

COMP9016 Assignment #1

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1 KNOWLEDGE REPRESENTATION

The purpose of this assignment is to assess the following **learning outcomes**:

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 lab work. You will construct a 2d environment along with a number of agents demonstrating your understanding/appreciation of knowledge representation in a domain specific formalism. 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 2-dimensional 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, how the agent would or would not-perform in worlds of different 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. The specification for the Agent, Environment, and Program to enable the game to run must be included. All code should be in a single python file.

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.

- **Tip for Part 1:** Review “agents.ipynb” and Chapter 2 of the recommended text. **Do not** overthink this, start fast and fail faster, it is much simpler to run three agents in a basic 2d environment and iteratively increase the complexity of the mechanics of the world. In fact, discussing the increased complexity introduced by altering the mechanics would be 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.

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 particular 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 SUBMISSION GUIDELINES

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)

NOTE: You should assume that your code will be executed in a **sub-directory** of the AIMA data repository called “studentSubmissions”. As such it is critical you use relative paths consistent with this i.e. if importing code ensure you specify parent folder first.

2.1 SUBMISSION DATE

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