Homework (2)

Deadline: 1404 / 02 / 19

English for Computing

Spring 1404

Tips

1. Using GPT is not allowed for answering the questions.
2. With each day of delay in submitting the answer sheet, you will lose 25% of your homework score.
3. Name your answer sheet using the format “ESP-SID-Name”.
4. Please upload your answer sheet in the appropriate section of the course page in CW.
5. Make sure you have written your name and student ID in your answer sheet.

Question 1

ICT Systems Audit and Infrastructure Upgrade

You have been recruited as a junior IT specialist at **TechNova Academy**, a rapidly expanding online training center that offers professional certification programs in fields like business analytics, cloud computing, and digital design. As the academy grows, the need for scalable, efficient, and reliable digital infrastructure has become critical. Your supervisor has assigned you to perform an audit of the current systems and propose necessary upgrades to ensure smooth operations across all departments.

One of the first issues you notice is the use of a **bus topology** for the office's Local Area Network (LAN). Although simple and inexpensive to set up initially, this topology is now leading to frequent **data collisions** and network downtime, especially during peak working hours. The IT department is considering migrating to a **star topology** to enhance network performance and fault isolation but needs your technical input before proceeding.

As you review the **student registration database**, you identify several design flaws. Key attributes such as full name, email address, and phone number are merged into single fields, violating basic **normalization** principles and making data retrieval inefficient. These poor design choices hinder reporting, analytics, and integration with other systems like email marketing platforms.

Meanwhile, the **media production team** has been creating educational video content using **uncompressed formats** such as RAW and AVI. Although these formats offer maximum quality, the resulting files are extremely large, often exceeding several gigabytes for a single lesson. This creates major bottlenecks in uploading, hosting, and streaming the content to students, many of whom have limited bandwidth.

The academy's leadership also plans to introduce new **input devices** to modernize the learning experience. Proposed devices include **interactive whiteboards**, **touchscreen tablets**, and **biometric authentication systems** for secure exam monitoring. They aim to provide a more engaging, immersive, and secure learning environment.

Your audit report must address the current system's weaknesses and recommend practical, technically sound solutions that align with best practices in database management, multimedia optimization, and network design.

Part A) Concept Explanation

In your own words, provide a clear definition (1–2 sentences) for each of the following technical terms based on the context of the scenario:

1) **Field** (in a relational database)
2) **Bus Topology**
3) **Lossy Compression**
4) **Input Device** (in ICT systems)

Part B) Database Improvement Recommendation

The academy's current student database merges full names and email addresses into a single field, making it difficult to retrieve or sort user information.
Based on good database design principles, explain the problem with this approach and describe how you would redesign the database fields to improve data organization and querying efficiency.

Part C) Multimedia Management Proposal

The academy is facing major problems with the extremely large size of its uncompressed lecture videos, which leads to long upload times and poor streaming performance for students.Recommend a specific video file format that would be better suited for online delivery, and explain how compression would affect both the file size and the quality of the streamed content.

Part D) Network Topology Decision

TechNova Academy currently uses a bus topology for its internal network, but the management is considering upgrading it to a star topology.

Based on technical reasoning, argue whether switching to a star topology would be beneficial. Discuss at least two advantages of star topology compared to bus topology in terms of network performance and fault tolerance.

Question 2

Next-Gen Game Development

Artificial Intelligence (AI) and Deep Learning have become critical technologies in modern game development. Developers are increasingly utilizing techniques such as procedural content generation (PCG), reinforcement learning (RL), behavior trees, and natural language processing (NLP) to create more adaptive, intelligent, and immersive gameplay experiences.

Procedural content generation (PCG) allows games like *No Man's Sky* to generate expansive worlds dynamically through the use of algorithms such as Perlin noise. Reinforcement learning (RL), a subset of machine learning, trains AI agents to optimize

their strategies through trial and error — a technique now employed in sports games like *FIFA 23* to produce more realistic player behaviors.

Behavior trees are structured decision-making models used for non-playable characters (NPCs), enabling them to react dynamically rather than following static scripts. For instance, *The Last of Us Part II* uses behavior trees to make enemies coordinate, adapt tactics, and respond emotionally to in-game events.

Generative AI models, including those based on large language models (LLMs) and convolutional neural networks (CNNs), are starting to be integrated into games to create realistic dialogues, procedural storylines, and advanced image generation for textures and environments. Unity and Unreal Engine have incorporated AI toolkits supporting navigation meshes, A* pathfinding algorithms, and autonomous agent simulations.

As AI continues to evolve, industry experts predict that by 2030, fully dynamic storytelling powered by generative AI and procedurally evolving environments will redefine player agency, offering customized, emergent narratives tailored to individual player behaviors.

Part A) Fill in the blanks

1) _____ is a machine learning method where AI learns through trial and error by receiving rewards or penalties.

2) _____ allows a game engine to create landscapes and textures algorithmically rather than manually.

3) _____ is used to give non-playable characters dynamic and hierarchical decision-making abilities.

4) _____ enables AI systems to generate dialogue and narrative content based on player interactions.

Part B) Match the Term to Its Definition

Terms:

1. Reinforcement Learning
2. Procedural Content Generation
3. Behavior Trees
4. Generative AI

Definitions:

A. Creation of assets, worlds, or levels using algorithms
B. Training AI to improve performance through feedback
C. Systems for structured decision-making in NPC behavior
D. Producing new dialogues, images, or stories based on learning models

Part C) Best Interpretation

1. Why are behavior trees preferred over static scripting for modern NPCs?

A) They consume less memory

B) They allow characters to make flexible, situational decisions

C) They limit the number of possible reactions

D) They prevent bugs in the code automatically

Part D) True or False? (Explain briefly)

1. True or False: Procedural content generation always produces identical levels for every player.

☐ True ☐ False

Explain: _____

2. True or False: Generative AI can create personalized story arcs based on player interactions.

   ☐ True ☐ False

   Explain: _____

Question 3

Read the following three passages and answer the questions by choosing the best choice (1), (2), (3), or (4).

Artificial intelligence is based around the idea that human intelligence can be defined in such exact terms that a machine can mimic it. The goals of artificial intelligence include learning, reasoning and perception, and machines are wired using a cross-disciplinary approach based in mathematics, computer science, linguistics, psychology and more.

As technology advances, previous benchmarks that defined artificial intelligence become outdated. For example, machines that calculate basic functions or recognize text through methods such as optical character recognition are no longer said to have artificial intelligence, since this function is now taken for granted as an inherent computer function.

Some examples of machines with artificial intelligence include computers that play chess, which have been around for years, and self-driving cars, which are a relatively new development. Each of these machines must weigh the consequences of any action they take, as each action will impact the end result. In chess, this end result is winning the game. For self-driving cars, the computer system must take into account all external data and compute it to act in a way that prevents collision.

1. The word "it" in paragraph 1 refers to

   - ☐ artificial intelligence
   - ☐ human intelligence
   - ☐ machine
   - ☐ Idea

2. Why is "psychology" mentioned in paragraph 1?

   - ☐ To name one of the disciplines among others that are used in building machines with artificial intelligence.
   - ☐ To point out that it is not the only discipline on which artificial intelligence is based.
   - ☐ To show how it is related to other disciplines such as mathematics and linguistics.
   - ☐ To state that artificial intelligence is also applied to this field.

3. It is implied in the passage that methods like optical character recognition

   - ☐ are no longer used in modern machines
   - ☐ used to be taken for granted in the past
   - ☐ used to be considered as a yardstick for defining artificial intelligence
   - ☐ are utilizing artificial intelligence on an unprecedented scale

4. The word "inherent" in paragraph 2 is closest in meaning to
   - ☐ Major
   - ☐ Intentional
   - ☐ Insignificant
   - ☐ Fundamental

5. According to the passage, an instance of a relatively old machine considered to have artificial intelligence is a
   - ☐ Calculator
   - ☐ Self-driving car
   - ☐ Computer translator
   - ☐ Chess-playing computer

Good luck!

English for Computing education team