

# The Wumpus World

## Introduction

The **wumpus world** is a cave consisting of rooms connected by passage-ways. Lurking somewhere in the cave are wumpi, a beast that eats anyone who enters its room. To make matters worse, some rooms contain bottomless pits that will trap anyone who wanders into these rooms (except for a wumpus, who is too big to fall in). The only mitigating feature of living in this environment is the occasional heap of gold.

## Specifications

### Basic wumpus world

The wumpus world is a grid of squares surrounded by walls, where each square can contain agents and objects. The agent always starts in the lower left corner (labeled as square [1,1]). An agent's precepts, actions and goals are listed below.

- In the square containing the wumpus and in the directly (not diagonally) adjacent squares the agent will perceive a stench.
- In the squares directly adjacent to a pit, the agent will perceive a breeze.
- In the square where the gold is, the agent will perceive a glitter.
- When an agent walks into a wall, it will receive a bump.
- When a wumpus is killed, it gives a woeful scream that can be perceived anywhere in the cave.
- The precepts will be given to the agent in the form of a list of five symbols; for example, if there is stench, a breeze, and a glitter but no bump and no scream, the agent will receive the percept [*Stench, Breeze, Glitter, None, None*]. The agent cannot perceive its own location.
- There are actions to go forward, turn right by 90 degrees, and turn left by 90 degrees. In addition, the action *Grab* can be used to pick up an object that is in the same square as the agent. The action *Shoot* can be used to fire an arrow in a straight line in the direction the agent is facing. The arrow continues until it either hits and kills the wumpus or hits the wall. The agent only has one arrow, so the *Shoot* action has effect only once. Finally the action *Climb* is used to leave the cave; it is effective only when the agent is in the start square.

- An agent dies a miserable death if it enters a square containing a pit or a live wumpus. It is safe (but smelly) to enter a square with a dead wumpus.
- The agent's goal is to find the gold and bring it back to the start as quickly as possible., without getting killed. To be precise, 1000 points are awarded for climbing out of the cave while carrying the gold, but there is a 1 point penalty for each action taken, and a 10,000 point penalty for getting killed.

## Multiple agents, wumpis et al

With  $n$  agents, we change the game as following.

- First there can be more than one wumpus. Specifically, we will have  $n$  wumpis and  $3n$  pits. The wumpis are stationary, although located randomly.
- Each agent has three arrows now.
- If two agents enter a square containing gold in the same step and both grab the gold, then we will say that they both got the gold.
- An arrow has no effect on an agent (or an agent is nimble enough to avoid any arrows).
- The size of the grid is  $3n \times 3n$ .

## Further details

Develop a rule-based reaction system for the agent. Your rule based system should not be dependent upon the number of agents, number of wumpis, number of pits or the size of the cave. It may, however, use the number of arrows.