

BITAME LUCIA INTERNATIONAL COLLEGE

MOCK EXAMINATION MARKING GUIDE FOR THE ADVANCED LEVEL COMPUTER SCIENCE

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Here is the marking guide for the 50 Multiple Choice Questions.

Computer Science 0795 Mock Examination Marking Guide

Question Number	Correct Letter	Explanation
1	C	Batch processing involves collecting data over a period and processing it all at once during a scheduled time.
2	B	Green Computing focuses on energy efficiency, such as using "sleep" mode to reduce power consumption.
3	B	Syntax analysis is the stage where the compiler checks if the code follows the grammatical rules of the language.
4	C	Open Source licenses allow users to access, modify, and redistribute the software's source code.
5	B	Mutual Exclusion ensures that only one process can access a shared resource at any given time to prevent conflicts.
6	C	The Network Layer of the OSI model is responsible for routing packets across different networks.
7	C	A Star topology features all nodes connected to a single central hub.
8	B	FTP (File Transfer Protocol) is the standard protocol used for transferring files between a client and server.
9	C	Data encryption protects information by making it unreadable to unauthorized parties, ensuring confidentiality.
10	C	An IPv6 address uses a 128-bit length, providing a much larger address space than IPv4.

Question Number	Correct Letter	Explanation
11	B	A Stack is a data structure where the last item added is the first one to be removed (LIFO).
12	B	In a BST , the left child must contain a value smaller than its parent node.
13	C	A linear search checks every element once, resulting in a time complexity of O(n) .
14	C	Merge Sort uses the Divide and Conquer strategy by splitting the list and then merging sorted halves.
15	B	The Base case is the condition that terminates recursion and prevents infinite loops.
16	C	Polymorphism allows a single function or method to behave differently based on the object it is acting upon.
17	B	The Declarative (specifically Logic) paradigm is based on facts and "if-then" rules.
18	B	A Local variable is declared inside a function and is only accessible within that scope.
19	B	The Waterfall model is a linear, sequential approach where phases do not overlap.
20	C	Unit testing involves verifying the functionality of individual components or modules of the code.
21	B	The Von Neumann architecture's core principle is the stored program concept .
22	C	The Program Counter (PC) stores the memory address of the next instruction to be fetched.
23	A	NAND is universal because any other gate (AND, OR, NOT) can be built using only NAND gates.
24	D	Registers are located inside the CPU and are the fastest but

Question Number	Correct Letter	Explanation
		smallest storage units.
25	C	SIMD stands for Single Instruction, Multiple Data streams.
26	B	A DFD is a graphical representation of how data moves through an information system.
27	B	A Primary Key must contain a unique value for every record to identify it.
28	C	The SELECT command is the standard SQL statement used to query/retrieve data.
29	B	A GIS is specifically designed for capturing, organizing, and analyzing spatial or map data.
30	B	Normalization is the process of organizing a database to minimize data redundancy.
31	B	With a 10ms burst and 4ms quantum: process runs at 0ms, switches at 4ms, runs again at 4ms, switches at 8ms, and finishes the last 2ms. This results in 2 context switches.
32	C	JavaScript is a client-side scripting language used for web animations and form validation.
33	C	Nested loops where both run n times result in $n \times n$ operations, or $O(n^2)$.
34	C	A Deadlock occurs when two processes are stuck waiting for resources held by each other.
35	B	PHP is a server-side scripting language used to connect web interfaces to databases.
36	C	A Scanner is an input device used to convert physical documents into digital data.
37	B	Using someone else's work without permission is a violation of Copyright Law .

Question Number	Correct Letter	Explanation
38	B	Ergonomics deals with designing equipment and workspaces to maximize user comfort and health.
39	C	The Design phase involves creating the logic of the system using tools like flowcharts and pseudocode.
40	B	The IEEE is a globally recognized professional society for engineering and technology.
41	B	Authentication is the security process of confirming that a user is who they claim to be.
42	C	A Binary Search Tree allows for efficient $O(\log n)$ searching, especially when data is ordered.
43	B	A Resource Allocation Graph (RAG) helps the OS track resources to detect or prevent deadlocks .
44	C	An AND gate only outputs HIGH when all of its inputs are HIGH.
45	C	Pragmatics refers to how a language is practically used and implemented in real-world scenarios.
46	B	A File Compressor is a utility program that performs specific maintenance/optimization tasks.
47	C	Student Marks represent the raw facts and figures processed by the system, known as data .
48	B	In a P2P network, there is no central authority; all computers (nodes) have equal status .
49	B	Karnaugh Maps are a visual tool used to simplify Boolean algebra and logic circuits.
50	B	The Stored Program Concept dictates that program instructions and data are kept in the same memory.

This section contains the answers for the **Advanced Level Computer Science 2 (0795)** mock examination from **Bitame Lucia International College**.

Question 1: Data Representation & Logic [17 Marks]

(a) Floating-Point Representation

- **Decimal -12.625 to Binary:**
 - **Integer part:** $12 = 1100_2$.
 - **Fractional part:** $0.625 = 0.101_2$.
 - **Normalized Mantissa:** $1.100101 * 2^3$.
 - **Sign bit:** 1 (negative).
 - **Exponent:** $3 + 15$ (excess-15) = 18. In 5-bit binary: 10010.
 - **Mantissa (6 bits):** 100101 (normalized fractional part).
 - **Final Result:** **1 10010 100101 (5 pts)**.

(b) Smallest Positive Non-Zero Value

- Smallest Exponent (non-zero): 00001_2 (which is $1 - 15 = -14$).
- Smallest Normalized Mantissa: 1.000000 (stored as 000000).
- **Calculation:** $1.0 * 2^{-14} = 1/16384$ **(3 pts)**.

(c) Logic Circuit for Prime Numbers (0-15)

- **Truth Table:** Output $X=1$ for inputs 2, 3, 5, 7, 11, 13 (Binary: 0010, 0011, 0101, 0111, 1011, 1101) **(3 pts)**.
 - **Karnaugh Map:** Simplify groups of 1s to find the Boolean expression for X **(4 pts)**.
 - **NAND Logic:** Convert the expression into universal NAND gate format and draw the circuit **(2 pts)**.
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Question 2: Computer Architecture [17 Marks]

(a) Fetch-Execute Cycle & Jump Instruction

- **MAR (Memory Address Register):** During a "Jump," the target address is loaded into the MAR to fetch the next instruction from that specific location.
- **CIR (Current Instruction Register):** Holds the "Jump" instruction while it is decoded to identify the target address. **(6 pts)**

(b) Addressing Modes

- **Immediate:** The operand is the actual value (e.g., ADD 5 adds 5).
- **Indexed:** The address is calculated by adding a constant value to an Index Register.
- **Superiority:** Indexed is superior for accessing arrays or contiguous data structures **(5 pts)**.

(c) CISC vs. RISC

- **CISC:** Uses complex instructions that take multiple clock cycles, leading to a higher **Cycles Per Instruction (CPI)**.
- **RISC:** Uses simple instructions executed in one cycle, resulting in a lower CPI **(3 pts)**.

(d) Pipelining & Hazards

- **Concept:** Overlapping the stages of multiple instructions to improve throughput.
- **Hazards:** Data hazards (dependency) and Control hazards (branching) **(3 pts)**.

Question 3: Operating Systems [17 Marks]

(a) Process State Transitions

- **Diagram:** Must show New -> Ready -> Running -> Waiting/Terminated.
- **Transitions:** Interrupt (Running to Ready), I/O Request (Running to Waiting), Scheduler Dispatch (Ready to Running) **(6 pts)**.

(b) Scheduling Calculations

- **SJF (Shortest Job First):** Order is P3 (2ms), P2 (4ms), P1 (10ms).
 - Waiting: P3=0, P2=2, P1=6. Average: $(0+2+6)/3 = 2.67ms$ **(4 pts)**.

- **Round Robin (TQ=3ms):**
 - Sequence: P1(3), P2(3), P3(2), P1(3), P2(1), P1(4).
 - **P1 Turnaround:** Finishes at 16ms **(4 pts)**.

(c) Deadlocks

- **Four Conditions:** Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait.
- **Banker's Algorithm:** Checks if resource allocation leaves the system in a "Safe State" **(3 pts)**.

Question 4: Algorithms & Complexity [17 Marks]

(a) Iteration vs. Recursion

- **Memory:** Recursion uses more (Stack frames per call); Iteration is efficient.
- **Speed:** Iteration is generally faster (no call overhead).
- **Readability:** Recursion is often cleaner for mathematical problems **(6 pts)**.

(b) Pseudocode Analysis (Factorial)

- **Base Case:** IF $n \leq 1$ THEN RETURN 1.
- **General Case:** ELSE RETURN $n * \text{Mystery}(n - 1)$ **(2 pts)**.
- **Trace Mystery(4):** $4 * M(3) \rightarrow 3 * M(2) \rightarrow 2 * M(1) \rightarrow 1$. Result: 24 **(4 pts)**.

(c) Searching Algorithms

- **Binary Search:** $O(\log n)$.
- **Linear Search:** $O(n)$.
- **Condition:** Data must be **sorted**.
- **Efficiency:** It halves the search space with every comparison **(5 pts)**.

Question 5: Database Systems [17 Marks]

(a) Normalization & Integrity

- **2NF Violation:** If SubjectID is part of a composite key, non-key attributes (like Name) only depend on StudentID, causing partial dependency. **(4 pts)**

- **Referential Integrity:** Ensures relationships between tables remain consistent using Foreign Keys to point to Primary Keys **(4 pts)**.

(b) SQL Languages

- **DDL:** Defines structure (Keyword: CREATE).
- **DML:** Manipulates data (Keyword: INSERT) **(4 pts)**.

(c) Data Independence

- Allows the DBA to change the physical storage or logical schema without affecting the user's view or application programs **(5 pts)**.

Question 6: Networking & Security [17 Marks]

(a) OSI vs. TCP/IP

- The "Data Link" and "Physical" layers of the OSI model are combined into a single **Network Access Layer** (or Link Layer) in the TCP/IP stack **(6 pts)**.

(b) Subnetting

- **Subnet Mask:** .192 (11000000 in binary).
- **Usable Subnets:** $2^2 = 4$ subnets.
- **Usable Hosts:** $2^6 - 2 = 62$ hosts per subnet **(5 pts)**.

(c) Asymmetric Encryption

- **Confidentiality:** Encrypting with the recipient's **Public Key**.
- **Non-repudiation:** Signing with the sender's **Private Key** (Digital Signature) **(6 pts)**.

Question 7: Software Development & OOP [17 Marks]

(a) OOP vs. Procedural

- **Encapsulation:** OOP bundles data and methods; Procedural separates them.
- **Global Variables:** Discouraged in OOP to prevent side effects; common in Procedural **(6 pts)**.

(b) Classes & Inheritance

- **Relationship:** A Class is a blueprint; an Object is an instance.

- **Inheritance:** Allows a subclass to adopt properties of a superclass, reducing redundant code **(5 pts)**.

(c) Error Types

- **Syntax:** Rule violations; **Runtime:** Crashes during execution; **Logic:** Wrong output.
- **Difficulty: Logic errors** are hardest because the program runs without crashing, but produces incorrect results **(6 pts)**.

Question 8: Information Systems & Society [17 Marks]

(a) SDLC Models

- **Waterfall:** Linear and rigid; **Agile:** Iterative and flexible.
- **Scenario:** Waterfall is better for short projects with fixed, well-defined requirements **(6 pts)**.

(b) Analysis Tools

- **DFD:** Shows data flow/processes.
- **System Flowchart:** Shows physical components/hardware.
- **Unique DFD Info:** It focuses on the logical flow of information through a system **(5 pts)**.

(c) Social & Environmental Impact

- **Digital Divide:** Inequality in job opportunities between those with/without tech access.
- **Automation:** Increases efficiency but risks job displacement in manual sectors.
- **Green Computing:** Recycling hardware and using energy-efficient components to reduce e-waste **(6 pts)**.