Chapter 1

I. True or False Questions

1. Hardware and software are completely independent, and a computer can function properly even if one of them is missing. [F]

2. The third generation of computers used microprocessors that contained the entire CPU on a single chip. [F]

3. Input devices are hardware components that allow users or external systems to enter data or commands into a computer for processing. [T]

4. The motherboard allows communication between the CPU, memory, storage devices, and peripherals by connecting them through essential buses, slots, and circuits. [T]

5. In Von Neumann architecture, both data and program instructions share the same memory and the same system bus. [T]

II. Multiple Choice Questions

1. Which generation of computers first used integrated circuits (ICs), allowing multiple transistors to be placed on a single chip? [C]
   a. First Generation
   b. Second Generation
   c. Third Generation
   d. Fourth Generation

2. What is the main reason hardware and software need each other to function properly? [C]
   a. Software is physical and controls the hardware's shape
   b. Hardware can operate fully without any instructions from software
   c. Software requires hardware to run, and hardware needs software to perform meaningful tasks
   d. Hardware and software perform the same roles in a computer system

3. Which of the following best explains the difference between storage devices and processing devices? [B]
   a. Storage devices execute instructions, while processing devices only hold data temporarily.

b. Processing devices interpret and execute instructions, whereas storage devices retain data either temporarily or permanently.

c. Both storage and processing devices only work when the computer is powered off.

d. Processing devices are only used for input, while storage devices are only used for output.

4. Which of the following statements best explains the difference between RAM, ROM, and Cache memory? [C]

a. RAM is permanent and faster than cache, while ROM is temporary and used only for storage.

b. ROM is volatile and stores active programs, while RAM contains permanent startup instructions for the computer.

c. Cache is faster than RAM and stores frequently used data, RAM is volatile and holds active programs, and ROM is non-volatile and stores essential startup instructions.

d. Cache and ROM are both volatile memories, while RAM permanently stores operating system files.

5. What makes a qubit different from a classical bit? [C]

a. It can only store 0

b. It can only store 1

c. It can exist in both 0 and 1 simultaneously (Superposition)

d. It is stored in DNA molecules

III. Open-Ended Questions

1. What are the main functions of the CPU?

- Executes program instructions

- Performs arithmetic and logical operations (ALU)

- Directs data flow between memory and other components (CU)

- Coordinates input and output device

- Controls the overall operation of the computer system.

2. Name three differences between RAM and ROM.
   - RAM is volatile; ROM is non-volatile
   - RAM stores active programs; ROM stores essential startup instructions like BIOS
   - RAM is temporary memory for the CPU; ROM is permanent memory

3. Why is Harvard architecture better than Von Neumann architecture for high-speed processing?
   - It has separate memory and buses for instructions and data, so the CPU can access both simultaneously and avoid the Von Neumann bottleneck.

4. How do neuromorphic chips improve computing efficiency compared to traditional CPUs and GPUs?
   - They mimic the brain using spiking neural networks, consuming power only when processing data, which reduces energy use and speeds up AI tasks.

5. How does quantum computing process information differently from classical computing?
   - It uses qubits, which can exist in superposition and be entangled, allowing multiple computations to happen at the same time.

Chapter 2

I. True or False Questions

1. Machine learning allows computers to improve their performance through data without explicit programming. [T]
2. Arthur Samuel coined the term "machine learning" in 1959. [T]
3. Supervised learning requires labeled data for training. [T]
4. Neural networks cannot learn complex, non-linear patterns in data. [F]
5. Federated learning centralizes all raw data to train a global model. [F]

II. Multiple Choice Questions

1. Who provided the formal definition of machine learning as learning from experience to improve performance?

a) Alan Turing

b) Tom Mitchell

c) Frank Rosenblatt

d) Arthur Samuel

→ b) Tom Mitchell

(He gave the well-known formal definition of ML in 1997.)

2. Which type of machine learning is used when the output variable is categorical?

a) Regression

b) Classification

c) Clustering

d) Dimensionality reduction

→ b) Classification

(Classification predicts discrete labels, e.g., spam/not spam.)

3. Which neural network model is especially good for remembering events from long sequences?

a) CNN

b) RNN

c) LSTM

d) Perceptron

→ c) LSTM

(Long Short-Term Memory networks handle long-term dependencies better than basic RNNs.)

4. What is the primary purpose of boosting in machine learning?

5. a) Reduce computation time

b) Convert weak learners into a strong learner

c) Label data automatically

d) Reduce dimensionality

→ b) Convert weak learners into a strong learner

(Boosting combines weak models (like small decision trees) into a powerful ensemble.)

6. In unsupervised learning, the system primarily aims to:

a) Predict outcomes using labeled data

b) Discover patterns or groupings in unlabeled data

c) Maximize cumulative rewards

d) Reduce feature importance

→ b) Discover patterns or groupings in unlabeled data

(It finds hidden structures, like clusters, without labeled outcomes.)

III. Open-Ended Questions

1. **Explain the difference between supervised and unsupervised learning with a real-world example.**

   Supervised learning uses labeled data, meaning each input comes with the correct output. For example, an email spam filter learns from labeled emails ("spam" or "not spam") to classify new emails.

   Unsupervised learning uses unlabeled data, finding hidden patterns or groupings. For example, customer segmentation in marketing groups customers by purchasing behavior without predefined categories.

2. **How does reinforcement learning differ from traditional supervised learning, and** what is a practical application?

   Reinforcement learning (RL) involves learning through trial and error with rewards and penalties, rather than labeled examples. The system learns an optimal strategy (policy) to maximize long-term reward.

Example: Training an autonomous robot to walk — it receives rewards for moving correctly and penalties for falling, gradually learning the best actions.

3. **Describe the concept of federated learning and why it is important for data privacy.**

   Federated learning is a distributed ML approach where models are trained locally on devices, and only the model updates (not raw data) are shared with a central server.
   This protects privacy because sensitive user data (e.g., messages, health records) never leaves the user's device, while still contributing to global model improvements.

4. Provide an example of how deep learning is applied in healthcare, and explain why it is effective.

   Example: Medical image analysis, such as detecting tumors in MRI or CT scans using convolutional neural networks (CNNs).
   It's effective because deep learning can automatically learn complex patterns and subtle features in images that might be hard for humans to detect, leading to more accurate and faster diagnoses.

5. **Discuss the significance of Arthur Samuel's checkers program in the history of machine learning.**

   Arthur Samuel's checkers program (1959) was one of the first systems that could learn from experience rather than being explicitly programmed for every rule. It improved its performance over time by playing against itself.
   This marked the birth of the idea that computers could learn from data and experience, laying the foundation for modern machine learning.

Chapter 3

I. True or False Questions

1. Supervised learning is when a person studies behavioral artificial intelligence whilst being watched by an observer. [F]
2. Artificial intelligence is already widely used all around the world to help study human mental health conditions. [F]

3. Behavioral data only measures the decisions people make, not what leads to those decisions. [F]
4. Automatically recorded data requires human observation to collect information.[F]
5. Behavioral AI focuses on understanding, predicting, and responding to human behavior.[T]
6. Supervised learning uses pre-labeled data to train an algorithm.[T]
7. Deep learning models are always easy to understand and interpret.[F]
8. NLP helps AI understand and analyze human language in text or speech form.[T]

II. Multiple Choice Questions

What does behavioral data mainly refer to?
 A. Emotional reactions only
 B. Measurements of targeted variables in behavior
 C. Social media activity only
 D. Neural brain scans exclusively
 ✅ **Answer:** B

What are the two main ways of collecting behavioral data?
 A. Manual and digital
 B. Human-recorded and automatically recorded
 C. Written and spoken
 D. Subjective and objective
 ✅ **Answer:** B

The Human Behaviour Change Project (HBCP) uses AI to:
 A. Replace therapists
 B. Predict behavioral intervention outcomes
 C. Collect only emotional data
 D. Diagnose diseases manually
 ✅ **Answer:** B

In supervised learning, what are "labels"?
 A. Answers or categories given to train the AI

 C. Clusters found by the algorithm
 D. Hidden layers of a neural network
 ✅ **Answer:** A

Which of the following best describes unsupervised learning?
 A. Learning with teacher feedback
 B. AI learns patterns without labeled data

C. Algorithm ignores similarities
D. AI relies on human correction
✅ **Answer:** B

Deep learning models use:
 A. Spreadsheets and tables
 B. Artificial neural networks
 C. Manual instructions
 D. Simple math equations only
 ✅ **Answer:** B

NLP is especially useful in which field?
 A. Understanding visual data
 B. Analyzing speech and text
 C. Building hardware
 D. Controlling physical robots
 ✅ **Answer:** B

In healthcare, AI can help to:
 A. Replace doctors completely
 B. Predict and identify mental illnesses early
 C. Collect student grades
 D. Manipulate emotional behavior
 ✅ **Answer:** B

In marketing, behavioral AI helps companies:
 A. Randomly display ads
 B. Understand customer preferences and personalize recommendations
 C. Block consumer purchases
 D. Create new social media platforms
 ✅ **Answer:** B

What is one key challenge of using AI in behavior analysis?
 A. Perfect data quality
 B. Overfitting and interpretability issues
 C. Too little access to algorithms
 D. Lack of computational power
 ✅ **Answer:** B

III. Open-Ended Questions

Explain the difference between supervised and unsupervised learning in simple terms.
 ✅ **Answer Key:** Supervised learning uses labeled data with known answers to train the AI,

while unsupervised learning has no labels, and the AI finds patterns or groups by itself.

How can behavioral AI be applied in the education field?
✅ **Answer Key:** It can track student performance, identify strengths and weaknesses, and create personalized or adaptive learning systems that adjust to each student's needs.

Why is interpretability an important issue in deep learning models?
✅ **Answer Key:** Because it's often unclear how the AI makes decisions (black-box problem), making it harder for humans to trust or verify the AI's reasoning.

Chapter 4

I. True or False Questions

1. Behavior pattern recognition only focuses on what people do, not why they do it. [F]
2. Smart devices like phones and watches can use behavior pattern recognition. [T]
3. The use of AI in behavior recognition became more common after 2020. [T]
4. Observation and data collection are the first steps in behavior pattern recognition. [T]
5. Machines can fully understand human emotions without any help from humans.   [F]
6. Behavior pattern recognition can help teachers improve classroom learning. [T]
7. Privacy and fairness are important ethical issues in this field. [T]
8. In the future, systems may be able to recognize emotions through movement and voice. [T]
9. Humans and AI work together because each has different strengths. [T]
10. Behavior pattern recognition is only useful in technology industries. [F]

II. Multiple Choice Questions

1. What is the main goal of behavior pattern recognition? [b]

a) To replace humans with machines

b) To understand and predict repeated actions or habits

c) To record data without using it

d) To collect personal information

2. In which year did researchers start studying teacher behavior patterns using AI tools? [b]

a) 2020

b) 2023

c) 2025

d) 2021

3. What is usually the first step in recognizing behavior patterns? [c]

a) Prediction

b) Classification

c) Observation

d) Reporting

4. Which tool helps measure a person's attention level? [a]

a) Eye tracking

b) Voice recorder

c) GPS

d) Step counter

5. Why do humans still play a big role in behavior recognition? [b]

a) Because machines are too slow

b) Because humans can understand context and emotions

c) Because technology is banned in schools

d) Because humans don't like computers

6. What is one common challenge for the future of this field? [b]

a) Too little data

b) Data overload and privacy problems

c) Lack of interest from scientists

d) No real-world use

7. What does fairness mean in behavior recognition? [a]

a) The system treats everyone equally and avoids bias

b) The system only studies one type of person

c) It ignores data from certain groups

d) It keeps results secret from humans

8. Why is it important to balance technology and ethics? [a]

a) So people can feel safe and respected

b) So machines can make faster decisions

c) So data can be shared without limits

d) So humans stop using technology

III. Open-Ended Questions

1. In your own words, what does behavior pattern recognition mean?

- It means studying and understanding how people or machines act repeatedly. It looks at what someone does, when they do it, and in what situation, so we can find patterns and maybe predict what they'll do next.

2. How has behavior pattern recognition changed from 2020 to 2025?

- It has become smarter and more real-world.

Early systems could only see simple actions, but now they use AI, sensors, and deep learning to understand emotions, habits, and unusual behaviors in classrooms, hospitals, and public spaces.

3. What are the four main steps in behavior pattern recognition?

- The steps are:

    1. Observation – collecting data through cameras, apps, or sensors.

    2. Pattern Detection – finding habits or repeated actions.

    3. Classification – grouping behavior into categories like focused or distracted.

    4. Prediction – guessing what might happen next based on past behavior.

4. Why do humans still play an important role even when AI is involved?

- Because humans understand emotions, context, and fairness. AI can find patterns fast, but people know the meaning behind actions. Humans make the final, ethical decisions.

5. Give two examples of how behavior pattern recognition helps in real life.

- In classrooms, it helps teachers see when students lose focus so they can change lessons. In healthcare, it helps doctors track patient recovery by watching movements or sleep habits.

6. What is one risk if behavior recognition is used the wrong way?

- It could invade privacy or be unfair if data is used without permission or taken out of context. That's why humans must control how it's used and protect people's information.

7. How do humans and AI work together in behavior recognition?

- AI collects and analyzes behavior data quickly, and humans read the results, understand emotions, and make decisions. Together, they make the process faster and more accurate.

8. In the classroom case study, how did behavior recognition help teachers?

- It showed when students stopped paying attention, so teachers could add breaks or activities. It made learning more fun and helped teachers understand students better.

Chapter 5

I. True or False Questions

1. Biometrics is the measurement of an individual's unique traits for authentication. [T]

2. Modern biometric systems only use fingerprints. [F]

3. The matcher module compares the new input features to stored templates. [T]

4. Physiological traits can change drastically as a person ages. [F]

5. Behavioral traits include signature recognition, keystroke dynamics, and voice recognition. [T]

II. Multiple Choice Questions

1. Which of the following is **not** a component of a biometric system? [c]
   a) Sensor
   b) Database
   c) Calculator
   d) Matcher

2. Which is a physiological trait? [b]
   a) Gait analysis
   b) Fingerprint recognition
   c) Keystroke dynamics
   d) Gesture patterns

3. Fingerprint recognition distinguishes individuals mainly by: [b]
   a) Finger size
   b) Valleys and ridges of a finger
   c) Hand color
   d) Finger temperature

4. Which behavioral biometric works by analyzing the rhythm and speed of typing? [b]
   a) Voice recognition
   b) Keystroke dynamics

c) Iris recognition
d) Face recognition

5. Which module stores biometric data during enrollment? [c]
   a) Sensor
   b) Feature extractor
   c) Database
   d) Matcher

III. Open-Ended Questions

1. What is the main purpose of biometrics?
   - To identify or verify an individual using their unique physical or behavioral traits.

2. Name the four fundamental components of a biometric system.
   - Sensor, Feature extractor, Database, Matcher.
3. Give one example of a physiological biometric trait.
   - Fingerprint, Face, Iris, Retina, Palm print, Hand geometry, DNA, Blood vein pattern (Any one)
4. Give one example of behavioral biometric trait.
   - Keystroke dynamics, Signature recognition, Voice recognition, Gait analysis, Gesture patterns (Any one)
5. Which company developed a smartphone-based gait analysis platform for healthcare?
   - Onestep

Chapter 6

I. True or False Questions

1. Behavior-based AI relies on extensive internal world models to make decisions. [F]

2. Rodney Brooks' subsumption architecture organizes behaviors in layers, where higher layers can override lower layers. [T]

3. Early autonomous robots like William Grey Walter's tortoises used simple feedback loops to navigate. [T]

4. Classical AI emphasizes reactive, real-time responses rather than symbolic planning. [F]

5. Modern behavior-based robotics integrates deep reinforcement learning to learn complex behaviors from sensory inputs. [T]

II. Multiple Choice Questions

1. Which paradigm emphasizes layered, reactive behaviors over symbolic reasoning?

   a) Classical AI

   b) Behavior-based AI

   c) Machine Learning

   d) Symbolic Planning

   → b) Behavior-based AI

2. What was the primary contribution of Rodney Brooks in the 1980s?

   a) Inventing the perceptron

   b) Developing the subsumption architecture

   c) Creating autonomous tortoises

   d) Introducing neural networks

   → b) Developing the subsumption architecture

3. Which of the following is NOT a typical sensor used in sensorimotor integration for robots?

   a) Cameras

   b) LIDAR

   c) Tactile sensors

   d) Typewriters

   → d) Typewriters

4. What is the role of behavior trees in robotics?

   a) They store raw sensory data

   b) They structure and execute modular tasks hierarchically

c) They replace reinforcement learning

d) They generate random behaviors

→ b) They structure and execute modular tasks hierarchically

5. Which evaluation metric measures a robot's ability to cope with changes or uncertainties in the environment?

a) Task performance
b) Adaptability
c) Learning efficiency
d) Robustness

→ d) Robustness

III. Open-Ended Questions

1. **Explain the difference between classical AI and behavior-based AI in terms of world modeling and decision-making.**
Classical AI relies on explicit, symbolic representations of the environment and makes decisions through top-down planning, requiring detailed knowledge and significant computation. In contrast, behavior-based AI avoids extensive internal world models and generates decisions through real-time, sensor-driven behaviors, allowing robots to react quickly and adaptively to dynamic environments without complex reasoning or precomputed plans.

2. **Describe the concept of subsumption architecture and how layered behaviors contribute to emergent intelligence.**
Subsumption architecture, proposed by Rodney Brooks, organizes robot control into layers of behaviors, where each layer handles a specific function—from basic reflexes like obstacle avoidance to higher-level goals such as exploration. Higher layers can override or subsume lower layers when needed, enabling more

sophisticated behavior while preserving fundamental actions. Emergent intelligence arises from the interaction of these simple, layered behaviors rather than explicit programming, producing complex, adaptive outcomes from straightforward routines.

3. **How did early feedback-based robots, like Walter's tortoises, demonstrate principles foundational to behavior AI?**

    William Grey Walter's tortoises were simple autonomous robots that used analog circuits to respond to light and touch. They operated through feedback loops, meaning the robots' actions depended on real-time sensory input rather than preprogrammed plans. This demonstrated a foundational principle of behavior-based AI: adaptive, environment-driven behavior can emerge without symbolic reasoning or extensive internal models.

4. **Discuss how sensorimotor integration enables adaptive behaviors in modern robots.**

    Sensorimotor integration allows robots to combine sensory input with motor actions to produce adaptive behaviors. By processing real-time data from cameras, LIDAR, and tactile sensors, robots can dynamically adjust their actions in response to changing environments. This enables reactive and flexible behaviors, such as avoiding obstacles, navigating uncertain terrain, or interacting safely with humans, making robots more autonomous and resilient in complex situations.

5. **Give examples of modern applications of behavior-based AI, including how deep reinforcement learning enhances these systems.**

    Modern applications of behavior-based AI include autonomous drones, self-driving cars, robotic vacuum cleaners, warehouse robots, and social robots. Deep reinforcement learning enhances these systems by enabling robots to learn complex behaviors directly from sensory inputs through trial-and-error interaction with their environment. This combination of reactive behavior and learning allows robots to

handle tasks that are too complex for manually designed rules, improving adaptability and performance in dynamic, real-world scenarios.

Chapter 7

I. True or False Questions

1. The Human AI-Interaction is commonly used only in the education sector. [F]

2. The camera speed detector takes videos of the vehicles on the road. [F]

3. If the human expresses anger, behavioral AI will use a negative tone in future responses. [T]

4. Alan Turing is the founder of computer science. [T]

5. Behavioral AI can detect false information even when its users provide it with inaccurate information. [F]

II. Multiple Choice Questions

1. When did Human-AI Interaction first start? [b]
   a. 1950s
   b. 1970s
   c. 1990s
   d. 2020s

2. To prevent hackers, AI considers authentication patterns; which authentication patterns are not included? [a]
   a. Scroll speed recognition
   b. Typing cadence
   c. Usage context
   d. Mouse movement

3. During the 1950s and 1960s, what were the AI systems not able to do? [d]
   a. Play chess

    b. Solve theorems

    c. Translate languages

    d. Diagnose medical conditions

4. In the healthcare industry, what is one major role of behavioral AI? [b]

    a. To assist surgeons by providing data-driven insights during operations.

    b. To act as a virtual assistant that provides medical advice and detects user stress levels.

    c. To support doctors in identifying common symptoms and suggesting possible conditions.

    d. To manage hospital finances and billing systems.

5. What is one major advantage of incorporating Large Language Models (LLMs) into behavioral AI systems? [c]

    a. They can store unlimited amounts of data without needing training.

    b. They used fixed patterns to generate consistent and repetitive responses.

    c. They can reason with contextual and human-like understanding.

    d. They can replace human emotional intelligence entirely.

III. Open-Ended Questions

1. State 3 benefits of human-AI interactions.

    - Productivity, efficiency, adaptable, personalized, improved accuracy, consistency, or reliability. (Any of those 3 answers is accepted)

2. What is a natural language?

    - Natural language is a term of AI that allows computers to be able to interpret, understand, and generate human language.

3. What types of tasks can humans perform better than AI?

    - Humans tend to do better on tasks that require contextual understanding and emotional intelligence.

4. Why is AI more adaptable to change compared to humans?

    - Different environments will only improve their system, unlike humans, who tend to take longer to adapt to new circumstances due to their resistance to change.

5. Why does bias from humans affect behavioral AI negatively?

- Behavioral AI focuses on human guidance and uses the information provided by them to generate new responses. This can create bias issues; if the user is persistent about a certain ideology that is enforced into the AI system, then the AI will continue to use this biased information.

Chapter 8

I. True or False Questions

1. Ethics is commonly used by humans to make decisions. [T]
2. Hardware development is often set with standards such as the Federal Communications Commission (FCC) and Conformité Européenne (CE). [T]
3. There is an excess of people who have proper skill and knowledge in hardware design. [F]
4. There are still thousands of ongoing illegal cobalt mining activities. [T]
5. Currently, there are already concerns about scarcity of raw materials. [T]

II. Multiple Choice Questions

1. Which of the following is not true about inadequate testing? [d]
    a. It becomes costly in the long run.
    b. It creates safety concerns.
    c. It becomes time-consuming to fix in the long run.
    d. It allows the creator to focus more on innovation.
2. To reduce power consumption, what should not be considered? [c]
    a. Leakage current
    b. IC power supply quiescent current
    c. IC packaging material thermal conductivity
    d. IC power supply reverse current
3. How to avoid poor supply chain management? [a]
    a. Diversify the supplier base
    b. Reduce communication between suppliers to prevent confusion
    c. Focus only on local suppliers to simplify logistics

  d. Rely on a single trusted supplier to maintain consistency

4. When sourcing hardware components, what serious concerns cannot be raised? [d]

  a. Ethical concerns

  b. Safety concerns

  c. Environmental concerns

  d. Economic concerns

5. What is not considered as ethical considerations in behavioral AI? [a]

  a. Maximing user engagement

  b. Accountability

  c. Bias and Discrimination

  d. Privacy concerns

III. Open-Ended Questions

6. What is the solution for the cost and quality dilemma?

  - The solution to this is to ensure that you understand the components that will be used. For example, the minimum clearance needed for the project.

7. Aside from cost and time, what can inadequate testing create?

  - Inadequate testing can create safety concerns for the users who are going to use the hardware system. This will decrease trust and reliability.

8. Why does incompatibility between software and hardware occur? (Mention 4)

  - Incompatibility between software and hardware is another challenge faced during hardware development. This problem typically arises due to different specifications, interferences, and functionality, as well as a lack of communication between the hardware and software departments.

9. State 3 inhumane working conditions for forced workers.

  - Excessive working hours, unsafe environments, a toxic workforce, and immense psychological pressure. (Any 3 is accepted)

10. How can the government help in establishing AI ethics?

  - There should be laws made about privacy protection and industry-specific guidelines for companies that want to implement AI into their workforce. Furthermore, governments can create awareness campaigns about the safety of not sharing personal information with AI, as information shared with AI can

be stored in their system and used to generate future responses for other users.