FACULDADE DE
CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE D
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Knowledge, Reasoning and Planning

Mini-Project 1

2025/2026

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Project Description

This practical project aims for each group of students to conceive and implement in Python a simple text-based version of the Pac-Man game, whose core focus is the intelligent behavior of the ghosts (i.e., the Pac-Man enemies that try to catch it). The game should run in the console with an ASCII grid (i.e., 2D array), and the player controls Pac-Man using the keyboard arrow keys. Apart from the input and output operations, the gameplay should follow a simplified version of the standard Pac-Man rules[1]:

- Pac-Man moves one cell at a time through a maze of walls, while collecting pellets (i.e., the dots) to increase the score (10 points per pellet);
- Pac-Man moves in the four cardinal directions (up, down, left, right);
- If Pac-Man comes into contact with a ghost, it loses a life and restarts the gameplay in the same position;
- After Pac-Man loses 3 lives, the game ends.

The game must include three ghosts, each controlled by a distinct intelligent agent built on a distinct knowledge base (KB) and reasoning procedure. Two of these KBs must use propositional logic, and the third must use first-order logic. The agents should present distinct rule sets, and not superficial variations. External AI libraries for logic cannot be used, but common data structures are allowed.

As previously mentioned, each ghost should demonstrate a different intelligent behavior, to be proposed and justified by the students. Moreover, the environment is partially observable for the ghosts. On each movement, every ghost has line-of-sight up to four cells in each of the four cardinal directions (up, down, left, right). However, line-of-sight is blocked by walls. In other words, beyond that four-cell radius or behind a wall, the world is unknown to that ghost at that moment. This creates the need for belief maintenance and reasoning under uncertainty. Consequently, the proposed solutions should

[1] The Pac-Man game is available to be played at https://freepacman.org.

allow a ghost to update its KB with percepts, and infer likely locations and valid paths to reach Pac-Man.

The project must also include a two-page report created with the IJCAI template that focus on the agents and KB design choices. The template is available at https://www.ijcai.org/authors_kit. Students may use either the LaTeX or Microsoft Word format. The report must not include code and should cover the following topics:

- Provide a high-level introduction to the developed solutions;
- Specify the propositions and predicates used, as well as the formulas;
- Describe the rules and explain the behaviors of each ghost.

Any questions about the project should be discussed with the teaching staff on office hours or during the practical or theoretical classes.

Rules and Important Dates

Each project must be implemented by a group of two students. All members of a group will receive the same grade unless there are exceptional disparities in contribution (particularly noticeable in the defenses). Projects will be evaluated against the same criteria for all groups and students: core game correctness; correct use of propositional and first-order logic; intelligence and adaptability of the agents controlling the ghosts; how creative are the proposed behaviors of the different agents; and how complete, organized, and well-written is the report.

The deadline to submit the project with all deliverables (code and report) is November 23, 2025. This deadline is final, and all deliverables must be submitted via InforEstudante. After the submission deadline, some classes will be used for presenting and defending the projects (a detailed schedule will be released afterwards). Projects that are not submitted to defense will be graded 0%.