Summary of the Files:

Lecture 1: Introduction to Artificial Intelligence

- **Definition & Impact**: AI enhances computers' usefulness and significantly influences human civilization.
- **Applications of AI**:
    - **Autonomous Vehicles**: Self-driving technology (e.g., Tesla Autopilot).
    - **E-commerce**: Recommendation systems (e.g., Amazon).
    - **Natural Language Processing (NLP)**: Virtual assistants (e.g., Siri, Google Assistant).
    - **Computer Vision**: Facial recognition.
    - **Robotics**: Autonomous vehicles.
    - **Expert Systems**: AI in medical diagnosis.
    - **Planning & Scheduling**: AI in space exploration.
    - **Machine Learning**: AI-based text classification.

Lecture 2: AI Agents & Environment Properties

- **AI Agent & Environment**: AI interacts with an external environment to achieve a goal.
- **Environment Classifications**:
    - **Fully Observable vs. Partially Observable**: AI can either see the whole environment (chess) or only part (self-driving cars).
    - **Deterministic vs. Stochastic**: Actions may have predictable (math problems) or uncertain results (traffic navigation).
    - **Episodic vs. Sequential**: Actions may be independent (spam filtering) or affect future decisions (chess).
    - **Static vs. Dynamic**: The environment may remain unchanged (crossword puzzles) or change constantly (self-driving cars).
    - **Discrete vs. Continuous**: AI can have fixed choices (chess) or infinite possibilities (robot navigation).

Multiple-Choice Questions (MCQs) with Answers & Explanations

1. What is a primary goal of Artificial Intelligence?

A) Making computers slower
B) Reducing human intelligence
C) Making computers more useful and intelligent
D) Eliminating all human jobs

Answer: C) Making computers more useful and intelligent
Explanation: AI enhances the capabilities of computers to perform tasks intelligently, rather than replacing human intelligence entirely.

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2. Which of the following is an example of AI in healthcare?

A) Google Translate
B) AI diagnosing tumors in MRI scans
C) Chess-playing AI
D) Tesla's self-driving system

Answer: B) AI diagnosing tumors in MRI scans
Explanation: AI is used in healthcare for medical image analysis and disease diagnosis, improving accuracy and efficiency.

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3. What type of AI system does Amazon use to suggest/recommend products?

A) Computer Vision
B) Expert Systems
C) Recommendation Systems
D) Robotics

Answer: C) Recommendation Systems
Explanation: AI-based recommendation systems analyze user behavior and suggest products accordingly, like on Amazon or Netflix.

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4. What is an example of AI in autonomous vehicles?

A) AI-generated art
B) Tesla's Autopilot system
C) AI-powered weather forecasting
D) AI in music composition

Answer: B) Tesla's Autopilot system
Explanation: Autonomous vehicles use AI for real-time decision-making, navigation, and obstacle detection.

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5. In AI environments, what does "fully observable" mean?

A) The agent has complete access to all information
B) The agent receives random information
C) The agent makes decisions without any input
D) The agent operates without interacting with the environment

Answer: A) The agent has complete access to all information
Explanation: In a fully observable environment, an AI agent can see and use all necessary information for decision-making, like in chess.

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6. Which of the following is an example of a partially observable environment?

A) Chess game
B) Self-driving car
C) Solving a math problem
D) Playing Sudoku

Answer: B) Self-driving car
Explanation: A self-driving car does not have complete information about the environment, such as other drivers' intentions.

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7. What is an example of a deterministic AI environment?

A) Self-driving cars in traffic
B) Chess game
C) Stock market prediction
D) Weather forecasting

Answer: B) Chess game
Explanation: In deterministic environments, the same action always leads to the same outcome, as in chess.

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8. In which type of environment do past actions influence future decisions?

A) Episodic
B) Static
C) Sequential
D) Continuous

Answer: C) Sequential
Explanation: In sequential environments, each action impacts future outcomes, such as in chess or robot path planning.

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9. What is an example of a dynamic AI environment?

A) Crossword puzzle
B) Sudoku game

C) Self-driving car in traffic
D) Solving a math problem

Answer: C) Self-driving car in traffic
Explanation: In dynamic environments, conditions keep changing, requiring AI to adapt in real time.

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10. Which AI category does Siri or Google Assistant belong to?

A) Computer Vision
B) Natural Language Processing (NLP)
C) Robotics
D) Expert Systems

Answer: B) Natural Language Processing (NLP)
Explanation: AI-powered virtual assistants use NLP to understand and respond to human language.

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11. Which of the following is an example of a discrete AI environment?

A) Chess game
B) Self-driving car
C) Human speech recognition
D) AI in agriculture

Answer: A) Chess game
Explanation: In discrete environments, there is a limited number of possible actions, like in a chess game with defined moves.

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12. What AI field is used for facial recognition?

A) Robotics
B) Computer Vision
C) NLP
D) Expert Systems

Answer: B) Computer Vision
Explanation: Computer vision enables AI to analyze and recognize visual data, such as human faces.

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13. In which type of AI environment is each decision independent of previous ones?

A) Episodic
B) Sequential
C) Deterministic
D) Stochastic

Answer: A) Episodic
Explanation: In episodic environments, decisions are made independently, like in spam filtering where each email is classified separately.

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14. Which AI system can assist doctors in diagnosing diseases?

A) Expert Systems
B) NLP
C) Robotics
D) Self-driving cars

Answer: A) Expert Systems
Explanation: Expert systems use AI to provide medical diagnosis by analyzing symptoms and medical history.

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15. Which type of AI environment has an infinite number of possible actions?

A) Discrete
B) Continuous
C) Static
D) Episodic

Answer: B) Continuous
Explanation: In continuous environments, AI has an infinite number of choices, such as in robot navigation.

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16. What AI field is responsible for text categorization?

A) Robotics
B) Machine Learning
C) NLP
D) Computer Vision

Answer: B) Machine Learning
Explanation: Machine learning allows AI to classify and organize text into categories using algorithms.

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17. What is an example of a stochastic AI environment?

A) Solving a math problem
B) Self-driving car in unpredictable traffic
C) Chess game
D) Solving a crossword puzzle

Answer: B) Self-driving car in unpredictable traffic
Explanation: In stochastic environments, outcomes are uncertain due to randomness, like in traffic where unexpected events occur.

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18. What AI field enables Google Translate to function?

A) Robotics
B) Expert Systems
C) Natural Language Processing (NLP)
D) Computer Vision

Answer: C) Natural Language Processing (NLP)
Explanation: NLP allows AI to understand and translate human languages.

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19. What type of AI environment does a crossword puzzle belong to?

A) Static
B) Dynamic
C) Stochastic
D) Partially Observable

Answer: A) Static
Explanation: In static environments, conditions do not change while AI is making decisions, as in a crossword puzzle.

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20. Which AI concept is used in Hubble Telescope experiment scheduling?

A) Robotics
B) Expert Systems
C) Planning & Scheduling
D) NLP

Answer: C) Planning & Scheduling
Explanation: AI helps in managing complex scheduling tasks like space exploration experiments.

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21. What distinguishes deterministic AI environments from stochastic ones?

A) Deterministic environments always produce the same result for a given action, while stochastic ones involve randomness.
B) Deterministic environments are slow, while stochastic ones are fast.
C) Stochastic environments always produce the same outcome.
D) Deterministic AI does not involve programming, while stochastic AI does.

Answer: A) Deterministic environments always produce the same result for a given action, while stochastic ones involve randomness.
Explanation: In deterministic environments, actions lead to predictable results (e.g., solving a math problem), whereas stochastic environments introduce uncertainty (e.g., traffic navigation).

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22. Which of the following is an example of an episodic AI task?

A) A chess game
B) A self-driving car making decisions on the road
C) A spam email filter
D) A robot navigating a maze

Answer: C) A spam email filter
Explanation: Episodic tasks treat each decision independently, without considering past actions. A spam filter classifies emails without remembering previous emails.

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23. In an AI system, what does "dynamic environment" mean?

A) The environment remains unchanged while the AI makes decisions.
B) The environment changes over time and affects AI decisions.
C) The AI controls the environment directly.
D) The AI ignores the environment and works in isolation.

Answer: B) The environment changes over time and affects AI decisions.
Explanation: A dynamic environment, such as a self-driving car system, continuously changes and requires AI to adapt in real-time.

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24. Which AI property applies to a self-driving car detecting pedestrians and other vehicles?

A) Fully Observable
B) Partially Observable
C) Deterministic
D) Discrete

Answer: B) Partially Observable
Explanation: A self-driving car does not have complete information about other drivers' intentions, making its environment partially observable.

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25. What is an example of a discrete AI environment?

A) Driving a car
B) Chess game
C) Stock market prediction
D) Voice recognition

Answer: B) Chess game
Explanation: Discrete environments have a finite number of possible actions, like a chess game where moves are limited and predefined.

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26. Which of the following is NOT a major AI application area?

A) Robotics
B) Computer Vision
C) Machine Learning
D) Astrology

Answer: D) Astrology
Explanation: AI is widely used in robotics, computer vision, and machine learning, but astrology is not a scientific application of AI.

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27. What is an example of a sequential AI task?

A) Classifying spam emails
B) A self-driving car navigating a road
C) Identifying objects in an image
D) Translating a single sentence

Answer: B) A self-driving car navigating a road
Explanation: In sequential tasks, current decisions impact future outcomes. A self-driving car's movements affect its next decisions.

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28. In AI, which term describes an environment where time plays a crucial role in decision-making?

A) Static
B) Dynamic
C) Fully Observable
D) Episodic

Answer: B) Dynamic
Explanation: In dynamic environments, such as self-driving systems, external conditions constantly change, requiring AI to adapt continuously.

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29. Which AI technique is most useful for categorizing documents into different topics?

A) Planning and Scheduling
B) Bayesian Reasoning
C) Machine Learning
D) Robotics

Answer: C) Machine Learning
Explanation: Machine learning enables AI to categorize documents into different topics based on patterns in data.

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30. Which of the following AI fields focuses on allowing computers to "see" and process images?

A) Natural Language Processing
B) Robotics
C) Computer Vision
D) Expert Systems

Answer: C) Computer Vision
Explanation: Computer Vision enables AI to analyze images and videos for applications like facial recognition and object detection.

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31. What is an example of a continuous AI environment?

A) Chess game
B) Sudoku puzzle
C) Robot arm movement
D) Solving a math problem

Answer: C) Robot arm movement
Explanation: Continuous environments involve infinite possible actions, like a robotic arm adjusting its movement with varying precision.

✅ **Exercise 1**

Given Graph:

```
adj = [[1, 2], [0, 2, 3], [0, 4], [1, 4], [2, 3]]
```

Required:

Print the BFS traversal from node 0.

🔍 **Solution + Explanation**

- **adj هو الـ Adjacency List اللي فيها كل node بيمثل الشبكة ، nodes متصلة بأي تانية.**
- **BFS بيبدأ من node 0 ويمشي على حسب ترتيب الجيران ، (neighbor nodes).**

```
from collections import deque
def bfs(adj, start):
    visited = [False] * len(adj)
    queue = deque([start])
    result = []
    visited[start] = True
    while queue:
        node = queue.popleft()
        result.append(node)
        for neighbor in adj[node]:
            if not visited[neighbor]:
                visited[neighbor] = True
                queue.append(neighbor)
    return result
# Example
adj = [[1, 2], [0, 2, 3], [0, 4], [1, 4], [2, 3]]
print("BFS Traversal:", bfs(adj, 0))
```

✅ **Output:**

```
BFS Traversal: [0, 1, 2, 3, 4]
```

🔎 **Explanation:**

- **Start at 0 → visit 1 and 2.**
- **Then from 1 → visit 3.**

- **Then from 2 → visit 4.**
- **3 and 4 already visited, so we stop.**

✅ **Exercise 2**

Given Graph:

```
adj = [[1, 2], [0, 2], [0, 1, 3, 4], [2], [2]]
```

Required:

Print the BFS traversal from node 0.

🧿 **Solution + Explanation**

```
adj = [[1, 2], [0, 2], [0, 1, 3, 4], [2], [2]]
print("BFS Traversal:", bfs(adj, 0))
```

✅ **Output:**

```
BFS Traversal: [0, 1, 2, 3, 4]
```

🔎 **Explanation:**

- **Start from node 0 → go to 1 and 2.**
- **From node 1 → already visited.**
- **From node 2 → visit 3 and 4.**

✅ **Concept Questions**

❓ **Q1: What are the main types of search?**

Answer:

- **Uninformed Search (Blind Search): No extra info (e.g., BFS, DFS).**
- **Informed Search (Heuristic Search): Uses knowledge about the problem (e.g., A*).**

❓ **Q2: What are the steps in problem-solving by search?**

Answer:

1. **Goal Formulation**
2. **Problem Formulation**
3. **Search**
4. **Execution**

❓ Q3: Why do we use BFS?

Answer:

- **To find the shortest path in an unweighted graph.**
- **It explores all nodes at the current depth before moving to the next level.**