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

**Programming Assignment 2**

**Total Marks: 15**

**Submission Deadline: 9 PM on 05/04/2021 (Monday)**

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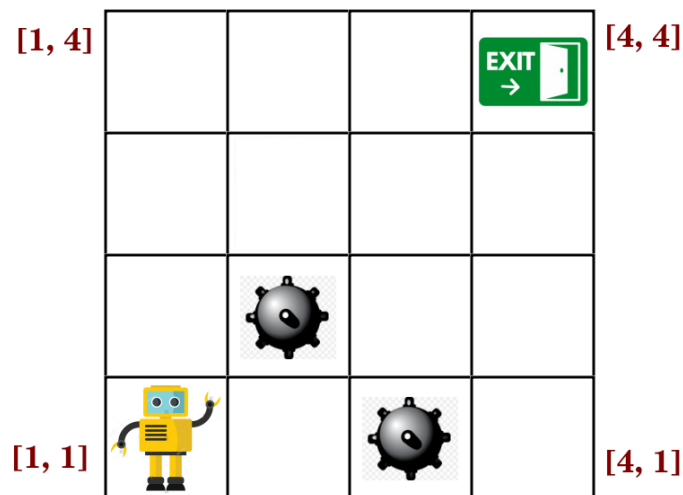
Each student must individually do this programming assignment. Your program must be written in Python and should run (without errors) on Python 3.6 or later.

Any form of plagiarism (major or minor) will result in -5 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** (15 marks)

The figure below shows a Land mine world containing two land mines. There is an agent in room [1,1]. The goal of the agent is to exit the Land mine world alive. The agent can exit the Land mine world by reaching room [4,4]. The Land mine world may contain several landmines, but there will always be a safe path from [1,1] to the exit. The agent will be able to detect a land mine from the rooms adjacent to the room containing the land mine. There will be three possible percepts: ' $= 0$ ', ' $= 1$ ' and ' $> 1$ '. The percept ' $= 1$ ' means that one of the adjacent rooms have a land mine. The percept ' $> 1$ ' means that two or more of the adjacent rooms have a land mine. Consider the figure shown below.



If the agent is in room [2,1], then it will detect/perceive ' $> 1$ '. If the agent is in room [1,2], then the percept will be ' $= 1$ '. In room [1,3], the percept will be ' $= 0$ '.

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 <sup>1</sup>. 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 there will always be a safe path that the agent can take to exit the Wumpus world. In other words, you can assume that the agent will not have to take a risk while navigating the minefield. Your goal is to make the agent move from [1,1] to [4,4] using minimum number of actions.

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. Also, you may assume that there is a safe path that the agent can take to exit the Mine field world. In other words, there will not be a situation where the agent will have to take a risk. The number of land mines will be between two to five.

Run the program “SatSolverExample.py.” It shows how to check for satisfiability.

## 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. As stated earlier, you should try to move the agent to room [4,4] using minimum number of actions such that all the land mines are avoided.

## 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>

## 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.

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<sup>1</sup><https://pypi.org/project/python-sat/>

- The variables (e.g. `_mineFieldWorld`) within the `Agent` class should not be directly accessed. Only the functions `FindCurrentLocation()`, `PerceiveCurrentLocation()` and `TakeAction()` should be used. 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.