CPSC460/560 Final Project: Intelligent Agents in Reinforcement Learning

For your final project, you will design, implement, and evaluate an intelligent agent that can operate in a complex environment of your choosing. This project emphasizes reinforcement learning and you demonstrate connection between theoretical foundations with interesting applications. This project is to be completed in groups of 2 to 3 students. Each group must clearly delineate and state the responsibilities of each student within the group. Each student must submit their own individual statement, reflecting their personal contributions to the project. Graduate students must submit individual project reports.

Agent Implementation

Your agent must demonstrate reinforcement learning ability. Examples include:

1. Search Agent
   - Combine search-based planning with reinforcement learning.
   - Example: Pac-Man that uses A* for pathfinding and Q-learning to decide when to chase rewards vs. avoid threats.

2. Reinforcement Learning Agent
   - Train an agent to navigate a gridworld, play Snake, or balance a task like CartPole.
   - Use Q-learning, SARSA, or other reinforcement learning techniques to learn effective strategies.
   - Explore exploration–exploitation tradeoffs (ε-greedy, decaying ε,…).

3. Adversarial Game Agent
   - Implement a two-player game AI (e.g., Tic-Tac-Toe, Connect Four, simplified Pac-Man with ghosts).
     - Baseline with minimax search and alpha–beta pruning.
     - Extend with reinforcement learning via self-play.
   - Analyze how learning improves performance compared to static strategies.

Experimentation

You must run experiments with different parameter settings, baselines, or strategies. Examples include:

- Comparing ε-greedy with different ε in reinforcement learning.
- Comparing minimax with a learned strategy in adversarial games.
- Measuring how learning curves evolve over time.

What to submit:

- Statement of responsibilities
- Your source code
- Experimental results (plots, tables, performance metrics).
- Project presentation (ppt slides)
- Graduate students:
  - Individual report with analysis of learning curves, strategy improvements, and observations.