CS 404 – Artificial Intelligence
HW 1 – Chp. 1,2
75pt

Please **type** your answers in the allocated space in this document **– keeping the questions as they are,** to ease grading (i.e. leave questions where you give answers) and submit via SUCourse, following the homework requirements listed on the web.

All your work must be your own; and you cannot share your homework, but you can discuss the topic or your answers after the deadline. I typically ask questions from homeworks in the exams.

Note that homeworks are great ways to see whether you have learned a topic and guide you for it. So you are strongly encouraged to do your own work and study while doing the homework. Exams will contain questions related to the homeworks.

You must follow the requirements about questions (e.g. answer in 1-2 lines etc). Irrelevant answers will result in points off.

Late homeworks incur a penalty of 5 points off each day, up to 2 days. Plz do not be late (so be careful about last minute glitches) as email exception requests each results in 30-60 min . extra work!

1. **0pt - Read Chapters 1 and 2.** See the 'What to Know' slides at the end of each slide set. In general, you are responsible of anything (discussion, example,…) covered in class and the more we talk about something in class, the more you are responsible to know that topic.

2. **10pts (5 pts each)**

a) **In which decade was the term 'artificial intelligence' coined and AI begin as an active research area?**

      a) 1940s   b)1950s   c)1960s   d) 1980s

   Answer: B

b) **Circle True or False - After initial excitement, the AI research encountered the a setback and caused disappointment, when solutions offered on toy problems did not generalize to other or bigger problems.**
   Answer: True

3) 40pts - Consider the vacuum cleaner world discussed in class: current location and local dirt sensors; left,right,suck,noop actions; 2-room world (A-on the left and B-on the right); sucking action cleans the room and rooms stay clean once cleaned. **But for this question, each movement and sucking actions costs one point (energy).**

a) 10pts – Can a simple reflex agent be perfectly rational for this environment? Explain in 1 line.

Answer: Since cleaning the rooms with as less energy as possible is an objective defined, then simple reflex agent is not being rational. It will start to go back and forth between room A and room B after both are clean thus it will waste energy all the time.

b) 10pts - Describe a rational <u>agent function</u> for the case in which each movement and sucking actions costs one point, in 1-2 lines. Does the corresponding agent program require internal state? (variable/memory needed?)

Reminder: The agent function describes the action for each possible <u>percept sequence</u>, not just the current <u>percept</u>. The agent function basically states the desired behavior and not the implementation.

Answer: A rational agent will require internal state to remember which room is clean. Agent function will state that it will not enter a clean room or the room that it has cleaned and eventually stop (NoOp) when both are clean.

c) 20pts – Complete the following pseudocode (the <u>agent program</u>) that will implement the desired rational agent function.

- Format/language does not matter. You can use {} or just use indentation to mean {}s.
- For simplicity of grading (uniform code), check both sensors at once, as in the given code part below.
- Don't forget that return exits the code!

```
function Rational-Vacuum-Agent ([location,status]) returns an action

        /* statA and statB are global variables which were initialized as
        false (= Dirty) when the agent is started. True refers to status
        Clean */

        if (Dirty and Location == A)

            statA = True

            return Suck

        else if (Clean and Location == A and statB == False)

            return Right

        if (Dirty and Location == B)

            statB = True

            return Suck

        else if (Clean and Location == B and statA == False)

            return Left

        if (statB and statA)

            return NoOP
```

4) 25pts - For each of the following assertions, <u>say whether it is true or false and support your answer with examples or counter examples where appropriate. 1 line explanation at most!</u>

Hint: You can answer many of these questions by thinking task environments and sample agents we have seen in class.

a) T / F - An agent that senses only partial information about the state cannot be perfectly rational.

Answer: False. An autonomous car cannot escape from a plane falling upon it or warn the driver about it.

b) T / F - There exist task environments in which no pure reflex agent can behave rationally.

Answer: True. The environment at question 3 is an example. Agent must visit each room even after they are clean in order to check if the room needs cleaning or not, it will be more costly than optimal thus irrational.

c) T / F - The input to an agent program is the same as the input to the agent function.

Answer: False. The input to agent program is the percept and input to an agent function is percept sequence.

d) T / F - Every agent is rational in an unobservable environment.

Answer: False. If a robot has an objective to move to point A to point B in an unobservable environment, and it doesn't move at all it is being irrational. Or robot can have an a priori knowledge and this shape behavior.

e) T / F - A perfectly rational poker-playing agent never loses.

Answer: False. The agent might be dealt a bad hand (card set that is not possible to win with) since poker is a non-deterministic game.