



JK Lakshmipat University, Jaipur
Department of Computer Science and Engineering
Artificial Intelligence (CS-1224)
End-Term, Date: December 06, 2023

Time: 2.5 hours

2023-24 Semester I

Max mark: 35

Please read the following instructions carefully.

- There are 5 questions printed on both sides.
- **No marks** for providing just expressions/answers unless accompanied with correct justification and/or derivation.
- In case of any doubt, make your assumption, write it clearly and continue.

1. State true or false for the following statements. Justify. (10*2)

(CO1, CO2, CO3, CO4)

- (a) In a finite state space, BFS is complete even if zero and negative step costs are allowed.)
- (b) DFS **always** expands at least as many nodes as A* search with an admissible heuristic.
- (c) Uniform-cost search is a special case of A* search.
- (d) A* terminates as soon as it enqueues a goal state.
- (e) Alpha-beta pruning is used to reduce the search space of expectimax trees.
- (f) If an arc $A \rightarrow B$ is consistent then so is arc $B \rightarrow A$.
- (g) Good child ordering improved effectiveness of pruning in a minimax tree.
- (h) BFS and DFS both return the shallowest goal in the search tree.
- (i) In MDPs, $V^*(s)$ may be computed using $\max Q^*(s, a)$
- (j) In reinforcement learning, all the values in Bellman equations are known except γ , the discount value.

2. Write Bellman equations. Draw a suitable diagram, label it well. (3+2)

(CO4)

3. Look at Figure 1 in which Q-values are provided for the grid world as discussed in the classes. (CO4)

(a) Provide $V^*(s)$ for each state. (2)

(b) Provide optimal policy. (2)

4. Of the following utility sequences which one is preferred? (4*1)

(CO4)

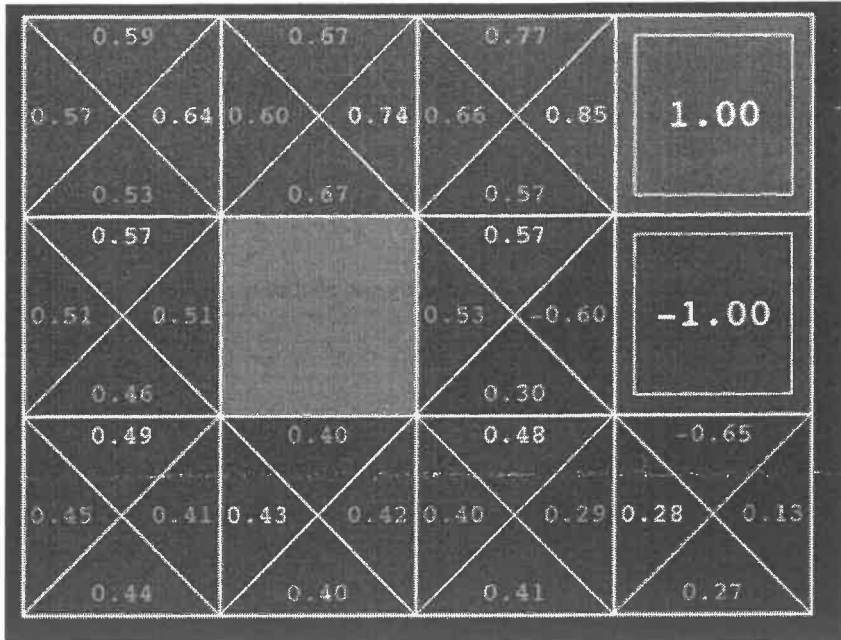


Figure 1:

- (a) $[0,0,1]$ vs $[1,0,0]$ when $\gamma = 1$.
- (b) $[0,0,1]$ vs $[1,0,0]$ when $\gamma < 1$.
- (c) $[1,2,3]$ vs $[3,2,1]$ when $\gamma = 1$.
- (d) $[1,2,3]$ vs $[3,2,1]$ when $\gamma = 0.5$.

5. What is a Markov process?

(2)