

MIDTERM PRESENTATION

Course: Introduction to Artificial Intelligence

Duration: 03 weeks

I. Formation

- The midterm project is conducted in groups of 03 – 05 students.
- Student groups conduct required tasks and submit the project following instructions below.

II. Tasks

a) Task 1 (3.0 points): A* with 8-Puzzle

In the 8-puzzle game, you have to move tiles, given an initial state, to obtain one goal state. Note that

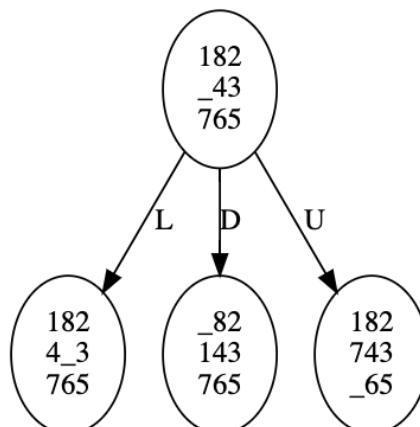
- The initial state can be arbitrary permutation of 8 tiles and the blank cell.
- There are four goal states as below.

1	2	3	8	7	6		1	2		8	7
4	5	6	5	4	3	3	4	5	6	5	4
7	8		2	1		6	7	8	3	2	1

- After a move
 - If cell 1 and cell 3 are adjacent to each other, horizontally or vertically, they are automatically swapped.
 - Similar for cell 2 and cell 4.

Students conduct the following requirements:

- Formulate the given problem in form of a state space, determine details of related components.
- A* algorithms to solve the game with 02 heuristic functions, explain admissibility and consistency of each function.
- Provide a function to illustrate the search tree with n nodes, n is a parameter.



- Propose an experiment to evaluate the optimality of the two selected heuristic.
 - Hint: randomize initial state, run the algorithm, measure the average path cost of the solution.
- Students organize the program regarding to the OOP model, ensure source code is compact and reasonable.
- Recommended editor: Google Colab

b) Task 2 (3.0 points): A* with Pacman

Students implement search strategies to help the pacman to collect all food points in the maze.

- Formulate the given problem in form of a state space, determine details of related components.
- Implement the A* algorithms to solve the problem, discuss the admissibility and consistency of the selected heuristic.
- Implement a complete program to execute designated algorithms, in which
 - Input: path to a layout file
 - Output: list of actions (North, East, West, South, Stop); total cost
 - The maze structure is as below
 - % → obstacles/walls
 - P → initial location of the pacman
 - . → food points, there could be multiple points
 - O → magical pies, pacman can go through walls for the 5 steps after eating a pie.
 - spaces → blank cells.
 - There are no ghosts in the maze.
 - If the pacman reaches to a corner, then it automatically teleports to the opposite corner of the maze.

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- Visualization: students visualize game steps on the console screen (press a key to start animation, do not need to press Enter for each step). Students are highly recommended to use the `pygame` library (0.5 bonus points).
- Students organize the program regarding to the OOP model, ensure source code is compact and reasonable.
- Recommended editor: Visual Studio Code

c) Task 3 (3.0 points): 16-queens

The problem is to place 16 queens on a chess board 16 x 16 so that there is no pair of them attacking each other.

Students formulate the game in form of a local search problem and implement a genetic algorithm to solve it, in which:

- The crossover step occurs at two random points.
- Mutation ration is flexible, in which the user can specify its value when execute the algorithm.

Hints:

- How to represent a state of the game?
- What is the successor function?
- Fitness function?



- Students organize the program regarding to the OOP model, ensure source code is compact and reasonable.
- Recommended editor: Google Colab

d) Task 4 (1.0 points): Presentation

- Student groups compose a presentation to report your work with your own template.
- The presentation must include below contents
 - Student list: Student ID, Full name, Email, Assigned tasks, Complete percentage.

- Briefly present approaches to solve tasks, should make use of pseudo code/diagrams.
- Avoid embedding raw source code in the presentation.
- Study topics are introduced briefly with practical examples.
- Advantages versus disadvantages
- A table of complete percentages for each task.
- **Format requirements:** slide ratio of 4x3, avoid using dark background/colorful shapes because of projector quality, students ensure contents are clear enough when printing the presentation in grayscale.
- Presentation duration is within **10 minutes**.

III. Submission Instructions

- Create a folder whose name is as
midterm_<group ID>_<your student ID>
- Content:
 - **source** → project folder, each task is located in a subfolder
 - **presentation.pdf** → presentation.
 - **demo.txt** → URL to the demo video with **the maximal duration of 03 minutes**.
- Compress the folder into a zip file and submit by the deadline.
- All member must submit the project.

IV. Policy

- **Student groups submitting late get 0.0 points for each member.**
- **Missing required materials in the submission loses at least 50% points of the presentation.**
- **Copying source code on the internet/other students, sharing your work with other groups, etc. cause 0.0 points for all related groups.**
- **If there exist any signs of illegal copying or sharing of the assignment, then extra interviews are conducted to verify student groups' work.**
- **AI tools are forbidden in this project.**

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