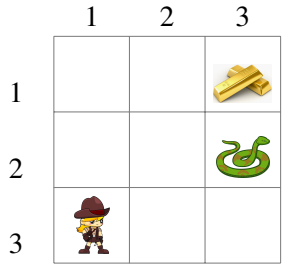
Exercise 1 :

Consider the following variation of the example from the lecture:



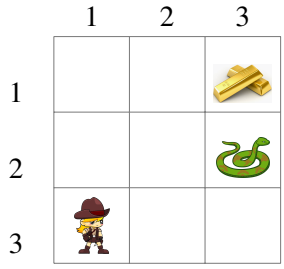
The only difference is that the reward is 1 point for the gold, -20 points for the snake, and 0 everywhere else.

(i) Compute the first 3 iterations of value iteration with $\gamma = 0.9$

(ii) Consider the value function after the 3th iteration. Does the optimal policy change with respect to the version in the lecture? Justify your answer.

Exercise 2 :

Consider the following variation of the example from the lecture:



But now the snake will move to an adjacent square every time. The following rules apply:

- If the adventurer is where the snake is, the snake will remain there. In that case, the adventurer cannot move with probability 0.5, else it moves where they wanted to.
- If the adventurer is next to the snake, then the snake will jump to the adventurer with probability 0.5 (and the adventurer cannot move) or remain where it is. If the adventurer is not next to the snake
- If the adventurer is not next to the snake, then the snake will move at random (0.25 percent in each direction).
- As in the original problem, when the adventurer moves there is a small chance (20%) that she falls to the right.

Getting the gold provides the adventurer 10 points. Being in the same square as the snake provides 5 points. Everything else provides -0.1 points. Formalize this problem as an MDP. Provide a formal description of the following.

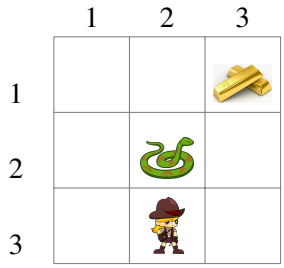
(i) Set of states

(ii) Actions

(iii) Reward function

(iv) Transition probability function. In particular, describe the possible outcomes for the initial state where we apply the north action.

(v) Transition probability function. In particular, describe the possible outcomes for the following state where we apply the east action.



Exercise 3 :

Consider the game of Tetris: https://en.wikipedia.org/wiki/Tetris_(NES_video_game).

Formalize this problem as an MDP. Provide a description of the following.

(i) Set of states

(ii) Actions

(iii) Reward function

(iv) Transition probability function

(v) Initial state

(vi) Set of terminal states

The description can be just a short text in English textual and not necessarily entirely formal.
