

CS 411 Homework 2

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1. Explain the difference between goal-based agent and utility-based agent

Goal-based Agent	Utility-based Agent
A goal set is defined, which is a subset of all possible states in the state space, This goal set can either be a singleton or a set with multiple states defined as the goal	A utility function is defined for the agent, which is a function of the current state and the paths that emanate from the current state.
It performs a search into the future based on the actions it can possibly take in its current state until it reaches one of the states in the goal set or until it exhausts the search space and does not find a path to a goal state	It also performs a search into the future based on the actions it can possibly take in its current state, but it does not stop its search on reaching a "goal state", it does not have a goal set defined. It performs the search based on the optimal path that maximises the utility function.
It has a boolean reward function, a state has a high reward if it is a goal state and low if it is a non-goal state and it looks like a step function when mapped in the state space	It has a non-boolean continuous reward function, it measures a heuristic of the optimality of its current state based on the paths that emanate from it and assigns the node the utility value of the path with the maximum utility value, When mapped onto the state space, it can be more continuous than a step function and not just a high and low
The architecture of a goal-based agent incorporates a check if the current state is a goal state or if in the future from this state whether a goal state can be reached.	The architecture of a utility-based agent incorporates a utility function on the current state to measure the utility of the current state, by searching into the future for the most optimal path which maximises utility.

2. Imagine environment below, in which the agent can move left, right, up and down, and pick up stars.

- a. Fully Observable - if the robot had sensors capable enough to know the location of itself, and all stars on the grid, the size of the grid, it would be a fully observable environment
- b. Partially Observable - if the robot had sensors which could only view a limited view of the map, say only one square or 2 squares around it in each direction left, right, up and down and had no prior knowledge of the position of the stars and can only know if a star is in its field of view
- c. Deterministic - If the robot had specific condition action rules of where to move that deterministically made it move either up, down, left or right, based on the squares it sees around it, the environment would be deterministic.
- d. Stochastic - If the robot, based on what it sees in the squares around it, moved either up, down, left or right, with some probabilities for each of them, rather than following a deterministic rule, it would be a stochastic environment.
- e. Dynamic - If the environment had continuously moving stars, it would have to make a decision in real time which direction to move in, and the environment would be dynamic
- f. Static - The environment is static if the stars do not move and the robot can only move one step at a time and the grid size stays fixed.
- g. Sequential - It is sequential if the grid is more like a maze or if the performance is measured by how fast the robot would pick up the parts
- h. Episodic - The environment would be episodic if the
- i. Known - If all the entities in the environment were known in the robot's action condition rules, the environment would be known.
- j. Unknown - If the environment had entities that the robot had not accounted for in its action condition rules, it would be an unknown environment
- k. Continuous - If the robot moved on a continuous plane instead of just atomic moves such as one square up, down, left or right, if it could move in any direction continuously over time, it would be a continuous environment
- l. Discrete - If the agent can only move in distinct steps in a fixed size grid, it is in a discrete environment, since it would only be within a finite set of states
- m. Single Agent - If there is only one robot and the stars are stationary, it is a single-agent environment

- n. Multi-agent - If there was more than one robot and if the stars also were moving based on the motion of the robot, it would be a multi-agent environment