Intro to Artificial Intelligence

Programming Assignment 2: Problem Solving in SWI-Prolog

You will write a general search-based problem solver in SWI-Prolog, and then demonstrate its application to different problem setups and search strategies.

You must appropriately translate the following puzzles into Prolog:

- the 'Sliding Tile' puzzle (`sliding-tile`) [**15 Points**],
- the 'Vampires and Werewolves' puzzle (`vamp-wolf`) [**15 Points**].

These need to be usable by your general search algorithm. Make sure that, when given a `Puzzle` (*e.g.* `sliding-tile` or `vamp-wolf`) and a valid `State` of that puzzle, you can:

- test if `State` is equivalent to some `OtherState`,
- enumerate all of the valid `Moves` from `State`.

You must correctly implement the following search strategies in Prolog:

- depth-first search (`dfs`) using a stack [**10 Points**],
- breadth-first search (`bfs`) using a queue [**10 Points**],
- heuristic search (`hfs`) using a priority-queue [**10 Points**].

These need to be usable by your general search algorithm. In addition, for the heuristic search (*a.k.a.* 'best-first') you should come up with admissible, non-trivial heuristics for the two puzzles. Include some *brief* (a few sentences at most) documentation of your heuristics and why they are admissible in `heuristics.txt`, a plain text file. [**10 Points**]

You need to create a general search-based problem solver that, when given a `Puzzle` to solve between `Start` and `Goal` states, and a search `Strategy`, prints out puzzle states order visited by the solver, and then the sequence of states and moves connecting `Start` to `Goal` (if one exists). We will provide specific the `Start` and `Goal` states that you will need to log soon via Learn.

[**5 Points per Logfile per** (`Puzzle`, `Strategy`) **Combination**]

WHAT to SUBMIT

Submit the following to Learn:

- all of the Prolog source files that you have written
- a short `readme.txt` file explaining how to run it
- the `heuristics.txt` file explaining your heuristics
- six plain-text log files {`sliding-tile`,`vamp-wolf`}-{`dfs`,`bfs`,`hfs`}`.txt`

The **Sliding Tile Puzzle** consists of a 4x4 grid of tiles. There are 16 tiles: one blank tile, and 15 numbered tiles labeled 1 through 15. The figure below shows one possible configuration.

12	1	2	15
11	6	5	8
7	10	9	4
	13	14	3

The puzzle allows the following moves with associated costs:

- the blank tile can swap positions with any adjacent tile (cost of 1).

You win when the numbered tiles are placed in increasing order; in row-major order, specifically. The blank tile may be anywhere; this means there may be multiple goal states.

Vampires and Werewolves. Three vampires and three werewolves are on the east side of Rio Grande, along with a boat that can hold one or two people. Find a way to get everyone to the west side without ever leaving a group of vampires in one place outnumbered by werewolves in that place. (It is well known that vampires are more civilized, and therefore less likely to start a fight). NOTE: the boat cannot cross without anyone in it.