CAP 6635 Artificial Intelligence
Homework 1 [8 pts, Due Jan 29 2023]

[Homework solutions must be submitted through Canvas. Only pdf, word, and txt files are allowed. If you have multiple pictures, please include all pictures in one Word/pdf file. You can always update your submissions before due date, but only the latest version will be graded.]

1. **[1 pt]** What is artificial intelligence? What is a rational agent? What is the key (essential) components for an individual (or an agent) to act humanly (i.e., intelligently)?

2. **[1 pt]** What is PEAS task environment description for intelligent agent? For the following agents, develop a PEAS description of their task environment
   - Assembling line part-picking robot
   - Robot soccer player

3. **[1 pt]** Figure 1 shows the relationship between an AI agent and its environment. Please explain the <u>names</u> and <u>functionalities</u> of the parts marked as A, B, C, and D, respectively.
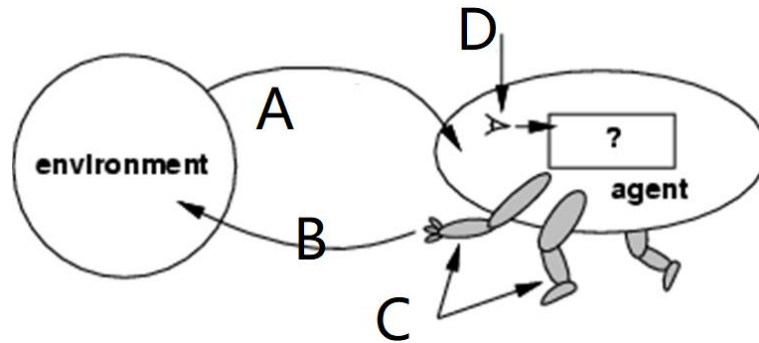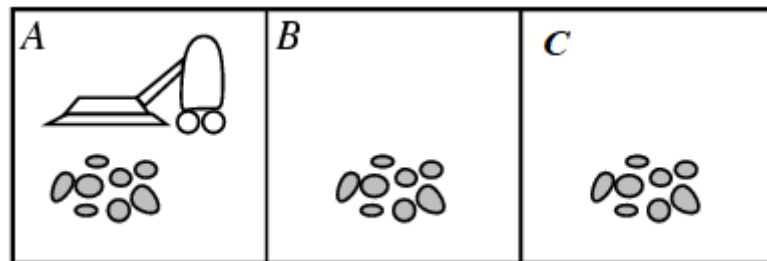

Figure 1

Figure 2

4. **[1 pt]** Please design pseudo-code of an energy efficient model-based vacuum-cleaner agent as follows:
   (1) The environment has three locations (A, B, C as shown in Figure 2) and three states ("Clean", "Dirty", "Unknown").
   (2) The vacuum-cleaner has four actions "Left", "Right", "Suck", and "Idle",

(3) The vacuum-cleaner will clean the dirt as soon as it senses that the current environment is Dirty,

(4) If the vacuum-cleaner senses the current environment is "Clean" or "Unknown", it will remain Idle for one time point, and

(5) The vacuum-cleaner will change location if it senses the current environment is "Clean" for two consecutive time points in a row, and

(6) The vacuum-cleaner will change location if it senses the current environment is "Unknown" for two consecutive time points in a row.

(7) When change locations, agent can only move "right" if it is at location "A", move "left" if it is at location "C", and randomly decide to move "left" or "right" if it is location "B"

Summarize percept sequences and corresponding actions as a table [0.5 pt],
Write the pseudo code of the agent [0.5 pt].

5. **[1 pt]** Please summarize task environment types for the following five agents, in terms of "observable", "deterministic", "episodic", "static", "discrete", "number of agents"

Agent	observable	deterministic	episodic	static	discrete	# of agents
Tic-tac-toe						
Tetris						
Texas hold 'em						
Robot soccer competition						
Vacuum cleaner						

Tic-tac-toe   Tetris   Texas hold'em   Robot soccer competition   Vacuum Cleaner
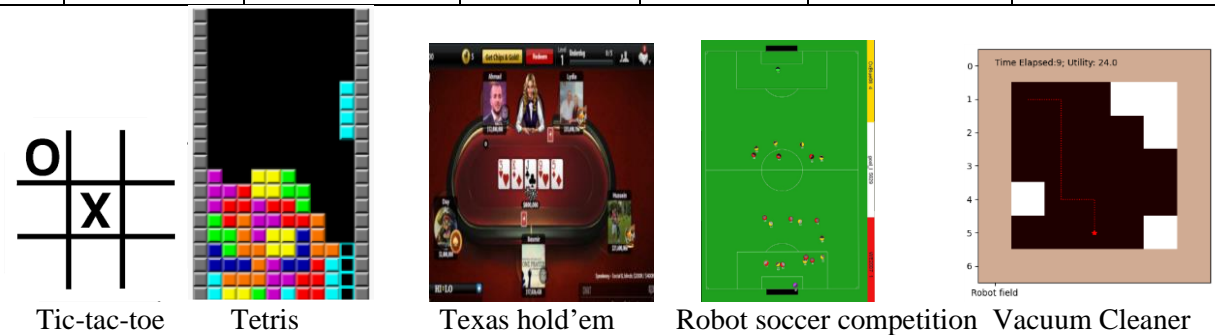
For all programming tasks, please submit the Notebook as html or pdf files for grading (your submission must include scrips/code and the results of the script).

For each subtask, please use task description (requirement) as comments, and report your coding and results in following format:
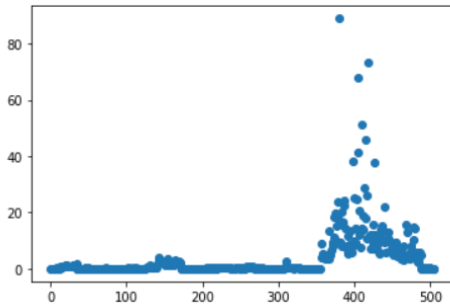
```
# Report all samples with respect to the Crim index on a plot (the x-axis shows the index of the sample, and the y-axis
# shows the crim index of the sample).

y = boston['Crim']
x=np.arange(y.shape[0]) # generate x index

plt.scatter(x, y, marker='o')
```
: <matplotlib.collections.PathCollection at 0x1c0d3ceebc8>

6. **[1.5 pt]** The "Source Code" module in Canvas lists three python programs. "simple.py" is a simple reflex agent, "model.py" is a reflex agent with a model to ensure agent walking through all locations. "goal.py" is a goal-based agent aiming to clean all dirty spots with minimum steps of moves.
   a. Use proper python IDE environment (FAU HPC environment will allow students to use Jupyter Notebook for python coding) to run each of the three python programs. Change environment as a 6x6 navigation board. Capture one screenshot (or plot) showing that the program is properly running (0.5 pt).
   b. Explain how the intelligent behaviors are improved from simple.py, model.py, and goal.py? (0.5 pt).
   c. Propose a solution to design a fourth agent program which may outperform "goal.py". Explain why your proposed solution can perform better (0.5 pt). (no need to implement the agent. Just description your idea using textual descriptions or pseudo-code).

7. **[1.5 pt]** Follow instructions in ChatGPTInstruction.pdf to set up a ChatGPT programming platform, and implement following tasks (You can use the notebook, ChatGPTConversations.pdf, as reference)
   a. Implement a ChatBot which takes a question as input and output answers [0.5 pt]
   b. Implement a continuous conversation ChatBot which can answer multiple questions in a continuous manner. The ChatBot takes one question as input, and outputs answers. It then takes a second question as input, and the answers should be relevant to both the first and the second questions (assume questions are relevant), and so on. [0.5 pt]
       i. For example, your first question can be something like "write a story about _xyz___ with _abc__ and _def__ being ___"
       ii. Upon receiving the answers, the second question can ask "_abc__ and _def__ both ____".
       iii. Be creative about the questions, it's time for you to challenge ChatGPT.

c. Based on questions and answers from the ChatBot, please suggest at least five features to differentiate whether the story/answers are generated from an AI agent (instead of being written by a genuine human being). [0.5 pt]
   i. Your "features" can be at a high level at this stage. For example, you can identify one feature as "ChatBot story/answer always start with ____".
   ii. This is an open question. There are no standardized answers. We are trying to use this to build a semester long project. This is just a starting point for you to get familiar with ChatGPT and its APIs, and also get sense about how AI is evolving.