**Assignment # 2**

**Artificial Intelligence**



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17-BSCS-541(A)

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| **C:\Users\DELL\Desktop\Government_College_University_Logo.jpg**  **G.C University Faisalabad, Sub Campus Layyah** |
| **Assignment #: \_\_\_\_\_\_2nd \_\_\_\_\_\_ Subject: Artificial Intelligence** |
| **Class: BSCS Semester: 6th** |
| **Total Marks: 50 Submission Date: 25 Aug 2020** |

**Question # 1: 10 Marks**

Consider the problem faced by an agent to learn and play tennis (or any other sport with which you are familiar). Describe the percept and action of the agent, and the types of learning the agent must do. Also, describe the subfunctions the agent will try to learn in terms of inputs and outputs.

**Solution:**

The risks that legitimize the executive's norm in the contender incomparable games foundation relationship are of unclear concern to the contender proficient relationship. The ordinary 22 years old contender who is unseemly by methods for preparing or mind examination to build his concurrence with a game foundation is correspondingly harmed in picking and holding an organizing administrator or cash related power. The contender unfit to pick ace and instructor on a typical, savvy clarification select a head upon a demonstration of unadulterated trust which leaves the contender subordinate upon the pro is viewed as a frill by the contender, the authority gets the contender trust conviction and reliance from the most punctual beginning stage of the relationship The issue with the games specialists industry is that the foxes are in the hen houses The contender virtuoso relationship is commonly one of conflicting power the chief demands the contender, who is totally dependent upon the ace for business bearing. This out for the count relationship prompts abuse by the ace and renouncing of responsibility by the contender.

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**Learning agents and types that agent must do**

**Learning agent**

As portrayed before are fundamentally the systems which are set in the mood for setting themselves up by getting from their own exercises and experiences. The Learning system in the authority is completely formed into three sorts:

1. Supervised Learning
2. Unsupervised Learning
3. Reinforcement Learning

### Supervised Learning

As the name itself proposes, in such a learning, the authority is controlled in each mean in prior itself. What it fundamentally derives is that the correct reaction in each down to earth sense each model issue is overseen in the Knowledge Base of the structure from the earliest starting point in its development stage. In this manner, at whatever point the chief goes standing up to ay issue, it endeavors to find a comparative issue or a near issue in its data base whose game-plan it starting at now has embedded in its system. If the issue isn't there or is an extraordinary course of action not really relative to those beforehand remaining in its structure, by then in those cases, the executive fails to work or play out any fundamental action.

### Unsupervised Learning

In the independent learning authorities, the reactions to the issues are not open with the head early. In such a learning, the leader needs to itself find the response for the issue by getting from its past exercises and experiences. In any case, the key information which shapes the foundation of the Knowledge Base is given to the administrator in its improvement stage, yet it needs to find the outlines with no other person. Such a head is more sharp than the Supervised Learning expert as it can find an immense response for those issues in like manner which the leader have looked considering the way that and has no previous data or relationship concerning it.

### Reinforcement Learning

In the Reinforcement Learning framework, the taking in method is basically undefined from in solo learning. Regardless, what is critical is that, in Reinforcement Learning, the head is given some prize once in a while for completing any endeavor. Here, the goal of the authority is to get the basic of such rewards. In this way, at whatever point any director attempts to find the response for any issue, it takes a gander at for an elective which would give him the most mind boggling prize focus interests. Such a learning makes the position sharp comparatively as chooses it recognize the most ideal decision according to the utility of the fashioner or the customer. The utility based executives use such a learning in their structures.

**Question # 2: 10 Marks**

**Write down the algorithm of Breadth first search, Depth first search and Hill Climbing. Also, explain the working of algorithm and conclude the time and space complexity.**

**Solution:**

**The algorithm of Breadth first search**

Breadth first search is a graph traversal algorithm that starts traversing the graph from root node and explores all the neighboring nodes. Then, it selects the nearest node and explore all the unexplored nodes. The algorithm follows the same process for each of the nearest node until it finds the goal.

The algorithm of breadth first search is given below. The algorithm starts with examining the node A and all of its neighbors. In the next step, the neighbours of the nearest node of A are explored and process continues in the further steps. The algorithm explores all neighbours of all the nodes and ensures that each node is visited exactly once and no node is visited twice.

**The algorithm of Depth first search**

Depth first search (DFS) algorithm starts with the initial node of the graph G, and then goes to deeper and deeper until we find the goal node or the node which has no children. The algorithm, then backtracks from the dead end towards the most recent node that is yet to be completely unexplored.

The data structure which is being used in DFS is stack. The process is similar to BFS algorithm. In DFS, the edges that leads to an unvisited node are called discovery edges while the edges that leads to an already visited node are called block edges.

**Time and Space Complexity.**

In computer science, the time complexity is the computational complexity that describes the amount of time it takes to run an algorithm.

In simple words, Time complexity of a program is a simple measurement of how fast the time taken by a program grows, if the input increases.

function isPrime(n) {

for (let i = 2; i < n; ++i) {

if (n % i === 0) {

return false;

}

}

return true;

}

Here the loop will run (log n)-1 times

1st iteration, i = 1

2nd iteration, i = 2

3rd iteration, i = 4

4th iteration, i = 8

….

kth iteration, i = 2 ^ (k-1)

So, 2 ^ (k-1) < n

now taking log on both sides

log (2 ^ (k-1)) < log n

k-1 = log n

Time Complexity: O(log n)

In computer science, the space complexity of an algorithm or a computer program is the amount of memory space required to solve an instance of the computational problem as a function of the size of the input.

In simple words, Space complexity of a program is a simple measurement of how fast the space taken by a program grows, if the input increases.

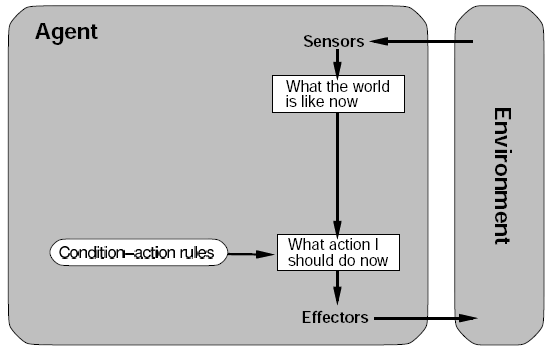
**Question # 3: 10 Marks**

Consider a simple thermostat that turns on a furnace when the temperature is at least 3 degrees below the setting, and turns off a furnace when the temperature is at least 3 degrees above the setting. Is a thermostat an instance of a simple reflex agent, a model-based reflex agent, or a goal-based agent? Justify your answer with solid reasons.

**Solution:**

**Simple reflex agent**

This agent selects actions based on the agents current perception or the world and not based on past perceptions.

For example if a mars lander found a rock in a specific place it needed to collect then it would collect it, if it was a simple reflex agent then if it found the same rock in a different place it would still pick it up as it doesn't take into account that it already picked it up.

This is useful for when a quick automated response is needed, humans have a very similar reaction to fire for example, our brain pulls our hand away without thinking about any possibility that there could be danger in the path of your arm. We call these reflex actions.This kind of connection where only one possibility is acted upon is called a condition-action rule, written as:

if hand is in fire then pull away hand

The simple reflex agent has a library of such rules so that if a certain situation should arise and it is in the set of Condition-action rules the agent will know how to react with minimal reasoning. These agents are simple to work with but have very limited intelligence, such as picking up 2 rock samples.

**Model-based reflex agent**

Model-based reflex agents are made to deal with partial accessibility; they do this by keeping track of the part of the world it can see now. It does this by keeping an internal state that depends on what it has seen before so it holds information on the unobserved aspects of the current state.

This time out mars Lander after picking up its first sample, it stores this in the internal state of the world around it so when it come across the second same sample it passes it by and saves space for other samples.

While reading this you are keeping track of where you have got to somewhere internally in your brain just in case you lose your place. But in order to update this internal store we need 2 things:

1. Information on how the world evolves on its own.e.g. If our mars Lander picked up the rock next to the one it was going to the world around it would carry on as normal
2. How the world is affected by the agents actions.E.g. If our mars Lander took a sample under a precarious ledge it could displace a rock and it could be crushed.We can predict how the world will react with facts like if you remove a supporting rock under a ledge the ledge will fall, such facts are called models, hence the name model-based agent.

**Goal-based agent**

In life, in order to get things done we set goals for us to achieve, this pushes us to make the right decisions when we need to. A simple example would be the shopping list; our goal is to pick up every thing on that list. This makes it easier to decide if you need to choose between milk and orange juice because you can only afford one. As milk is a goal on our shopping list and the orange juice is not we chose the milk.

So in an intelligent agent having a set of goals with desirable situations are needed. The agent can use these goals with a set of actions and their predicted outcomes to see which action(s) achieve our goal(s).Achieving the goals can take 1 action or many actions. Search and planning are two subfields in AI devoted to finding sequences of actions to achieve an agents goals.Unlike the previous reflex agents before acting this agent reviews many actions and chooses the one which come closest to achieving its goals, whereas the reflex agents just have an automated response for certain situations.

Although the goal-based agent does a lot more work that the reflex agent this makes it much more flexible because the knowledge used for decision making is is represented explicitly and can be modified. For example if our mars Lander needed to get up a hill the agent can update it’s knowledge on how much power to put into the wheels to gain certain speeds, through this all relevant behaviors will now automatically follow the new knowledge on moving. However in a reflex agent many condition-action rules would have to be re-written.

**Question # 4: 10 Marks**

For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties

1. Performing a gymnastics floor routine.
2. Exploring the subsurface oceans of Titan.
3. Playing soccer.
4. Shopping for used AI books on the Internet.
5. Practicing tennis against a wall.
6. Performing a high jump.
7. Bidding on an item at an auction.

**Solution:**

1. Therefore, women's gymnastics floor routines are performed to music, and must include dance moves, while men's floor routines strictly focus on strength — and even though the floor routine is one of only two events (vault is the other) that both male and female gymnasts do in competition, the respective floor routines ...Aug 11, 2016
2. The list could go on, but right now the focus stays on Cassini, which with funding continued through 2017 will continue to give us new and striking discoveries like the river dubbed the moon’s ‘little Nile’ feeding into Ligeia Mare. Nor do I want to ignore the recent work from Howard Zebker (Stanford University) and team, who have been working with Cassini radar data and new gravity measurements to tell us more about the internal structure of Titan and its shape. The idea that Titan boasts a deep
3. A. Number of players: The maximum number of players on the field for one team at any one time is six (6). One of the players must be designated as a goalie by wearing a pinnie of a different color than the rest of the team. The Goalkeeper may only use their hands in the designated goal box, but may come out of the goal box area and play like a field player and use only their feet. Upon returning to the goal box they may use their hands once again. A team may start with five (5) players without forfeiting the contest.
4. PEAS Description ▷ Performance measure: Price, quality, appropriateness, efficiency. ▷ Environment: Current and future Web sites, vendors, shippers. ▷ Actuators: Display to user, follow URL, fill in form. ▷ Sensors: Web pages (text, graphics, scripts).
5. The first exercise will be hitting as many forehands as you can handle in a row. If you imagine a power scale of 1-10, 1 being the softest you could possibly hit and 10 being your hardest shot, start off on level 4-5 and build up as the drill carries on.

This way you build you improve your ball control and the rallies will last much longer so you will hit a lot more balls than if you start off on an 8 or 9.

**Question # 5: 10 Marks**

1. Explain why problem formulation must follow goal formulation.
2. What is the difference between a world state, a state description, and a search node? Why is this distinction useful?
3. Compare the performance of A∗ and Breadth-first search with suitable example and suggest which one is best for which kind of scenario? You can use any example related to searching to justify your answer.

**Solution:**

1. In goal formulation, we decide which aspects of the world we are interested in, and which can be ignored or abstracted away. Then in problem formulation we decide how to manipulate the important aspects (and ignore the others). If we did problem formulation ﬁrst we would not know what to include and what to leave out. That said, it can happen that there is a cycle of iterations between goal formulation, problem formulation, and problem solving until one arrives at a sufﬁciently useful and efﬁcient solution.
2. how the world is, because the agent might want to imagine things that aren\u2019t true but it could make true, and because the agent cares about the world not its internal representation of it. Search nodes are generated during search, representing a state the search process knows how to reach. They contain additional information aside from the state description, such as the sequence of actions used to reach this state. This distinction is useful because we may generate different search nodes which have the same state, and because search nodes contain more information than a state representation.3.12 The state space is a tree of depth one, with all
3. So in summary, both Greedy BFS and A\* are Best first searches but Greedy BFS is neither complete, nor optimal whereas A\* is both complete and optimal. However, A\* uses more memory than Greedy BFS, but it guarantees that the path found is optimal. Try changing the graph and see how the algorithms perform on them.