (A percept value of 4 will not be possible because the agent will not be able to reach such a room.) In the figure shown above, if the agent is in room [2,1], then it will perceive 1. If the agent is in room [3,2], then the percept will be 2. In room [1,3], the percept will be 0.

The agent only needs to find the location of the room that contains gold. It is possible that after visiting all the "safe" rooms agent is unable to infer the location of gold. So, the two possible outputs of your program will be:

1. Gold is present in room [x,y].
2. Gold could not be detected after visting all the safe rooms.

Write a python program that uses propositional logic sentences to check which rooms are safe. The inference should be drawn using the SAT solver python-sat [1]. The logical agent can take four actions: Up, Down, Left and Right. These actions help the agent move from one room to an adjacent room. You may assume that land mine will not be present in room [1,1]. Safe room is a room that you are sure (through logical inference) that it does not contain a land mine. While trying to move from the current room to an unvisited safe room, you can use breadth first search to find the shortest path (through the previously visited safe rooms). If there are no unvisited safe rooms left and Gold cannot be inferred, then the program should give the output 2 mentioned above.

A sample program is given ("ROLLXYZ_FIRSTNAME.py"). Run the program and see the output. You must modify this program. While evaluating your program, a different Mine field world will be used.

Run the program "SatSolverExample.py." It shows how to check for satisfiability. Instead of symbols, you must use integers because the SAT solvers use positive and negative integers to stand for positive and negative literals. (See the "SatSolverExample.py" program to understand this.) To keep things uniform, everyone should use Glucose3 class from the pysat.solvers library as shown in "SatSolverExample.py" program.

How to proceed?

Initially, the KB contains propositional logic sentences that correspond to the background knowledge (if any). At each step, the agent perceives a room. New sentences corresponding to the new percept must be added to the KB in CNF form. After perceiving, agent checks whether there are rooms that are unvisited and safe. (See the Hybrid agent given in the textbook in Section 7.7.2.) I expect students to implement a simplified version of the Hybrid agent that uses minimum number of symbols that are sufficient for the given problem.

Useful Links for the SAT Solver

https://pypi.org/project/python-sat/

Note: You should install python-sat for python3.
Command on Ubuntu : python3 -m pip install –user python-sat (Update the system before running the command.)

https://pysathq.github.io/

https://pysathq.github.io/usage.html

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[1]https://pypi.org/project/python-sat/

Instructions for submission

- Run the given program (i.e. "ROLLXYZ_FIRSTNAME.py") and see the output.

- You must modify the "ROLLXYZ_FIRSTNAME.py" file which is given.

- Don't submit the Agent.py file. A different Mine field world will be used for evaluation.

- The variables (e.g. _mineFieldWorld) within the Agent class should not be directly accessed. Only the functions FindCurrentLocation(), PerceiveCurrentLocation() and TakeAction() should be used. During evaluation, I will change the names of the functions and variables that you are not supposed to access.

- All your code must be written in the same program file (i.e. "ROLLXYZ_FIRSTNAME.py").

- Your submission should contain just one file : ROLLXYZ_FIRSTNAME.py (program). Don't submit a zip file or any other file.

- You should modify the filenames to your own roll number and first name. Use only **capital letters** in the file name. (File extension can be in small case.)

- Marks will be deducted if instructions are not followed.

- Contact the TAs if you have a query.

- Inform the IC or the TAs if you notice any bug in Agent.py program.

- Don't postpone things for the last minute.