

**CmpE 540 Principles of Artificial Intelligence**  
**Fall 2007**  
**Project 3—Due: 28/12/2007 13:00**

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This project is to be done individually, but you are free to discuss your ideas with one other person who is taking this class. After discussing your ideas, write your program and documentation on your own. Please do not get help from anyone else. If you use any material for the answers, please cite your sources appropriately. Be sure to tell the name of your friend with whom you have discussed your ideas. Please submit your documentation as printed hard-copy and your programs on CD. If you submit your project after the due date, you will get a penalty. Projects will not be accepted after 1/1/2008.

**Scenario** Consider the Wumpus World from Section 7.2. The following modifications are applied to the Wumpus World. Other details of the Wumpus World are to be considered the same as the original Wumpus World.

1. Each square other than the start can be a pit with a probability that can be tuned.
2. In addition to pits, each square other than the start can be a mountain with a probability that can be tuned.
3. If the agent moves to a square where there is a mountain, it receives a score of -20.
4. In the squares that are directly above or below a mountain, the agent will perceive a breeze. For example, if there is a mountain in square (2,2), then there is a breeze in squares (2,1) and (2,3).
5. Forget about turning left or right so that if the agent is in a cell, it can move to any adjacent cell without first turning its face in the right direction.

**Tasks** Design and implement an agent that starts from the start state and walks in this modified Wumpus World to look for gold. The agent should reason probabilistically. Section 13.7 revisits the Wumpus World in terms of probabilistic reasoning.

1. **Design:** Explain the agent architecture you use in detail. What are its components? How does it choose its actions? Describe its probabilistic reasoning. Are you using Bayesian networks in your system? Why or why not?
2. **Implementation:** Your code should be able to do the following:
  - (a) Ask the user for the probability of having a pit and the probability of having a mountain in a cell. (Hint: One intuitively thinks that these probabilities may play an important role in how the agent would choose its actions.)
  - (b) Generate a Wumpus World with these probabilities and show it on the screen. Your display need not be fancy.

- (c) Implement the action you designed. The agent will be aware of the probabilities of pit and mountain, but it will not know the actual configuration of the world. The agent should reason about the environment probabilistically and generate actions that will lead it to the gold state.
- (d) Print each action that the agent takes. Doing so, also show its alternatives, why it is choosing the current action (and not the alternatives), and what its current (probabilistic) knowledge is about the squares in the world.
- (e) Keep track of the agent's performance by calculating its score (see the performance measure in Section 7.2). After each action, print the agent's score.

You can make assumptions that are not conflicting with the description of the modified Wumpus World. But, justify your assumptions appropriately.