

Assignment 2:

Q1) Since the performance measure is concerned only with the first T steps, a rational agent must maximize the performance not by just completing the task but completing it before the time T steps. So, in this case a rational agent's action is not determined just by wanting to get to the desirable state in the environment, but also the current time step as the agent needs to try to get to a state before time T steps that helps maximize its performance. For example, while taking an exam, a student increases his pace and determines his actions not just by the paper but also based on the time left in the exam.

Q2) The conditions that would make the environment:

- (a) Fully observable: If the agent's sensors give access to the complete state of the environment like the positions of the stars, any traps in the squares that are to be avoided and boundaries of the environment, and as a result the agent knows the action to be taken to maximize performance.
- (b) Partially observable: If the agent's sensors give access to the state of the environment partially. For example, if the agent knows the positions of the stars in the environment, but is not equipped with sensors to detect mines that are under the squares, then we say the environment is partially observable.
- (c) Deterministic: If there is no uncertainty in the environment and the agent's actions are determined only by its current state. In this case, if it is certain that there are no mines or anything except for stars in the environment, then the agent can take the action only based on its current state.
- (d) Stochastic: If there exists some uncertainty and the agent's action cannot be based on a specific state. In this case, we can consider an environment similar to the partially observable case (b). If there are some mines in the environment that cannot be detected by the agent, then this uncertainty must also be considered by the agent while calculating its next action.
- (e) Dynamic: If the environment changes over time, then it is dynamic. In this case, if things like the positions of the stars, number of squares in the environment, etc keep changing while the agent is still thinking of the next action, then it is a dynamic environment.
- (f) Static: If the environment stays the same over time, then it is static. In this case, if the things like the positions of the stars, number of squares in the environment and paths, etc are fixed before the agent starts collecting the stars, then it is static.
- (g) Sequential: If the current action affects future actions, then it is a sequential environment. In this case, the given environment is already sequential as the agent's current action will determine its future path and the agent needs to keep track of this path to backtrack in the event of reaching a dead end.
- (h) Episodic: If a sequence of actions is not determined by a previous sequence of actions, then it is an episodic environment. This environment is not episodic as the agent's current action could affect its future path and the agent needs to backtrack in case of a dead end.
- (i) Known: If the outcomes of all actions are already known, then it's a known environment. In this case if the agent knows exactly where the stars are, number of squares in the environment and number of stars, etc, then it is a known environment.
- (j) Unknown: In this case, if the information about positions of the stars, number of squares in the environment, type of moves available, etc is not known to the agent beforehand, then it is an unknown environment.
- (k) Continuous: This problem is not a continuous environment as the types of moves available to the agent (left, right, up, down) are discrete and no uncertainties exist in this.
- (l) Discrete: In this case, the positions of stars, number of squares and type of moves available are fixed and the agent takes a sequence of discrete actions based on percepts at discrete times. This is a discrete environment.