

**Institute of Information Technology  
University of Dhaka**

**Topic: Wumpus World AI Agent Project Report**  
**Artificial Intelligence (CSE-604)**

**Submitted by:**

**Mashiat Amin Farin - 1202**

**Mohammad Momenuzzaman - 1227**

**Monayem Sarker - 1228**

**Submitted to:**

**Dr. Ahmedul Kabir**

**Associate Professor**

**Institute of Information Technology**

**University of Dhaka**

# Introduction

This report provides an overview of the development and implementation of an AI agent for the classic "Wumpus World" game.

## Project Overview

### Background

The "Wumpus World" game is a popular artificial intelligence problem where an agent navigates a grid-based cave environment while facing various challenges, including:

**Pits:** Dangerous locations that the agent should avoid falling into.

**Wumpus:** A deadly monster that the agent must eliminate by shooting it with an arrow.

**Gold:** A valuable treasure that the agent aims to collect.

**Breezes:** Environmental cues indicating the proximity of pits.

**Stenches:** Environmental cues indicating the presence of the Wumpus.

Our project can have multiple arrows, gold, pits and wumpus as desired. And is able to kill wumpus and safely climb out from base.

### Objectives

The primary objectives of the project were as follows:

**Design an Intelligent Agent:** Create an intelligent AI agent capable of making informed decisions to navigate the Wumpus World safely and efficiently.

**Implement Game Logic:** Develop the game logic, including handling environmental cues (breeze, stench), updating the agent's knowledge, and executing actions (move, shoot, grab).

**Achieve Success:** Enable the agent to complete the game by returning to the starting point with the gold, avoiding pits, and eliminating the Wumpus.

**Loop Detection and avoidance:** In this game we keep track of the agent's movement history, so if the agent repeats the same steps in the same direction, we try to avoid it and find a new, unexplored and safe tile.

# AI Agent Design

## Utilizing Logic in the Wumpus World AI Agent

In our Wumpus World AI agent project, logic played a pivotal role in modeling and reasoning about the environment. Specifically, we employed a combination of first-order logic and propositional logic to make intelligent decisions and navigate the complex game world.

### Propositional Logic

Propositional logic was employed to represent the knowledge and observations of the agent as it explored the Wumpus World. In this logic:

**Symbols:** We used propositional symbols to represent various states and conditions in the environment. For example, symbols could represent the presence of stench or breeze in a particular tile, whether the agent perceives glitter, the position of the Wumpus, and so on.

**Logical Operators:** Logical operators such as AND, OR, and NOT were used to combine and reason about these symbols. For instance, if the agent perceives stench in a tile AND does not perceive a breeze, it may infer that the Wumpus is nearby.

**Knowledge Base:** The agent maintained a knowledge base that stored its beliefs and the deductions it made using propositional logic. As the agent explored, it updated this knowledge base with new information and used it to make decisions.

### First-Order Logic

In addition to propositional logic, first-order logic was employed to capture more complex relationships and rules in the Wumpus World:

**Objects and Predicates:** First-order logic allowed us to introduce objects, such as tiles and entities (e.g., the agent, the Wumpus), and predicates that described relationships between these objects. For instance, predicates could express that a tile is adjacent to another tile or that the agent perceives a stench when it is near the Wumpus.

**Quantifiers:** We used quantifiers like "for all" and "there exists" to express general rules about the environment. For example, we could specify that for all adjacent tiles, if one contains a breeze, it implies the presence of a pit in the neighboring tile.

**Inference and Reasoning:** First-order logic allowed the agent to perform more sophisticated inference and reasoning. It could derive conclusions about the state of the environment based on the relationships and rules defined in the logic.

## Benefits of Logic

The integration of both propositional and first-order logic in our AI agent provided several advantages:

**Structured Knowledge:** Logic provided a structured way to represent and organize the agent's knowledge about the environment. This made it easier to manage and reason about complex situations.

**Inference:** Logic enabled the agent to draw logical inferences from its observations. For example, it could deduce the possible locations of pits and the Wumpus based on perceptual information.

**Decision Making:** Logic plays a crucial role in decision-making processes. The agent could use its logical deductions to decide where to move, when to shoot its arrow, and when to grab the gold.

## Results and Achievements

The AI agent successfully completed the objectives of the project. It demonstrated the following key achievements:

**Safe Navigation:** The agent effectively tries to navigate the cave environment while avoiding pits and other hazards.

**Wumpus Elimination:** It can eliminate the Wumpus by shooting arrows when facing it.

**Gold Collection:** The agent collects the gold when encountered and carries it back to the starting point.

**Loop Detection:** The agent incorporates logic to detect and break out of loops in its path.

**Decision-Making:** The agent makes informed decisions based on environmental cues, knowledge, and objectives.

## Conclusion

This report summarizes the key aspects of Wumpus World AI project, including its objectives, design, achievements, and potential areas for future development.