COMP9016 Assignment #1

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1 KNOWLEDGE REPRESENTATION

The purpose of this assignment is to assess the following **Learning Outcomes**:

- LO1 Appraise domain specific formalisms used in knowledge representation schemes.

- LO2 Compare and contrast current knowledge representation approaches integrated in systems relevant to AI.

- LO3 Select, apply and evaluate a knowledge representation scheme for a specified domain.

To that end, you are going to build upon the theory discussed in lectures and the practical work carried out as part of your lab work. You will construct a 2-dimensional (2D) environment along with a number of agents demonstrating your understanding of knowledge representation in a domain specific manner. You will investigate the capabilities of search techniques and articulate a rationale for where, when and why an approach is appropriate. Finally you will critique two approaches for inferring state in your environment discussing and demonstrating the pro's and con's of each.

1.1 BUILDING YOUR WORLD

Create a 2D world that will play host to a game to be played by agents. Provide context for the mechanics of the world and the conditions under which the game is complete. The intent of this exercise is for you to demonstrate your understanding of how a problem can be modeled abstractly. To this end, implement three **different** agents, providing a PEAS description of each and a rationale for their inclusion.

- Critique the advantages and disadvantages of each agent type.

- Demonstrate each agents ability to perform or under-perform in the 2-dimensional world.

- Discuss, and evaluate, the agents suitability in worlds of arbitrary sizes.

The game should be implemented in Python, you may use any of the libraries made available from the AIMA python repository but they must be clearly referenced, your own code and contributions should be clearly highlighted.

Write a clear and concise description of the agent-based game. The purpose of this is to articulate an understanding of the underlying concepts being implemented both from a theoretical and practical perspective.

1.2 Searching your world

- Formulate a well defined **problem statement** and identify a **goal-state** under which your game is complete. Why is this important to search? As part of your solution you should be including the initial state, the set of actions, the transition model, a goal test function and a path cost function.

- Select three **uninformed search** techniques and discuss their appropriateness to your world under appropriate headings for search.

- Implement the three **uninformed search** techniques discussed for your world. Discuss the results.

Write a clear and concise report detailing the search techniques utility with regards your agent-based game. The purpose of this is to articulate an understanding of the underlying concepts being implemented both from a theoretical and practical perspective.

1.3 Forward-Chaining and Backward-Chaining

Forward-Chaining and Backward-Chaining introduces the capacity for inference in an environment. How does this benefit the operation of an agent, in particularly in your world? Provide a short critical analysis of both approaches. Thereafter demonstrate their applicability by utilising them in your world (Note: if this requires a bending of the rules in your world that is ok - the important part is the discussion/analysis).

2 Tips

- **Tip for Part 1**: Review "agents.ipynb" and Chapter 2 of the recommended text. **Do not** overthink this, start fast and fail faster, run the three agents in basic environments first and iteratively increase the complexity of the mechanics of the world. In fact, discuss the increased complexity introduced by altering the mechanics as that is of interest.

- **Tip for Part 2**: Review "search.ipynb" and Chapter 3 of the recommended text.

- **Tip for Part 3**: Forward and backward-chaining are instances of *AND-OR* search trees, read up on them on wikipedia, in the recommended text (section 4.3.2) and the "AND-OR Graph Search" in "search.ipynb".

- **Tip for all Parts**: Do not provide masses of text lifted from the text/online or wikipedia. Be your own editor, focus on what is important and articulate that in a rationale way that is technically accurate. Demonstrating a capacity to explain complex topics in a clear and concise manner is indicative of a higher level of understanding and will be rewarded with an appropriate grade. Make sure your narrative is coherent.

3 SUBMISSION

3.1 WORD COUNT

There are three distinct questions as part of this assignment Q1.1-Q1.3. In answering these it is important that you demonstrate an understanding of the underlying theory as applied in the context of your environment. There is a suggested word limit of 500 words per question, your ability to articulate your answer succinctly is indicative of a deeper understanding in itself. I would also recommend the use of tables for any experimental results and/or diagrams/visualisations if they aid the message you are trying to convey. Boilerplate text articulating about what an agent is search algorithm should be kept clear and to the point (it is not really what I am looking for).

3.2 JUPYTER NOTEBOOK & CODE

A single jupyter notebook will be reviewed in grading your assignment. The folder structure will be as follows

- aima repo (top level dir)
    - AssignmentOneSubmissions (Folder for All Submissions)
        * Initials_StudentNumber (Folder for Individual Student Submission)
            · Initials_StudentNumber.ipynb (Only file I will look at and correct)
            · EXTRA_DIR (Directory with additional resources, I will not look at this)

As such it is critical you use relative paths consistent with this i.e. if importing code ensure you specify how you are importing it. Do not submit the whole aima data repo in a sub-dir

3.3 SUBMISSION DATE

This assignment is due by 23:59 at the end of Week 6