**AI ASSIGNMENT 01**

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**QUESTION 01**

The Turing’s original paper published in 1950 mainly focused on Artificial Intelligence and was labelled as: "Computing Machinery and Intelligence”. In this paper, Turing proposed the Turing machine which now comes under the acting humanly view of AI. The Turing test was met with several objection that Alan Turing addressed in his paper. The objections that still carry some weight today and their refutation by Alan Turing are:

**Objections:**

Informality of behavior: Some raised an argument that the Turing test solely was a test for ability to mimic the behavior of humans and not their intelligence. This is a valid objection as many of the robots and machines that we are surrounded by heavily rely on their built in programs instead of learning along the way like a human mind does.

Consciousness: Another objection was that not all machines lack consciousness (i.e.: being aware/responsive to the surroundings) like humans are. The objection is still argued upon as there is no mutual opinion over whether consciousness is really important to be intelligent or not.

Structure of the nervous system: This argument said that the human brain can never be replicated and programmed into machines.

**Refutations:**

Alan Turing’s argument was that some human behaviors can be predicted in advance that are not reflex/spontaneous and can be programmed into machines. He also said rejected consciousness to be necessary for intelligence. Further, he acknowledged the importance of brain but said that there was no way that a machine couldn’t be designed to demonstrate the same behavior. His refutations are valid as we have seen AI advancing with neural networks that simulate the working of human brain.

One objection can be related to whether AI offers a fair scale of judgement in all areas as some say that the Turing test is biased towards a particular group of people(i.e.: native English speakers).

The prediction he made is not reasonable currently in my opinion. Although there are many machines that have been close, there is no machine that has definitely passed the Turing test.

**QUESTION 02**

1. Playing a decent game of table tennis: Yes this can be solved by computers by designing a robot with a robotic arm and a detection system (using camera) that tracks the movement of the opponent (human) and then responds with the optimal angle for the shot. The machine can be fed with algorithms that help it in calculating the best angle and power applied in response.
2. Driving in the center of Karachi: This can’t be solved currently due to the unpredictability of the environment in which the self-driving car has to operate. For example, the car might not be trained on how to respond to bumpy roads. Similarly, the traffic situation is also quite unpredictable and can vary greatly due to any circumstance like protests. In that case, the car might not be able to navigate its way out of the traffic. The weather condition like heavy rainfall also greatly effects the situation of the roads and the automated car might get stuck with zero visibility.
3. Discovering and proving new mathematical theorems: Discovering can’t be done by a computer on its own as it primarily relies on the existing formulas and theorems that it has been taught to solve mathematical problems. A computer is limited to the knowledge that it has been given by humans and hence the theorems that a computer knows has already been discovered. However, to some extent they can prove the theorems like in reinforcement learning or neural networks.
4. Writing an intentionally funny story: Yes it is possible for a computer to generate an intentionally funny story using natural language processing and machine learning practices. However, since humor is human trait, there can be variance in the type of audience that finds the story funny.
5. Translating spoken English into spoken Urdu in real time: This task can be done by a computer using speech to speech technology where the computer first translate English into text, translates it into Urdu and then gives output in spoken Urdu. We can see practical implementation of this in global conferences where leaders from different languages interact and use this technology for the speech to be translated into their native language.

**QUESTION 03**

The domain in this scenario is an online food delivery system where the agent visits the website and chooses the food item according to his/her preference and the food items available in the restaurant. The environment is fully observable as the agent can view the entire menu, search for specific food items and pick the one that he wishes to order.

The environment is deterministic as the search results depend on the food item that the agent searches for and the food items posted by the restaurants which is known. However, the environment is not episodic as the search for food item can extend over time as they decide for which food to pick. This involves more than once interaction with the agent. The environment is also static as the food items posted by the restaurant are not changing in seconds or without any prediction. If any such changes are made, the restaurant usually informs the customers about new food items being released. Also here, the agent is not directly affecting the environment.

The environment is also discrete as a limited number of actions are defined for the agent for example adding food items to cart, checking out, paying online etc.

A simple reflex agent may not be suitable for an online food delivery system because it only considers the current state and immediate input to decide the action. Such agents lack the ability to reason or plan ahead and make decisions based on limited information.

In an online food delivery system, there are multiple factors that need to be considered, such as the customer's location, the availability of delivery drivers, the restaurant's cooking time, and the customer's previous orders. A simple reflex agent cannot handle these complex situations and may not be able to provide optimal solutions.

Instead, a goal-based agent, may be more suitable for an online food delivery system. These agents can use past data to learn and make predictions, consider multiple factors simultaneously, and plan ahead to optimize the delivery process.

**QUESTION 04**

1. Playing Soccer

P: Pace of players, accuracy in making goal/aim, angle of shot

E: Soccer field

A: Computer screen

S: Console, keyboard, mouse

1. Exploring he subsurface of Arabian Sea

P: Depth of the sea, visibility, tides in the sea (high or low)

E: Arabian Sea

A: The machine exploring the sea subsurface, ship/boat (if accompanied by a human)

S: Multibeam echo sounders (to measure depth), tide gauge, torch (in case if night time), camera

1. Shopping for used AI books on the Internet

P: Condition of books, price of the book, date when it was published (updated version or not)

E: Internet browser, online stores

A: Screen

S: Keyboard and mouse or touch (in case of phone)

1. Practicing tennis against a wall

P: Power applied to shot, material of the wall (soft/hard), durability and strength of tennis racket

E: Backyard with a wall

A: Tennis racket, tennis ball

S: Eyes (to see the ball), touch (to make the shot in response to wall), sound

1. Knitting a sweater

P: Sharpness of needle, fabric/material of sweater, speed of knitting, experience with knitting

E: Sweater with knitting needle

A: Needle, knitting machine

S: Eyes to check the knitting, hands to knit/to move the machine

**QUESTION 05**

1. An agent that senses only partial information about the state cannot be perfectly rational.

This is true as the agent will be rational but not perfectly as some of the information concerning the environment is hidden from it. For example, automated cars with a partially observable environment can take rational decisions about the movement of car and which route to take but it is not always perfect as the entire route is not visible on the way. The car can get stuck in traffic or meet with any unforeseen circumstance.

1. There exist task environments in which no pure reflex agent can behave rationally.

This is true in several cases like games (Tic TAC toe) where a history needs to be maintained. For example, in the game of tic tac toe, a simple reflex agent will not be having a history of the previous cell in which it has placed marker so there are chances that it might try to access it again.

1. There exists a task environment in which every agent is rational.

This is true as in certain environments, all the agents can perform rationally. For example, in case of cleaning a room:

Simple reflex agent: It will clean the room based on its current state (e.g.: dirty) and maintain a history of the path it took to clean the room previously is not important.

Model-based reflex agent: It will first partially observe the environment of room and then follow a set of steps to clean the room like vacuum where there is dirt.

Goal based agent: The vacuum will be only focused on reaching the goal of cleaning the entire place when placed in a room.

Utility based agent: The vacuum can first determine a path to take with minimum number of obstacles and maximum dirt to clean the room efficiently.

Learning agent: The vacuum like Roomba learns from the environment and then optimizes the cleaning process based on that learning.

1. The input to an agent program is the same as the input to the agent function.

This is false as the agent takes the entire view as input to determine the sequence of steps to be taken. Whereas, the agent program only has current percept as input.

1. It is possible for a given agent to be perfectly rational in two distinct task environments.

This is true as for example a vacuum cleaner might be trained to pick up dirt from the environment of room and clean it. But it can perform the same rational action in a different environment like a garden and vacuum it.