



**PAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF COMPUTING AND INFORMATICS  
DEPARTMENT OF CYBER SECURITY**

<b>QUALIFICATION:</b> BACHELOR OF COMPUTER SCIENCE, BACHELOR OF COMPUTER IN CYBER SECURITY & BACHELOR OF INFORMATICS	
<b>QUALIFICATION CODE:</b> 07BACS, 07BCCS & 07BAIF	<b>LEVEL:</b> 5
<b>COURSE:</b> COMPUTER ORGANISATION AND ARCHITECTURE	<b>COURSE CODE:</b> COA511S
<b>DATE:</b> December 2025	<b>PAPER:</b> THEORY
<b>DURATION:</b> 120 Minutes	<b>MARKS:</b> 100

<b>SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER</b>	
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**THIS QUESTION PAPER CONSISTS OF 4 PAGES**  
(Excluding this front page)

**INSTRUCTIONS**

1. Answer ALL the questions on the answer scripts.
2. Write clearly and neatly.
3. Number the answers clearly.

**PERMISSIBLE MATERIALS**

1. None.

**SECTION A [15 MARKS]: Answer All Questions. Each Question Weighs 1 Mark.**

Indicate whether each of the following statements is True or False.

1. Unlike EEPROM, standard CD and DVD optical discs cannot be electrically erased and rewritten. True / False
2. Multiplexers are used in digital circuits to manage signal and data routing. True / False
3. Read-only memory (ROM) is implemented using combinational circuits. True / False
4. The address of the next instruction to be fetched is stored in the program counter. True / False
5. The use of addressing bits is determined solely by the number of operands. True / False
6. Registers temporarily store data and instructions waiting to be processed by the ALU. True / False
7. A data register can only store data and cannot be used to calculate an operand's address. True / False
8. The hexadecimal equivalent of the binary number 10100101 is A5. True / False
9. In floating-point arithmetic, a positive exponent surpassing the maximum allowed exponent is called exponent overflow. True / False
10. Super-pipelined architecture utilizes numerous, finely detailed pipeline stages. True / False
11. The decode instruction phase determines both the opcode and the operand specifiers. True / False
12. Amdahl's Law states that the speedup of a program using multiple processors in parallel computing is not limited by the fraction of the program that cannot be parallelized. True / False
13. The Arithmetic Logic Unit (ALU) performs the computer's data processing functions. True / False
14. A flip-flop exists in one of two states and remains in that state without input. True / False
15. A thread is a dispatchable unit of work within a process that has its own processor context and stack data area. True / False

**SECTION B [15 MARKS]: Answer All Questions. Each Question Weighs 1 Mark.**

Choose the correct answer for each of the following:

1. Component of the CPU is responsible for performing arithmetic and logical operations?
  - A. Control Unit
  - B. Cache Memory
  - C. Arithmetic Logic Unit (ALU)
  - D. Instruction Decoder
2. Which factor influences the number of bits used for addressing in a processor?
  - A. Instruction length
  - B. Memory size
  - C. Number of registers
  - D. All of the above
3. During instruction execution, which step involves retrieving the instruction from memory?
  - A. Fetch instruction

- B. Decode instruction
  - C. Execute instruction
  - D. Store result
4. Which register holds the data temporarily before it is written to memory?
- A. Program Counter
  - B. Instruction Register
  - C. Memory Buffer Register
  - D. Stack Pointer
5. On an optical CD, what are the tiny indentations that store data called?
- A. Tracks
  - B. Pits
  - C. Grooves
  - D. Blocks
6. Which CPU component acts as a high-speed storage area for frequently used data?
- A. Cache Memory
  - B. Control Unit
  - C. System Bus
  - D. ALU
7. What is the binary equivalent of the hexadecimal number 7B?
- A. 01111011
  - B. 10111011
  - C. 01110111
  - D. 10011010
8. Which register stores the address of the instruction to be executed next?
- A. Memory Data Register
  - B. Instruction Register
  - C. Program Counter
  - D. Accumulator
9. Which type of register is used to store the status of the CPU after an operation?
- A. General Purpose
  - B. Data
  - C. Condition Code
  - D. Address
10. Which architecture allows multiple instructions to be executed simultaneously?
- A. Superscalar
  - B. Single-cycle
  - C. Sequential
  - D. Multi-core
11. Which digital circuit component is used to select one of many input signals to pass to the output?
- A. Decoder
  - B. Multiplexer
  - C. Register
  - D. Counter

12. In floating-point arithmetic, what occurs when the exponent is too small to be represented?
  - A. Exponent Overflow
  - B. Exponent Underflow
  - C. Significand Overflow
  - D. Significand Underflow
13. Which type of memory is non-volatile and cannot be modified during normal operation?
  - A. Random Access Memory
  - B. Cache Memory
  - C. Read Only Memory
  - D. Flash Memory
14. Which digital circuit component toggles its output based on a clock signal?
  - A. Latch
  - B. Flip-Flop
  - C. Multiplexer
  - D. Gate
15. The instruction register holds \_\_\_\_\_.
  - A. the address of the next instruction
  - B. the data to be processed
  - C. the current instruction being executed
  - D. the output of the ALU

**SECTION C [70 MARKS]: Comprehension questions.**

**Question 1**

**[12 marks]**

- a) Discuss the concepts of paging and swapping in memory management, highlighting their advantages and disadvantages. (6 marks)
- b) Briefly explain the three primary cache mapping schemes used to manage data transfer between main memory and CPU cache. (6 marks)

**Question 2**

**[6 marks]**

The CPU is a critical component in any computer system, and efficient CPU utilization is crucial for optimal performance. Compare and contrast Interrupt Driven with DMA I/O strategies focusing on how each method impacts CPU usage. (6 marks)

**Question 3**

**[10 marks]**

A delivery drone has 2 GB of memory. Suppose this memory is word addressable meaning that every word has its own unique address for accessing it.

- a) If each word in memory has its own address, how many total words can be stored in its memory? (assume a standard word size of 4 bytes). (4 marks)
- b) Imagine this memory is organized into blocks, where each block holds 64 words. How

many blocks would this memory have? (3 marks)

- c) How many lines of cache memory will be required to accommodate all blocks main memory in (b) above by using the direct cache addressing scheme? (3 marks)

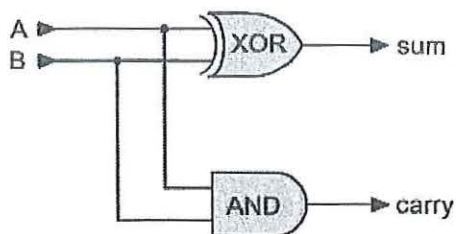
**Question 4 [6 marks]**

- a) Explain your understanding of Boolean algebra and Boolean identities, and describe how and why they are used to model digital circuits. Provide examples and, where appropriate, illustrations to support your explanation. (6 marks)

**Question 5 [15 Marks]**

The following diagram represents a logical circuit. Please provide answers to the accompanying questions based on your understanding of circuit analysis

- a) Provide a complete name of this circuit (2 marks)  
b) Within the architecture of a CPU, where exactly would you find this circuit? (3 marks)  
c) Citing its components A, and B, describe how this circuit work (4 marks)  
d) Provide a truth table for the circuit. Ensure that the truth table clearly displays all input and output labels, along with the corresponding values. (6 marks)



**Question 6 [21 marks]**

- a) Instruction addressing modes are essential concepts in computer architecture, dictating how the processor identifies the operands (data) required for an instruction. These addressing modes offer various methods to access data, providing trade-offs between speed, flexibility, and complexity, allowing efficient programming depending on the use case.

Explain any four types of instruction addressing modes, and include an example for each mode in your response. (8 marks)

- b) Identify and briefly explain the purpose of any four(4) CPU registers crucial for instruction execution. (8 marks)

- c) The Program Status Word (PSW) holds key information about a program's current state. Name and briefly explain any five common status flags found within a PSW. (5 marks)

\*\*\*\*\*END OF PAPER\*\*\*\*\*