UBC NET Paper -II Computer Science And Application

Q1. Which of the following is a characteristic feature of OLED displays?
(a) Reliance on backlighting for illumination
(b) Use of a liquid crystal layer for color modulation
(c) Self-emissive properties of individual pixels
(d) Requirement of a vacuum-sealed chamber for operation

Q2. Which of the following statements accurately describes Bresenham's line drawing algorithm?
A. It is primarily used for rendering curved lines in computer graphics.
B. It ensures that the generated line passes through all given points.
C. It minimizes the number of calculations required for drawing a line.
D. It is suitable for anti-aliasing purposes in high-resolution displays.
E. It relies on recursive subdivision for accurate line rendering.
Choose the correct answer from the options given below:
(a) A, C
(b) B, D
(c) C, E
(d) A, E

Q3. Which network topology provides high fault tolerance and scalability but requires more cabling than other topologies?
(a) Ring Topology
(b) Mesh Topology
(c) Star Topology
(d) Bus Topology

Q4. What is the primary function of HDLC (High-Level Data Link Control) in data communication?
(a) To ensure error-free transmission of data
(b) To provide flow control between sender and receiver
(c) To establish a physical connection between devices
(d) To regulate access to the communication medium

Q5. Which of the following statements about weaving in Aspect-Oriented Software Development is FALSE?
(a) Weaving is the process of integrating aspects with the base code.
(b) Weaving can occur at compile-time, load-time, or runtime.
(c) Weaving can only be done using compile-time instrumentation.
(d) Weaving allows for the modularization of crosscutting concerns.

Q6. In a Generic Process Model, which phase typically involves creating a Software Requirement Specification (SRS)?
(a) Framework Activity
(b) Software Development
(c) Software Testing
(d) None of the above

Q7. What role do membership functions play in fuzzy logic systems?
(a) They define the input and output variables of the system
(b) They represent the degree of truth or falsity of linguistic variables
(c) They specify the goals and subgoals of the planning process
(d) They model the state space of the problem domain

Q8. What is the key characteristic of a Hopfield network that distinguishes it from other neural network architectures?
(a) Supervised learning
(b) Unidirectional connections
(c) Recurrent connections
(d) Sigmoid activation functions

Q9. Parallel sorting algorithms often use a divide-and-conquer strategy. Which property of comparison trees makes them particularly suitable for this approach?
(a) Balanced structure
(b) Minimal height
(c) Ordered arrangement of elements
(d) Dynamic resizing capability

Q10. Which of the following statements is/are true regarding the application of greedy algorithms to the activity selection problem?
(i) In the activity selection problem, a greedy algorithm always selects the activity with the shortest duration first.
(ii) A greedy algorithm can provide an optimal solution for the activity selection problem by always selecting the next activity that starts after the last selected activity ends.
(iii) The activity selection problem can be solved using dynamic programming instead of a greedy algorithm.
(iv) A greedy algorithm for the activity selection problem requires sorting the activities based on their finish times.
(a) Only (ii) and (iv)
(b) Only (i) and (iii)
(c) Only (ii), (iii), and (iv)
(d) Only (i), (ii), and (iv)

Q11. During the loading phase of a program, which action typically occurs?
(a) Conversion of source code to machine code
(b) Allocation of memory for the program's variables
(c) Execution of the program's instructions
(d) Transfer of the program's instructions from secondary storage to main memory

Q12. In a demand-paging system, when does relocation of a program occur?
(a) During the loading phase
(b) During the linking phase
(c) During the execution phase
(d) During the compilation phase

Q13. Which property distinguishes LL(1) grammars from other types of grammars commonly used in parsing?
(a) They can be parsed using a single lookahead symbol.
(b) They generate languages that are context-free.
(c) They prioritize leftmost derivations over rightmost derivations.
(d) They are suitable for parsing ambiguous grammars.

Q14. Consider a declaration 'int a, b, c;' in a high-level language. How would an intermediate code generator typically represent this declaration in a three-address code format?
(a) declare int a, b, c
(b) a = b = c = 0
(c) int a; int b; int c;
(d) Intermediate code does not handle declarations.

Q15. Which library function in C is used to compare two strings?
(a) strcmp()
(b) strcompare()
(c) strcoll()
(d) compare()

Q16. In C programming, how does the 'switch' statement enhance sequence control compared to multiple 'if-else' statements?
(a) The 'switch' statement allows for evaluating multiple conditions simultaneously, whereas 'if-else' statements do not.
(b) The 'switch' statement simplifies the control flow by evaluating a single expression against multiple constant values, reducing the complexity compared to nested 'if-else' statements.
(c) The 'switch' statement can handle ranges of values more effectively than 'if-else' statements.
(d) The 'switch' statement provides better performance for all types of conditions compared to 'if-else' statements.

Q17. Consider the following code snippet:

```
#include <iostream>
using namespace std;
class A {
public:
  A() { cout << "A constructor" << endl; }
  virtual ~A() { cout << "A destructor" << endl; }
};
class B : public A {
public:
  B() { cout << "B constructor" << endl; }
  ~B() override { cout << "B destructor" << endl; }
};
int main() {
  A* ptr = new B;
  delete ptr;
  return 0;
}
```

What will be the output of the program?
(a) A constructor
(b) A constructor, B constructor
(c) A constructor, B constructor, B destructor, A destructor
(d) A constructor, B constructor, A destructor, B destructor

Q18. What is the purpose of the seekg() function in C++ file streams?
(a) Sets the position of the output pointer
(b) Sets the position of the input pointer
(c) Closes the file stream
(d) Flushes the output buffer

Q19. What is the primary purpose of a valid time?
(a) To represent the time when a fact is true in the real world
(b) To represent the time when a fact is recorded in the database
(c) To represent the time when a fact expires or becomes invalid
(d) To represent the time when a fact is modified in the database

Q20. Which of the following is NOT a typical requirement for effective genome data management?
(a) Support for versioning and lineage tracking
(b) Scalability to handle large-scale genomic datasets
(c) Integration with biomedical literature databases
(d) Ability to analyze genetic variations and mutations

Q21. Which of the following statements about automorphisms of a group is TRUE?
(a) Every group has a unique automorphism.
(b) The identity automorphism is the only automorphism of a group.
(c) Automorphisms form a group under composition.
(d) Automorphisms are always isomorphisms between groups.

Q22. Which of the following is NOT a field?
(a) Integers modulo n under addition and multiplication modulo n.
(b) Rational numbers under addition and multiplication.
(c) Real numbers under addition and multiplication.
(d) Polynomials with real coefficients under addition and multiplication.

Q23. Which of the following is NOT a common cache coherence protocol?
(a) Snoopy protocol
(b) Directory-based protocol
(c) MSI protocol
(d) Multicast protocol

Q24. Which arbitration policy grants access to the processor with the highest priority during contention?
(a) Round-robin arbitration
(b) Fixed priority arbitration
(c) Random arbitration
(d) Weighted fair arbitration

Q25. Which scheduling algorithm aims to strike a balance between priority-based scheduling and round-robin scheduling by allowing processes to dynamically adjust their priority levels based on their execution behavior?
(a) Shortest Remaining Time First (SRTF) scheduling
(b) Lottery scheduling
(c) Feedback scheduling
(d) Guaranteed scheduling

Q26. Which of the following statements is/are true about applications of simplex mode?
(i) Simplex mode is ideal for situations where data transmission needs to be quick and bidirectional.
(ii) Broadcasting radio signals to listeners is an example of simplex communication.
(iii) Simplex mode is commonly used in applications like file transfer protocols.
(iv) Simplex communication is suitable for applications where immediate feedback from the receiver is essential.
(a) Only (ii)
(b) Only (i) and (iii)
(c) Only (ii) and (iv)
(d) Only (iii) and (iv)

Q27. Which type of addressing is typically used in relocatable programs to allow for flexible memory allocation?
(a) Absolute addressing
(b) Relative addressing
(c) Direct addressing
(d) Indirect addressing

Q28. What happens if you attempt to open a file in output mode that doesn't exist?
(a) It creates a new file automatically.
(b) It throws a runtime error.
(c) It prompts the user to create the file.
(d) It returns a null pointer.

Q29. In group theory, what is an automorphism of a group?
(a) A mapping from the group to itself that preserves the group operation and the identity element.
(b) A bijection from the group to itself that preserves the group operation but not necessarily the identity element.
(c) A mapping from the group to another group that preserves the group operation and the identity element.
(d) A bijection from the group to another group that preserves the group operation but not necessarily the identity element.

Q30. When discussing the types of database backups, which method involves making a copy of all data blocks that have changed since the last backup, minimizing the time and storage space needed?
(a) Full Backup
(b) Incremental Backup
(c) Differential Backup
(d) Snapshot Backup

Solutions

S1. Ans.(c)
Sol. OLED (Organic Light Emitting Diode) displays are known for their **self-emissive properties, meaning that each pixel emits its own light**. This contrasts with technologies like LCDs (Liquid Crystal Displays), which rely on backlighting for illumination. OLEDs do not require a backlight because the organic materials emit light when an electric current is applied. They do not use a liquid crystal layer for color modulation, and they do not require a vacuum-sealed chamber for operation.

S2. Ans.(c)
Sol. Bresenham's line drawing algorithm is designed to draw straight lines with minimal computational overhead. It is efficient because it uses integer arithmetic rather than floating-point calculations, which **minimizes the number of calculations required for drawing a line**. It does not render curved lines, handle anti-aliasing, or use **recursive subdivision**. Instead, it is a straightforward and efficient way to determine which pixels should be highlighted to approximate a straight line between two points.

S3. Ans.(b)
Sol. Mesh topology is known for its high fault tolerance and scalability because each node is connected to every other node. This redundant connection pattern allows the network to continue functioning even if one or multiple connections fail. However, this advantage comes at the cost of requiring significantly more cabling and network interfaces than other topologies, making it more expensive and complex to install and maintain.

S4. Ans.(a)
Sol. HDLC (High-Level Data Link Control) is a bit-oriented code-transparent synchronous data link layer protocol developed by the International Organization for Standardization (ISO). Its primary function is to ensure **error-free transmission of data** between network nodes. It achieves this through framing, error detection, and correction mechanisms. While HDLC also provides flow control, its main goal is to ensure the integrity and reliability of data transmission.

S5. Ans.(c)
Sol. In Aspect-Oriented Software Development, weaving is the process of integrating aspects (crosscutting concerns) with the main code base. This can happen at various stages, including compile-time, load-time, or runtime. The statement that weaving **can only be done using compile-time instrumentation is false because weaving can also occur during load-time or runtime, depending on the tools and techniques used**.

S6. Ans.(d)
Sol. In a Generic Process Model, the phase that typically involves creating a Software Requirement Specification (SRS) is often termed **"Requirements Engineering"** or **"Requirements Analysis."** This phase is part of the initial stages of the software development lifecycle and not directly associated with the choices provided.

S7. Ans.(b)

Sol. Membership functions in fuzzy logic systems represent the **degree of truth or falsity of linguistic variables**. They map the input space to the membership value between 0 and 1, indicating how strongly an input belongs to a particular fuzzy set. This allows fuzzy systems to handle imprecise and vague data by expressing variables in linguistic terms (e.g., "low," "medium," "high").

S8. Ans.(c)

Sol. The key characteristic that distinguishes a Hopfield network from other neural network architectures is its **recurrent connections**. In a Hopfield network, all neurons are interconnected and the connections are bidirectional with symmetric weights. This recurrent structure allows the network to be used as an associative memory system.

S9. Ans.(a)

Sol. The **balanced structure** of comparison trees makes them particularly suitable for parallel sorting algorithms that use a divide-and-conquer strategy. A balanced tree ensures that the divide-and-conquer process can evenly split the data, leading to efficient parallel processing and minimizing the depth of recursive calls.

S10. Ans.(c)

Sol. The **correct statements** regarding the application of greedy algorithms to the activity selection problem are:

(ii) A greedy algorithm can provide an optimal solution by always selecting the next activity that starts after the last selected activity ends.

(iii) The activity selection problem can be solved using dynamic programming instead of a greedy algorithm.

(iv) A greedy algorithm for the activity selection problem requires sorting the activities based on their finish times.

Statement (i) is incorrect because a greedy algorithm for the activity selection problem does not necessarily select the activity with the shortest duration first; it focuses on the earliest finishing time to maximize the number of activities.

S11. Ans.(d)

Sol. During the loading phase of a program, the primary action is **to transfer the program's instructions from secondary storage (like a hard disk) to main memory (RAM)**. This is necessary so that the CPU can access and execute the program's instructions. Conversion of source code to machine code occurs during the compilation phase, allocation of memory for variables happens during the execution phase, and execution of the program's instructions is what happens after loading.

S12. Ans.(c)

Sol. In a demand-paging system, relocation of a program typically occurs **during the execution phase**. This is because demand paging loads pages into memory only when they are needed, which can happen at runtime as the program executes and accesses different parts of its code and data. Relocation refers to adjusting the addresses used in the program to match the actual physical addresses in memory, which is handled by the operating system during execution.

S13. Ans.(a)

Sol. LL(1) grammars are distinguished by their ability **to be parsed using a single lookahead symbol**. The "LL" in LL(1) stands for "Left-to-right scanning of the input, Leftmost derivation" and the "1" indicates that one lookahead symbol is sufficient to make parsing decisions. They are a subset of context-free grammars (option B), but what specifically sets LL(1) grammars apart is the single lookahead symbol used in parsing.

S14. Ans.(a)

Sol. In intermediate code generation, declarations are often represented in a simplified and abstract form. A typical representation in three-address code format would be a direct declaration statement that specifies the type and the identifiers. **Option A, declare int a, b, c,** captures the essence of the declaration in the intermediate code, indicating the creation of three integer variables.

S15. Ans.(a)

Sol. The **'strcmp()'** function in the C standard library is used to compare two strings. It returns an integer less than, equal to, or greater than zero if the first string is found to be less than, to match, or to be greater than the second string, respectively.

S16. Ans.(b)
Sol. The 'switch' statement simplifies sequence control by allowing a single expression to be evaluated against multiple constant values (case labels). This reduces the complexity and improves readability compared to using multiple nested 'if-else' statements, which can become cumbersome and difficult to manage. Thus, **option B is the correct answer**. Option A is incorrect because switch does not evaluate multiple conditions simultaneously, and option C is incorrect because switch handles discrete values rather than ranges. Option D is not universally true, as performance benefits depend on specific cases.

S17. Ans.(c)
Sol. In the given code, when 'new B' is called, it constructs an object of class B, which first calls the constructor of its base class A, then its own constructor. Thus, the output starts with **"A constructor"** followed by **"B constructor"**. When delete ptr is called, since ptr is of type A* but points to an object of type B, the destructor of B is called first due to the virtual destructor in class A, followed by the destructor of A. This results in the output: **"A constructor, B constructor, B destructor, A destructor".**

S18. Ans.(b)
Sol. The 'seekg()' function in C++ is used **to set the position of the input (get) pointer in a file stream**. This allows for repositioning the pointer to read data from a different location within the file.

S19. Ans.(a)
Sol. The primary purpose of valid time is **to represent the time period during which a fact is true in the real world**. This concept is used in temporal databases to track historical data accurately by recording when the information was valid, as opposed to when it was entered or modified in the database (which is recorded as transaction time).

S20. Ans.(c)
Sol. While **integration with biomedical literature databases** (option C) can be beneficial, it is not a typical core requirement for effective genome data management. The essential requirements for managing genomic data effectively include support for versioning and lineage tracking (option A), scalability to handle large-scale genomic datasets (option B), and the ability to analyze genetic variations and mutations (option D).

S21. Ans.(c)
Sol. An automorphism of a group is an isomorphism from the group to itself. The set of all automorphisms of a group G, denoted as Aut(G), **forms a group under composition**. This group is called the automorphism group of G. This means that the composition of two automorphisms is also an automorphism, and every automorphism has an inverse which is also an automorphism.

S22. Ans.(d)
Sol. A field is a set equipped with two operations (addition and multiplication) satisfying certain properties, including the existence of multiplicative inverses for all non-zero elements.

- The integers modulo n form a field if and only if n is prime.
- Rational numbers and real numbers are fields.
- The **set of polynomials with real coefficients is not a field** because polynomials do not generally have multiplicative inverses within the set of polynomials. For example, the polynomial x does not have an inverse polynomial such that their product is 1.

S23. Ans.(d)
Sol. The Snoopy protocol and Directory-based protocol are common cache coherence protocols used to maintain consistency in multi-processor systems. The MSI protocol (Modified, Shared, Invalid) is a specific type of snoopy protocol used to manage cache coherence.
Multicast protocol is **not a cache coherence protocol**. It is a communication protocol used for transmitting messages to multiple recipients simultaneously in networking.

S24. Ans.(b)
Sol. Round-robin arbitration cycles through processors in a fixed order. **Fixed priority arbitration** grants access to the processor with the highest priority during contention. Random arbitration selects a processor randomly. Weighted fair arbitration allocates access based on weights assigned to processors.

S25. Ans.(c)

Sol. Shortest Remaining Time First (SRTF) is a preemptive scheduling algorithm that selects the process with the smallest amount of remaining time. Lottery scheduling assigns tickets to processes, and the scheduler randomly selects a ticket to decide the next process to run. **Feedback scheduling (also known as Multi-Level Feedback Queue scheduling)** dynamically adjusts the priority of processes based on their execution behavior, combining elements of priority-based and round-robin scheduling. Guaranteed scheduling ensures each process gets a proportionate share of the CPU based on predefined guarantees.

S26. Ans.(a)

Sol. Simplex mode refers to a communication mode where data transmission is unidirectional. **(i) is incorrect** because simplex mode is not bidirectional. **(ii) is correct** as broadcasting radio signals is a classic example of simplex communication. **(iii) is incorrect** because file transfer protocols typically require bidirectional communication (even if only for acknowledgments). **(iv) is incorrect** because simplex communication does not provide immediate feedback.

S27. Ans.(b)

Sol. Relative addressing is used in relocatable programs because it specifies addresses relative to a base address, allowing flexible memory allocation when the program is loaded.

S28. Ans.(a)

Sol. In most programming languages, opening a file in output mode (e.g., "w" mode in C) will **automatically create a new file if it does not exist**. This allows the program to write data to the file immediately.

S29. Ans.(a)

Sol. An automorphism is a bijection (one-to-one and onto mapping) **from a group to itself that preserves the group operation and the identity element**. This means that the structure of the group remains unchanged under the automorphism.

S30. Ans.(b)

Sol. Incremental Backup copies only the data blocks that have changed since the last backup (whether full or incremental), thus minimizing the time and storage space needed.