

SIT215 Computational Intelligence

Assignment 3:

Project



Grading and weighting: (% total mark for unit): 40%

Submission Deadline: 8:00 pm AEST, 25 May 2024 (Week 11 Saturday)

Overview

In SIT215, you have been studying the process of solving automation problems through the construction of intelligent blocks, knowledge base (KB), and the corresponding inferred principles. This study has comprehensively covered various models and algorithms essential for AI-driven automation solutions. This Assignment 3 - project is designed to enable you to showcase your understanding and skills in automated planning by engaging in Problem-Based Learning (PBL) activities.

In our classes, we have been conducting PBL in AI/CI concepts exploration and practices, you will continue to join class discussions and activities in the PBL style. Together with your self-directed study in some sections of this project, you will further demonstrate what you have learnt about problem-solving via your project deliverables in this assignment. This PBL-based project requires you to utilise planning and action techniques (particularly with Planning Domain Definition Language PDDL) and apply computational intelligence principles, AI/CI knowledge and reasoning practices to address real-world problems.

Learning Objectives

This assignment is designed to enable you to demonstrate your learning achievements in ULO2, and ULO3 for this unit. Specifically, these are addressed through the achievement of the following task-specific learning objectives:

- Demonstrating proficiency in working with software systems and frameworks for automated planning.
- Describing and modelling planning problems using appropriate concepts and models.
- Implementing, evaluating, and analysing the performance of automated planning solutions.
- Effectively communicating the process and outcomes of your research and developed project.

Preparatory Learning Activities

In order to complete this assessment task, you will need to first develop an understanding of a range of topics covered in this unit in weeks 1 to 9. Given the assessment deadline, this may require you to learn these topics independently to understand the scope as soon as possible in earlier weeks. The topics that you will need to be familiar with are:

- Knowledge and Logic
- Reasoning and Planning
- Automated Planning and Evaluation

Having some knowledge of these areas and understanding how they inter-relate will make it far easier to understand learning materials and explain and describe your investigations and outcomes in this assignment. Our advice is that you use this assignment as a basis for the study of these underlying areas to assist in integrating the knowledge covered in this unit into a meaningful 'whole', which supports completing this assessment task.

Submission Components

This is an individual assessment task. You must submit the following to the relevant Assignment Dropbox folder on the Unit Site no later than the given deadline:

- 1) **A report ([YourID]_assign3project_report.pdf)** Your report should provide adequate information to evidence your learning against the objectives stated above and in line with the assessment rubric provided. See details in the section *Guide for Your Report Writing*.
- 2) **All .pddl and/or .py codes developed or used in this assessment.** Your code must include appropriate documentation (sufficient internal comments) that explains what the code does. You can choose your own editor, but you are recommended to use the online editor and solver(s) on planning.domains: <https://editor.planning.domains/>.

Note: If your solution includes the usage of any open-source libraries. In that case, you need to provide those libraries or make them accessible to the assessor (e.g., by providing a link to a download site and instructions on how to install and use the library in your solution).

Your Task

Conduct a Problem-Based Learning (PBL) exercise to explore automated planning with PDDL. Write a comprehensive report that details the development process, knowledge base, reasoning, and representation, as well as results and discussions. Students aiming for grades higher than a Pass must fulfill all the criteria for subsequent grades.

Exploration of automated planning and PDDL (P/C-level Criteria)

- 1) Read the relevant documentation for using PDDL, starting with what we have discussed and practised in classes and practical (workshop) between weeks 7-9. Then select one of the **projects (pddl examples)** on the following repository, that interests you most, to investigate further:
 - pddlgyim GitHub repository: <https://github.com/tomsilver/pddlgyim/tree/master/pddlgyim/pddl>
- 2) Based on your selected **project (pddl example)**, implement its PDDL problem and domain. Execute it and obtain all necessary outcomes. Then, complete your report accordingly based on the guides in *Guide for Your Report Writing* section of this tasksheet.

PDDL for the Wumpus World **project** (D-level Criteria)

- 1) Extend your PDDL study by further investigating the Wumpus World **project** discussed in our class (see the Wumpus World case in week 5 class materials – Lecture and Prac).
- 2) Analyse the provided .pddl problem and domain files and identify the logical mistake(s) (Hints: logical misinterpretation of action capabilities). Provide details in your report.
 - (Unit Site > Assessment Resources > [Assignment #3 folder](#)): wumpus-domain-a.pddl
 - (Unit Site > Assessment Resources > [Assignment #3 folder](#)): wumpus.pddl
- 3) Suggest, implement and verify solution(s) to rectify the issue. Provide these details in your report.

Solver Comparison (HD-level Criteria)

- 1) Extend your PDDL Wumpus World study by comparing two of the PDDL solvers from the provided list on the planning.domains online editor, reviewing their strengths and limitations.
- 2) Explore the impact of constraints by adding one to two of them to the Wumpus World domain/problem using PDDL. Analyse the impact of these constraints on planning effectiveness, quality, and stability.

Guide for Your Report Writing

Your report should provide adequate information to evidence your learning against the objectives stated above and in line with the assessment rubric provided, including the following sections in your submission. You may organise these into sub-sections as needed to better structure your response.

<i>Sections</i>	<i>Guide for you</i>
<ul style="list-style-type: none"> • Introduction to Automated Planning 	<p>Begin by discussing the principles of automated planning based on your selected PDDL project (pddl example). Explain, aligned with AI and CI perspectives, how automated planning would work with an <i>Environment</i> modelling, how <i>Goals</i> and <i>Actions</i>, and any relevant components of intelligent system/agent would be achieved.</p> <p><i>This guide has provided you with details (like Q&A guide) and aims to help you to address this section effectively by your own words. There is no strict word limit, but please note, it is just an introduction section, if you address this section with concise writing, this should be no more than 300 words as a guide.</i></p>
<ul style="list-style-type: none"> • PDDL problem(s) and domain(s) Implementation 	<p>Elaborate on your experience and the outcomes in PDDL development in this assignment, including reproducing example(s), completing the problem(s) and domain(s), justifying the automation planning outcomes. Then comment on how your studies and understanding outlined in the previous Introduction section enable you to complete this PBL-based PDDL study and implementation.</p> <p><i>There is no word limit, subject to the scale of your project in this assignment. See the Task section for details. For students aiming for D/HD, you need to further include an additional study on Wumpus World.</i></p>
<ul style="list-style-type: none"> • Results and Discussions 	<p>Present and explain the outcomes of your working PDDL solution, employ visual aids like graphs, charts, tables, figures, screenshot etc, to enrich your explanation. Discuss the significance of these results and what they indicate about your solution's performance and effectiveness.</p> <p><i>There is no word limit, subject to the scale of your project in this assignment. See the Task section for details. For students aiming for D/HD, you need to further include an additional study on Wumpus World.</i></p>
<ul style="list-style-type: none"> • Knowledge Base and Representation 	<p>In relation to your PDDL implementation on the automated planning application(s), provide a detailed elaboration on how the intelligent system/ agent's knowledge base is constructed and represented. Discuss the types of inferred knowledge that have been derived in your PDDL application.</p> <p><i>There is no word limit, subject to the scale of your project in this assignment. See the Task section for details. For students aiming for D/HD, you need to further include an additional study on Wumpus World.</i></p>
<ul style="list-style-type: none"> • Conclusion and lessons learned 	<p>Summarise key findings and reflect on the project's impact on your understanding of automated planning and computational intelligence modelling in the real-world scenario, and what are different informed learning paradigms in AI. <i>As a guide - No more than 300 words as it is a conclusion, if you address this section with concise writing.</i></p>
<ul style="list-style-type: none"> • Acknowledgement 	<p>Record any external assistance, if applicable</p>
<ul style="list-style-type: none"> • References 	<p>List all sources cited in your assignment</p>

Marking

Your submission will be evaluated based on criteria that reflect the depth of your automated-planning and problem-solving skills, technical proficiency, theoretical knowledge, and communication effectiveness. against the quality of your work. A numeric mark (out of a total mark of 40) will be determined by how well your work aligns with the grading criteria and its standard as outlined in the rubric available on the Unit Site under Resources>Assessment.

- Meets Minimum Standard

- Showing proper problem-based learning and self-directed learning procedures on automated-planning through completed tasks
- Demonstrating foundational problem-solving and automated-planning through task completion, showing basic grasp of relevant theories, and communicating a viable solution clearly
- Exceeds Minimum Standard
 - Exhibiting advanced analysis and application of AI modelling, alongside clear, detailed communication and evidence of critical thinking in solution development.
- Excellent Standard
 - Highlighting meticulous attention to detail, introducing creative and resourceful solutions, and engaging in thoughtful evaluation of design decisions.
- Outstanding Standard
 - Advances beyond coursework to explore new theoretical questions or applications with insightful critical thinking, creates innovative software solutions marking a high level of effectiveness and efficiency, and excels in communicating complex designs, showing leadership and deep understanding in collaborative settings.

Late Penalties

In accordance with Faculty assessment policies, late submissions to the submission folder will incur a penalty based on Deakin's Penalties for late submission and Due dates policies, <https://www.deakin.edu.au/students/study-support/assessments-and-examinations/assessments>

Getting Help and Support

Students are encouraged to support each other in discussing the tasks and assisting in overcoming problems in understanding the concepts, models, and algorithms. Engaging and discussing in class time (lecture, Prac) and outside class time in the unit site discussion forum or Teams site peer support channel will improve your understanding and help others build their knowledge. Note, however, that this is an individual assessment task, and all development work and report writing must principally be the work of the student being assessed. Wherever sourcing from appropriate references, ensure that you accurately and appropriately reference the source work. Academic penalties for collusion and plagiarism are severe. Students are urged to seek guidance and advice from the teaching team if they have concerns about appropriately completing this task.

Guidance Support

The teaching team is here to support you in this task. If you are having trouble understanding the learning material or this task, please seek assistance from us during class time. Outside class time, the best way to do this is by asking questions in the Discussion Forum on the Unit Site. Answers to your question will also help other students who undoubtedly have the same problems as you.

Report Writing Help

While the teaching team is happy to provide advice and guidance on writing your report, please read the guidelines and instructions in this task sheet. The university also provides support services for students. In particular, the Writing Mentors team offer great assistance for students completing written assessment tasks – especially report writing. Visit <http://www.deakin.edu.au/students/studying/study-support/writing-mentors> for more information.

Feedback

Students are actively encouraged to seek formative feedback from peers and teaching staff, on their work completed before the submission deadline, to ensure they are on track with this task. Feedback may be obtained during weekly scheduled practical classes upon request. Talk to us, and we'll support you! Besides, marking feedback will be provided after the evaluation process around 1.5 weeks after the submission due date.

End of Assignment 3 Tasksheet.