Student Information:

• **Name:** Hanad Ahmed Mohamed

• **Student** ID: CS211115100

• **Course:** Artificial Intelligence

• **Date:** 26-10-2024

Question 1

An intelligent agent is a system that can observe its surroundings, process information, and take actions to achieve specific goals. It does this by using sensors to gather data, making decisions, and using tools (called actuators) to make changes in its environment.

Example: Traffic Light Control System
Performance Measure: Minimize traffic congestion and reduce wait times at intersections.
Environment: City streets, intersections, vehicles, and pedestrian crossings.
Actuators: Traffic light signals (red, green, yellow).
Sensors: Traffic flow sensors, vehicle detection cameras, pedestrian crossing buttons.

Question 2

A *goal-based agent* would be most appropriate for this type of environment.

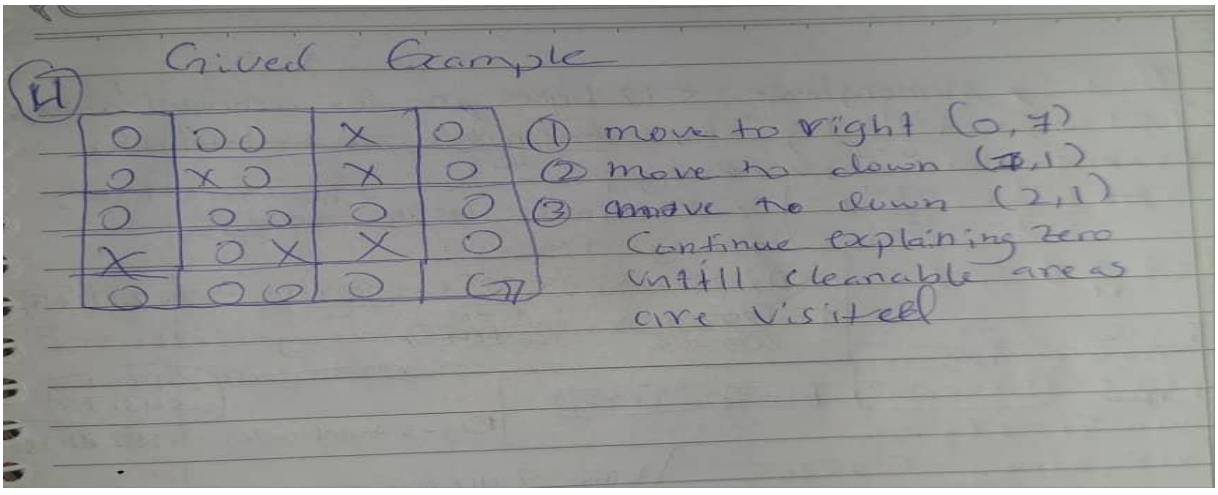
Why: In a partially observable, dynamic, and stochastic (random) environment, the agent doesn't have complete information and faces constant changes. A goal-based agent is effective because it can adapt its actions to focus on achieving a specific outcome, even if it doesn't know all details of the environment. By having a clear goal, the agent can prioritize its actions and adjust based on feedback from the environment.

Example: Imagine a *rescue drone* designed to find and help lost hikers in a forest. The drone can't see the entire area and faces changing weather conditions. With a goal-based design, it focuses on locating the hiker, even if it doesn't have all information about the forest. As it flies, it adjusts its path based on what it sees and any new information it receives, making its way toward the goal of locating the hiker efficiently.

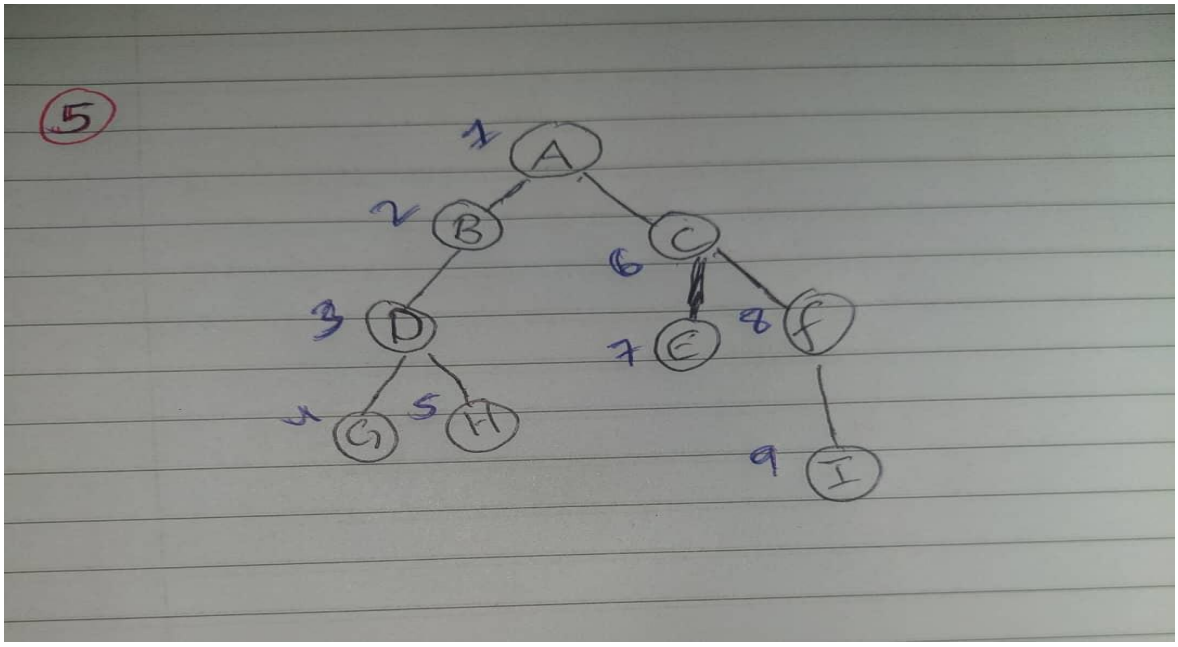
Question 3

Environment Type	Example AI System
Fully Observable	Traffic light system that sees all cars at an intersection.
Partially Observable	A drone exploring a forest where not all areas are visible.
Deterministic	Factory robot following a fixed sequence of steps.
Stochastic	Stock market predictor handling random changes in prices.
Episodic	Email spam filter where each email is a separate task.
Dynamic	A self-driving car adjusting to live traffic conditions.
Discrete	Chess-playing AI with defined moves on a grid.

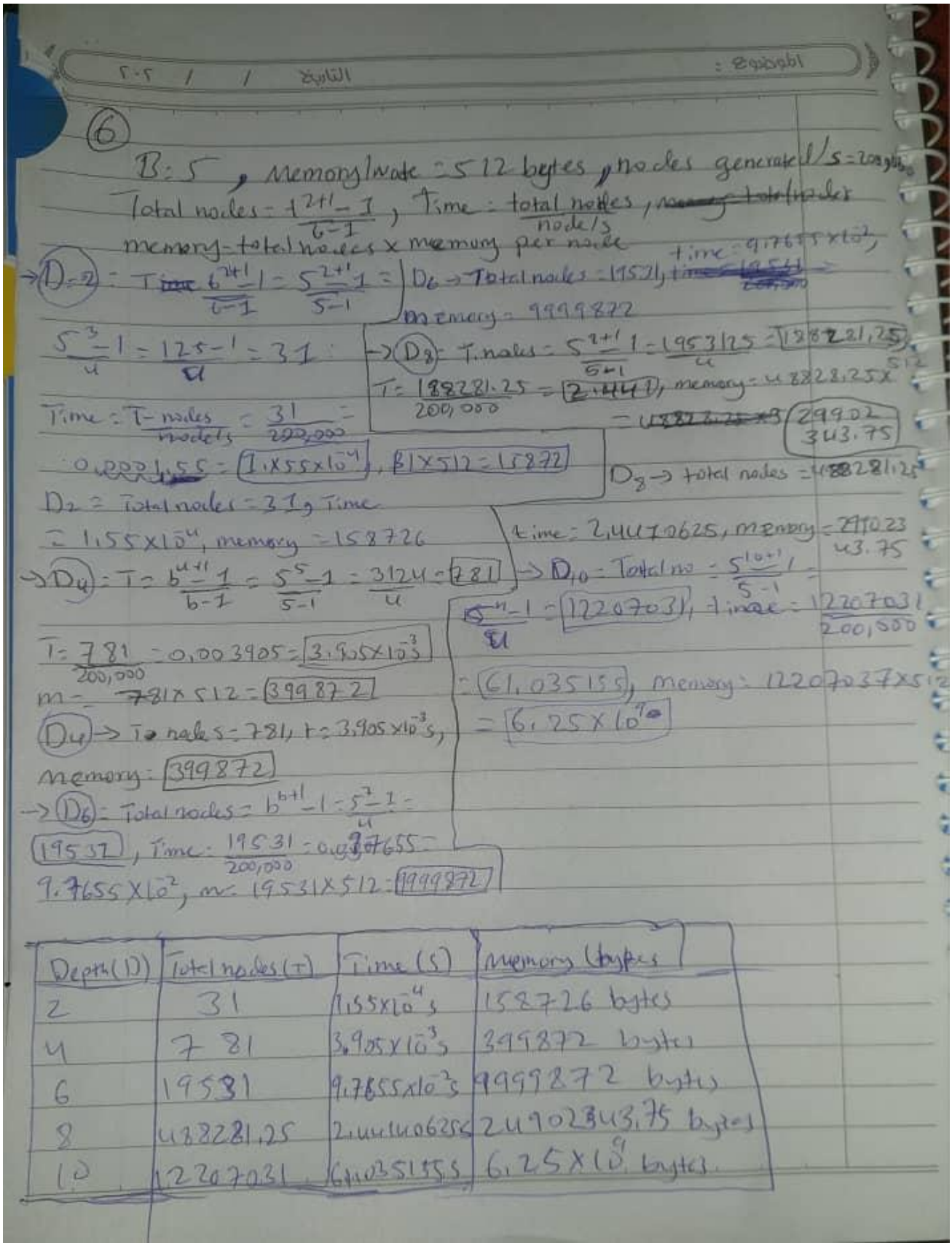
Question 4



Question 5

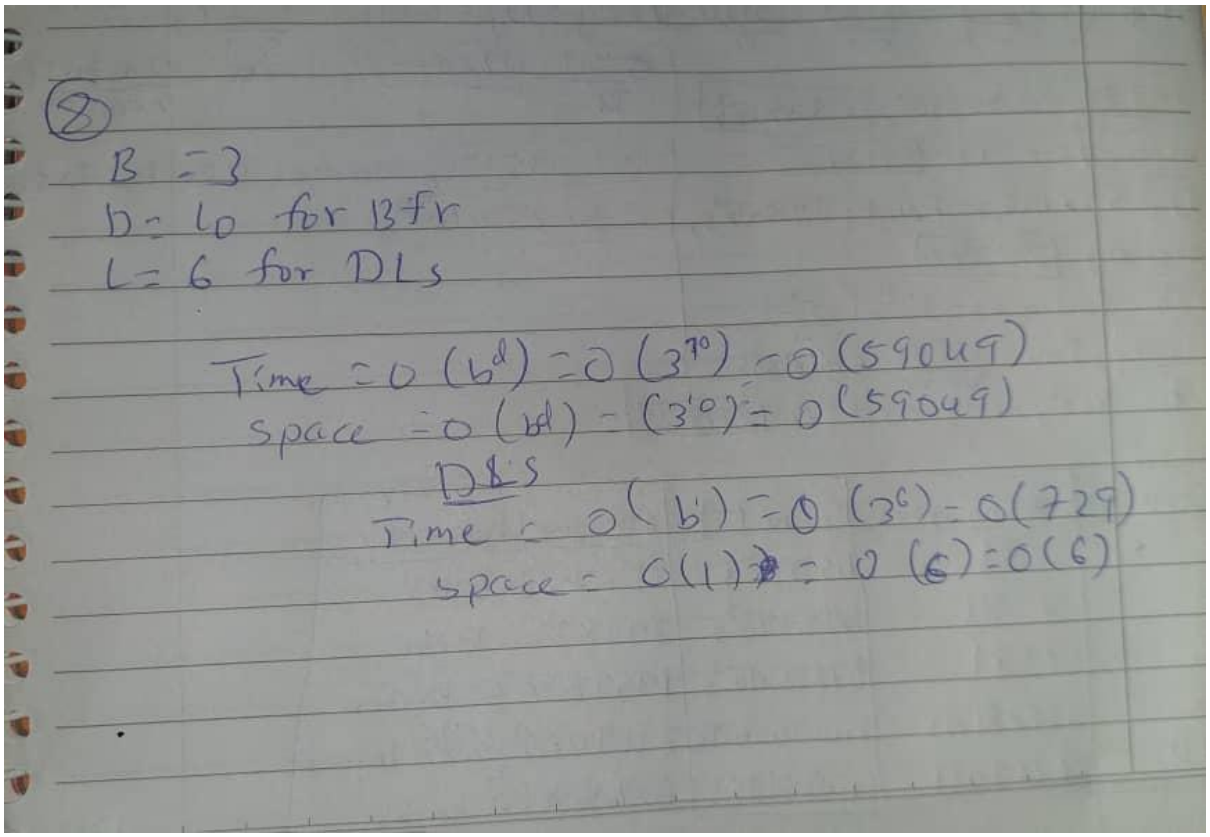


Question 6



Depth (D)	Total nodes (T)	Time (s)	Memory (bytes)
2	31	1.55×10^{-4} s	158726 bytes
4	781	3.905×10^{-3} s	399872 bytes
6	19531	9.7655×10^{-2} s	9999872 bytes
8	4882281.25	24.41406258	2490243.75 bytes
10	122070031	610.351555	6.25×10^{9} bytes

Question 8



Question 10

Design an intelligent agent that operates in an unknown environment. This environment is stochastic, partially observable, and dynamic. Use a utility-based approach and provide a real-world application.

Answer: A **utility-based agent** makes decisions based on how useful each outcome is, choosing actions that bring the highest benefit.

Example: A weather-predicting AI.

- **Environment**: The weather is unpredictable, with changes happening frequently, and the AI can only observe current data partially.
- **Utility**: The AI assesses the usefulness of each prediction, aiming for the most accurate and timely forecast.
- **Real-world Application**: This agent could help cities prepare for extreme weather, sending alerts based on predicted conditions like storms or heatwaves.