Value Iteration Algorithm

Task 1

INTERPRETATIONS AND COMMENTS:

We observed that our VI algorithm converged at 118th iteration. We analyzed the trace file and came to the following conclusions for each of the states.

CENTER:

When IJ was at center and MM was in a dormant state then IJ tend to move to the EAST because we had a good arrow shooting probability there(0.9).

IJ can also hit MM with the help of blade here which causes significant decrement in health of MM, but it has less probability of success.

Whereas if MM seems to be in a ready state then IJ preferred to choose safe positions to defend itself, i.e. up/down/left.

NORTH:

When IJ is in NORTH state and MM in dormant state then IJ tried to move down to CENTER state, because from here it can attack MM easily.

Whereas when MM is in a ready state, again IJ prefered to stay and craft material(if possible) to defend himself.

EAST:

When IJ is in EAST and MM is in dormant state, IJ tried to attack the MM. Blade hit has high damage but arrow shooting has more success probability.Therefore IJ would want to shoot, if there are arrows, exact action would still be negotiable.

Whereas when MM is in ready state, IJ wants to defend itself but moving to CENTER won't be helpful as MM's attacks are still succesfull there, so IJ will either shoot the arrow or hit with the blade.

WEST:

When MM is in dormant state IJ would like to attack, so IJ would either shoot or IJ would like to move to center in order to increase the shooting probability.

When MM is in ready state IJ would rather stay here or shoot.

So WEST,D was giving SHOOT or LEFT and WEST,R was giving SHOOT or STAY, as expected.

SOUTH:

When MM is in dormant state IJ wants to move UP so that it can attack MM, or GATHER material there.(if possible)

When MM is in ready state IJ would want to STAY or GATHER in material.

So SOUTH,D gave GATHER or UP and SOUTH,R gave GATHER or STAY as expected.

Comment:

Since the discount factor is high this justifies that Indiana preparing to attack by moving to center or east from non-attackable states,when mm is in dormant state and prefers to play safe when mm is in ready state.I.e,considering long term benefits.

It took 118 iterations(including initial one) to converge, which is quite understandable as delta is 1e-3 which is a very small figure.

Task 2

Case 1:

No.of iterations to converge = 120
Policy for other states excluding EAST were more or less the same.
When IJ is at EAST and MM is ready to attack policy resulted in LEFT only for higher values of MM health.
On the same side, if health was<= 50, HIT or SHOOT was prefered.
Number of iterations to converge are almost the same as in task1.

Case 2:

No.of iterations to converge = 57
As the step cost for STAY action is now 0, so for most of the states where IJ is not willing to attack, IJ choosed STAY action.

Case 3:

No.of iterations to converge = 8
It is obvious to have such a less value for iterations because gamma(discount factor) is kept to be 0.25. By keeping gamma to such a low value resulted in decreasing the value of the same reward which the IJ can get at earlier time instants to a negligible number. Hence is shown in the behaviour of IJ that it now focuses on immediate rewards, leading to early convergence.

Simulation

No . 1: (W, 0, 0, D, 100)

Simulation 1
(W, 0, 0, D, 100):: step = RIGHT
(C, 0, 0, R, 100):: step = RIGHT
(E, 0, 0, R, 100):: step = HIT
(E, 0, 0, R, 100):: step = HIT
(E, 0, 0, R, 50):: step = HIT
(E, 0, 0, R, 50):: step = HIT
(E, 0, 0, D, 75):: step = HIT
(E, 0, 0, D, 25):: step = HIT
(E, 0, 0, D, 25):: step = HIT
(E, 0, 0, D, 0):: step = UP

In this starting state, IJ moves to the centre and then towards east. It then stays on east block and continues firing blades at the monster.(HIT blades)
It is interesting to see that since the number of blades is taken to be infinite and the damage it deals when hit, IJ always prefers to hit these. There are various other options and even though shooting MM with arrow has 0.9 probability in the East block, IJ still prefers blade since it is infinite whereas arrows are finite and once finished, arrows will have to be made again and a high step cost of 20 does not give this liberty.

No. 2: (C, 2, 0, R, 100)

Although we see slight change in the initial steps taken by this simulation, where IJ firstly goes to NORTH square to craft and stays there until MM comes to dormant state. Once the MM comes to the dormant state IJ starts attacking MM with the help of blade and continues till MM dies away.

Simulation 2
(C, 2, 0, R, 100):: step = UP
(N, 2, 0, R, 100):: step = CRAFT
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(N, 1, 3, R, 100):: step = STAY
(E, 1, 3, R, 100):: step = HIT
(E, 1, 0, D, 100):: step = HIT
(E, 1, 0, D, 100):: step = HIT
(E, 1, 0, D, 100):: step = HIT
(E, 1, 0, D, 50):: step = HIT
(E, 1, 0, R, 50):: step = HIT
(E, 1, 0, D, 75):: step = HIT
(E, 1, 0, D, 75):: step = HIT
(E, 1, 0, R, 25):: step = HIT
(E, 1, 0, D, 50):: step = HIT
(E, 1, 0, D, 50):: step = HIT
(E, 1, 0, D, 50):: step = HIT
(E, 1, 0, D, 50):: step = HIT
(E, 1, 0, R, 50):: step = HIT
(E, 1, 0, R, 0):: step = UP