Value-Iteration-Algorithm

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1 Value Iteration Algorithm

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1.1 Part 2

1.1.1 Task 1

We have generated Trace files for part 2 which can be found in the outputs directory. Code returns the trace of the states as output with best policy and its utility values.
- Iterations: It took 118 iterations to reach convergence.
- Gamma : 0.999
- Delta : 0.001
- Step Cost : -10

Some observations are as follows:

1. Indiana Jones when present in center square, do not/ very rarely resort to attack (It might be because of low success rate). In the converged iteration, when IJ is in center, it never choses to hit MM. Moreover, I was only able to find only 4 instances of shoot that too only when MM's health was 25.\
2. High Gamma Value makes IJ a risk aversive person. He tries to avoid being in the vulnerable states when MM is in Ready state. This can be seen in the start state mentioned below in which IJ prefers to STAY in North Square as long as MM is in steady state.
3. IJ prefers to hit MM rather than shoot. It might be because of two reasons, one being high damage of HIT over SHOOT and other being availibility of arrows.
4. IJ being a risk averse person avoids facing MM without any arrows and hence tries to gather material to craft arrows. After which he tries to attack MM.
5. It is also noticed that CRAFT and GATHER actions are preffered when MM is in ready state.

- **Initial State: (W, 0, 0, D, 100)**

  Action Taken: Right ; **Resulting State**: (C, 0, 0, D, 100)
  Action Taken: Right ; **Resulting State**: (E, 0, 0, D, 100)
  Action Taken: Hit ; **Resulting State**: (E, 0, 0, D, 50)
  Action Taken: Hit ; **Resulting State**: (W, 0, 0, D, 0)
  End state is reached as MM health becomes zero.

- **Initial State: (C, 2, 0, R, 100)**

  Action Taken: Up ; **Resulting State**: (N, 2, 0, R, 100)
  Action Taken: Craft ; **Resulting State**: (N, 1, 1, R, 100) / (N, 1, 2/3, R, 100)
  Action Taken: Craft ; **Resulting State**: (N, 0, 2, R, 100) / (N, 0, 3, R, 100)
  Action Taken: Stay ; **Resulting State**: (N, 0, 2, R, 100)

  From here onwards, IJ will prefer to stay in this state only so as to avoid being attacked by MM. IJ would get out of this case only if MM attacks and become dormant or STAY action fails and IJ ends up in East. Former option is more probable in my opinion as it is likely that MM will attack so further states are as follows:

  Action Taken: ---- ; **Resulting State**: (N, 0, 2, D, 100)
  Action Taken: Down ; **Resulting State**: (C, 0, 2, D, 100)
  Action Taken: Right ; **Resulting State**: (E, 0, 2, D, 100)
  Action Taken: Hit ; **Resulting State**: (E, 0, 2, D, 50)
  Action Taken: Hit ; **Resulting State**: (E, 0, 2, D, 0)
  End state is reached as MM health becomes zero.

1.1.2 Task 2

Case1 Indiana now on the LEFT action at East Square will go to the West Square.
No significant change is noticed as we have already scene CENTER square already has very much significance as IJ tries to avoid attacking from there and morover tries to avoid being in CENTER square as it renders him vulnerable to MM.

Also Number of iterations remains approximately same ie. 120

Case2 The step cost of the STAY action is now zero.
Significant changes are seen only in the WEST square. Now stay action is highly preferred there. Also convergence is achieved in 57 iterations.

Case3 Change the value of gamma to 0.25

Early convergence is seen as GAMMA value is increased. It can be seen clearly as number of iterations drastically decreases from 118 to 8!

1.2 Part 3

It will be submitted in the later phase.