

# BITAME LUCIA INTERNATIONAL COLLEGE

## MOCK EXAMINATION MARKING GUIDE FOR THE ADVANCED LEVEL ICT

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Here is the marking guide for the 50 multiple-choice questions for the Information and Communication Technology (0796) Mock Examination.

### Mock Examination Marking Guide: ICT 1 (0796)

Question #	Correct Answer	Explanation
1	<b>B</b>	The Von Neumann architecture, developed in the 1940s, is characterized by using the "stored program concept".
2	<b>B</b>	Networked systems are designed for resource sharing, such as peripherals and distributed computing, unlike stand-alone systems.
3	<b>B</b>	The <b>Decode</b> phase is where the control unit interprets the instruction to determine the operation required.
4	<b>C</b>	<b>Interrupts</b> are signals sent by hardware or software to the processor to alert it that an event needs immediate attention.
5	<b>C</b>	<b>SIMD</b> (Single Instruction, Multiple Data) allows one instruction to act on multiple data points simultaneously, ideal for graphics.
6	<b>B</b>	A <b>Defragmenter</b> reorganizes files on a disk to occupy contiguous storage locations, optimizing file access speed.
7	<b>C</b>	<b>RISC</b> (Reduced Instruction Set Computer) focuses on simple instructions and high clock speeds for efficiency.
8	<b>C</b>	<b>Registers</b> are at the top of the memory hierarchy, offering the fastest access but at the highest cost per byte.

Question #	Correct Answer	Explanation
9	B	In <b>Pre-emptive Scheduling</b> , the OS can forcibly interrupt a running process to give CPU time to another task.
10	C	A <b>Multi-user OS</b> allows multiple users to access the same central computer resources at the same time.
11	B	<b>Procedures</b> are the set of instructions or rules for people (users) to follow when interacting with the system.
12	C	An <b>EIS</b> (Executive Information System) supports senior management in making non-routine, strategic decisions.
13	C	An <b>Automated Payroll System</b> is a human-made (artificial) system, unlike biological or environmental systems.
14	B	A <b>Data Flow Diagram</b> focuses on the logical flow and movement of data between processes and storage.
15	B	<b>Green Computing</b> is the practice of environmentally responsible usage and disposal of computer technology.
16	B	<b>Shareware</b> is software provided for free on a trial basis, intended for purchase after the trial ends.
17	B	The <b>Copyright Act</b> provides legal protection for original works, including software source code.
18	B	The <b>Digital Divide</b> is the socio-economic gap between those who have access to ICT and those who do not.
19	B	Natural language processing and speech recognition rely on <b>Neural Networks</b> and linguistic analysis.
20	B	<b>Augmented Reality</b> (AR) overlays digital information, such as images or data, onto the physical world.
21	A	For the decimal 10, the binary is \$1010\$. In 8-bit, it is padded with zeros as \$00001010\$.
22	B	The <b>Distributive Law</b> states that $A \cdot (B + C) = (A \cdot B) + (A \cdot C)$ .

Question #	Correct Answer	Explanation
23	C	A <b>NAND</b> gate is the inverse of an AND gate; it produces '0' only when both inputs are '1'.
24	B	<b>De Morgan's Theorem</b> states the complement of a product is equal to the sum of the complements: $(A \cdot B)' = A' + B'$ .
25	B	<b>Top-down design</b> is a strategy that breaks a large, complex problem into smaller, manageable sub-problems.
26	C	A <b>Boolean</b> data type is specifically used for logical values that can only be True or False.
27	B	A <b>Record</b> is a heterogeneous data structure that allows different data types to be grouped as a single unit.
28	B	<b>Acceptance Testing</b> is the final phase of testing to ensure the system satisfies the user's requirements.
29	C	A <b>Sorting Algorithm</b> is designed to organize elements in a list into a specific order (ascending or descending).
30	B	<b>Debugging</b> is the specific process of locating, analyzing, and removing errors (bugs) from a program.
31	C	A <b>Local Area Network</b> (LAN) is restricted to a small geographic area like a single building.
32	C	In a <b>Star topology</b> , all nodes are individually connected to a central connection point like a hub or switch.
33	C	The <b>OSI model</b> consists of 7 layers (Physical, Data Link, Network, Transport, Session, Presentation, Application).
34	C	<b>SMTP</b> (Simple Mail Transfer Protocol) is the standard protocol used for sending emails over the internet.
35	B	A <b>Parity Check</b> adds an extra bit to a data unit to ensure the total number of 1s is even or odd, detecting 1-bit errors.
36	C	A <b>Router</b> or <b>Gateway</b> is used to route data between different

Question #	Correct Answer	Explanation
		networks that may use different protocols.
37	<b>B</b>	<b>IPv6</b> was developed because the 32-bit address space of IPv4 could no longer meet the demand for IP addresses.
38	<b>B</b>	<b>Encryption</b> uses algorithms to scramble data into an unreadable format to protect it from unauthorized access.
39	<b>B</b>	<b>TELNET</b> is a protocol that allows a user on one computer to log into another computer on the same network.
40	<b>B</b>	An <b>ISP</b> provides the necessary infrastructure and services for users to connect to the internet.
41	<b>B</b>	A <b>Primary Key</b> must be unique for every record in a relational database table.
42	<b>C</b>	The <b>SELECT</b> command is used in SQL to fetch or retrieve specific data from a database.
43	<b>D</b>	<b>A1</b> is an absolute reference (stays same), while <b>B1</b> is relative (becomes <b>B2</b> when moved down one row).
44	<b>B</b>	<b>PaaS</b> provides the environment (tools and OS) for developers to build and deploy applications.
45	<b>B</b>	<b>Inheritance</b> allows a "child" class to adopt the attributes and behaviors of a "parent" class.
46	<b>B</b>	<b>HTML</b> (HyperText Markup Language) is the standard language used to create the structure of web pages.
47	<b>C</b>	A <b>Relational DBMS</b> stores data in tables (relations) consisting of rows (tuples) and columns (attributes).
48	<b>C</b>	<b>Encapsulation</b> is the OOP principle of bundling data and methods together and restricting direct access.
49	<b>B</b>	A <b>Gantt Chart</b> is a type of bar chart that illustrates a project schedule over time.

Question #	Correct Answer	Explanation
50	<b>B</b>	A system that manages commercial tasks (like stock) and triggers alerts automatically is <b>Automated Commercial Data Processing</b> .

This marking guide provides solutions and mark allocations for the Information and Communication Technology 2 (0796) Mock Examination. As per the instructions, candidates must answer any **SIX** questions, with each question carrying **17 marks**.

## Question 1: Computer Architecture (17 Marks)

a) Compare and Contrast CISC and RISC (6 Marks)

Feature	CISC (Complex Instruction Set Computer)	RISC (Reduced Instruction Set Computer)
<b>RAM Usage</b>	Low; emphasis is on hardware, leading to small code sizes.	High; simpler instructions require more lines of code, consuming more RAM.
<b>Instruction Complexity</b>	High; single instructions can perform complex, multi-cycle tasks.	Low; simple instructions that perform one basic operation.
<b>Clock Cycles (CPI)</b>	Variable; instructions take multiple cycles to execute.	Constant; most instructions execute in a single clock cycle.

b) Machine Instruction Cycle and Interrupts (6 Marks)

- **Fetch:** The CPU retrieves the next instruction from memory using the Program Counter.
- **Decode:** The Control Unit interprets the instruction to determine what operation to perform.
- **Execute:** The CPU carries out the operation (e.g., an ALU calculation).
- **Store:** The result is written back to a register or memory location.
- **Interrupt Flow:** When an interrupt occurs (e.g., keyboard input), the CPU finishes its current instruction, saves the state of the current process, transfers control to an **Interrupt Service Routine (ISR)**, and resumes the original task once the ISR completes.

c) Flynn's Architectures (5 Marks)

- **SIMD (Single Instruction, Multiple Data):** One instruction is applied to multiple data points simultaneously.

- **MIMD (Multiple Instruction, Multiple Data):** Multiple processors execute different instructions on different data.
  - **Efficiency:** For large arrays of identical scientific data, **SIMD** is more efficient because it processes the entire array in parallel with a single command, reducing instruction overhead.
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## Question 2: Operating Systems (17 Marks)

### a) Scheduling Types (5 Marks)

- **Pre-emptive:** The OS can forcibly stop a running process to give the CPU to another (e.g., a higher priority task).
- **Non-pre-emptive:** A process holds the CPU until it finishes or voluntarily yields control.
- **Detrimental Scenario:** In a multi-user system, if a process enters an infinite loop or a very long calculation, the entire system "freezes" for other users because the OS cannot force the process to stop.

### b) RR vs. SJF Scheduling (6 Marks)

- **SJF Starvation:** Shortest Job First can lead to starvation if short processes keep arriving, causing long processes to wait indefinitely.
- **Round Robin (RR) Solution:** RR uses a **time quantum**. Every process gets a small, equal slice of CPU time, ensuring that even long processes eventually make progress.

### c) Memory and Device Management (6 Marks)

- **Memory Management:** The OS allocates/deallocates RAM space and handles virtual memory.
  - **Device Management:** The OS manages communication between the CPU and hardware via drivers.
  - **Slow Peripherals:** The OS uses **Buffers** (temporary storage areas) to hold data until the device is ready. **Interrupt Priorities** ensure that critical device signals are handled before less important ones.
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## Question 3: Information Systems (17 Marks)

### a) Components of an Information System (4 Marks)

- **People:** Medical staff/administrators who enter and use patient data.
- **Procedures:** The rules for patient check-in or emergency protocols.
- **Technology:** The hardware (servers, PCs) and software (database) used.
- **Data:** Raw patient facts (names, medical history, blood types).

b) Level 0 DFD for Patient Registration (7 Marks)

- **External Entities:** Patient, Medical Staff.
- **Process:** Register Patient.
- **Data Stores:** Patient Database, Insurance Provider list.
- **Flows:** Patient details into the process; Confirmation back to the patient.

c) Evolutionary Prototyping vs. Waterfall (6 Marks)

- **Recommendation:** Evolutionary Prototyping.
  - **Justification:** Hospitals have complex, evolving needs. Prototyping allows for constant **user feedback** from doctors/nurses and reduces **risk** by identifying usability issues early, unlike the rigid Waterfall model.
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## Question 4: Databases (17 Marks)

a) Data Redundancy (5 Marks)

- **Concept:** Storing the same piece of data multiple times in different places.
- **Problems:**
  1. **Storage Waste:** Consumes unnecessary disk space.
  2. **Inconsistency:** Updating a record in one place but forgetting another leads to conflicting data.
  3. **Update Anomalies:** Difficulty in maintaining data integrity during changes.

b) Normalization to 3NF (6 Marks)

1. **1NF:** Remove repeating groups and ensure atomic values in every cell.
2. **2NF:** Remove partial functional dependencies (all non-key attributes must depend on the whole primary key).
3. **3NF:** Remove transitive dependencies (non-key attributes should not depend on other non-key attributes).

c) Keys and 1:M Relationships (6 Marks)

- **Primary Key:** A unique identifier for a record (e.g., **BOOKID** in the **Books** table).
- **Foreign Key:** A primary key from one table placed in another to create a link (e.g., **BOOKID** in the **Borrowing** table).
- **1:M Illustration:** One book can be borrowed many times. The **BOOKID** (PK) in the **Books** table is linked to multiple entries of the same **BOOKID** (FK) in the **Borrowing** table.

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## Question 5: Logic and Boolean Algebra (17 Marks)

a) Alarm System (6 Marks)

- **Expression:**  $\text{Alarm} = (A \cdot B) + (C \cdot A')$
- **Truth Table:**

A	B	C	$A \cdot B$	$C \cdot A'$	Alarm
0	0	0	0	0	<b>0</b>
0	0	1	0	1	<b>1</b>
0	1	1	1	1	<b>0</b>
0	1	1	0	1	<b>1</b>
1	0	0	0	0	<b>0</b>
1	0	1	0	0	<b>0</b>
1	1	0	1	0	<b>1</b>
1	1	1	1	0	<b>1</b>

b) Boolean Simplification (5 Marks)

1.  $(A \cdot B) + (A \cdot B')$  : Given expression.
2.  $A \cdot (B + B')$  : **Distributive Law.**
3.  $A \cdot (1)$  : **Complement Law** ( $B + B' = 1$ ).
4. **A : Identity Law.**

c) NAND Gates and Universality (6 Marks)

- **Circuit:** To represent "A", one could use two NAND gates in a NOT-NOT configuration (though A is just a wire, logic design might require buffering).
- **Universal Gate:** NAND is called "Universal" because combinations of it can be used to create any other basic logic gate (AND, OR, NOT, XOR).

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## Question 6: Networking (17 Marks)

a) OSI Layers (6 Marks)

- **Network Layer:** Responsible for logical addressing (routing) and path determination.  
**Protocol:** IP (Internet Protocol).
- **Transport Layer:** Responsible for end-to-end communication, error recovery, and flow control.  
**Protocol:** TCP (Transmission Control Protocol).

b) Star vs. Mesh Topology (6 Marks)

- **Fault Tolerance: Mesh** is superior as it provides multiple redundant paths. If one link fails, data reroutes. In **Star**, if the central hub fails, the whole network goes down.
- **Cost: Star** is much cheaper and easier to implement. **Mesh** requires extensive cabling and complex configuration, making it very expensive for large corporations.

c) Error Detection (5 Marks)

- **Parity Check:** Adds a single bit to make the count of 1s either even or odd.
- **Checksum:** Calculates a value based on the sum of data bits. The receiver recalculates this sum; if it doesn't match the sent value, an error is detected.

## Question 7: Algorithms and Data Structures (17 Marks)

a) Binary vs. Linear Search (6 Marks)

- **Linear Search:** Checks each item sequentially. Time complexity is  $O(n)$ . For 1,000,000 items, it may take 1,000,000 comparisons.
- **Binary Search:** Repeatedly divides the sorted list in half. Time complexity is  $O(\log n)$ . For 1,000,000 items, it takes only approximately 20 comparisons ( $2^{20} \approx 1,048,576$ ).

b) Trace Table for Bubble Sort [5, 2, 8, 1] (7 Marks)

Pass	i	j	A[j]	A[j+1]	Action	List State
1	0	0	5	2	Swap	[2, 5, 8, 1]
1	0	1	5	8	No Swap	[2, 5, 8, 1]
1	0	2	8	1	Swap	[2, 5, 1, 8]
2	1	0	2	5	No Swap	[2, 5, 1, 8]
2	1	1	5	1	Swap	[2, 1, 5, 8]
3	2	0	2	1	Swap	[1, 2, 5, 8]

c) Recursion (4 Marks)

- **Definition:** A function that calls itself to solve smaller sub-problems.
- **Advantage:** Can lead to cleaner, shorter code for complex problems like tree traversals.
- **Disadvantage:** High memory usage due to the **stack** overhead of multiple function calls.

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## Question 8: ICT and Society (17 Marks)

### a) Digital Divide (6 Marks)

- **Definition:** The gap between those with access to modern technology and those without.
- **Factors:**
  1. **Income:** High cost of devices/internet in poor communities.
  2. **Infrastructure:** Lack of electricity or fiber-optic cables in rural areas.
- **State Action:** Subsidize internet costs for schools or provide community ICT centers.

### b) Copyright vs. Ethics (5 Marks)

- **Copyright Law:** A legal framework that punishes illegal copying/distribution.
- **Code of Ethics:** A set of professional guidelines (like ACM/IEEE) that govern behavior and integrity.
- **Protection:** Copyright protects **financial interests/intellectual property**, while ethics ensures **professional conduct** and public safety.

### c) Green Computing (6 Marks)

- **Definition:** Environmentally sustainable computing.
- **Practices:**
  1. Implementing server virtualization to reduce physical hardware.
  2. Using energy-efficient hardware (Energy Star rated).
  3. Proper e-waste recycling programs for old components.