NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMPUTING AND INFORMATICS
DEPARTMENT OF COMPUTER SCIENCE

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE, BACHELOR OF COMPUTER IN CYBER SECURITY & BACHELOR OF INFORMATICS	
QUALIFICATION CODE: 07BACS, 07BCCS & 07BAIF	**LEVEL:** 5
COURSE: COMPUTER ORGANISATION AND ARCHITECTURE	**COURSE CODE:** COA511S
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DURATION: 2 HOURS	**MARKS:** 100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
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THIS QUESTION PAPER CONSISTS OF 5 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. Calculator.

SECTION A [15 MARKS]: Each Question Weighs 1 Mark.

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

1. A microprocessor's speed is maximized when it receives a continuous stream of instructions without any interruptions. [True/False]
2. In a pipelined processor, multiple instructions can be executed at the same time, each in different stages of completion. [True/False]
3. The simplified instruction set of RISC processors allows for faster interrupt handling compared to CISC processors. [True/False]
4. Machine parallelism refers to the simultaneous execution of independent instructions, which can enhance overall performance. [True/False]
5. Organizational attributes, such as the hardware design of a computer, are typically hidden from the programmer and do not affect how the programmer writes code. [True/False]
6. The Instruction Set Architecture (ISA) defines the set of instructions a processor can execute and determines how software interacts with hardware. [True/False]
7. Cache memory is generally faster than the register file because it is closer to the processor core. [True/False]
8. Overflow in arithmetic operations can occur without a carry, depending on the type of operation and how data is represented. [True/False]
9. The typical states of a process include: new, ready, running, waiting, and terminated, while interrupt handling is a separate mechanism. [True/False]
10. Memory swapping occurs when a process is moved to secondary storage to free up main memory for other processes. [True/False]
11. A hexadecimal digit represents 4 bits, and sequences of hexadecimal digits are often used to represent binary numbers in a more compact form. [True/False]
12. The instruction set of a processor allows the programmer to directly control the operations the processor performs. [True/False]
13. Memory references are typically faster than register references because memory can store more data than registers. [True/False]
14. The kernel is the core of the operating system, and it is typically written in low-level programming languages like C or assembly. [True/False]

15. A processor's clock frequency, measured in Hertz (Hz), directly affects how many instructions it can execute per second, influencing its performance. [True/False]

SECTION B [15 MARKS]: Each Question Weighs 1 Mark.

Choose the correct answer for each of the following:

1. Binary 11001010 is hexadecimal _____.

   A. C A B. 9 A

   C. D 2 D. 6 A

2. A _____ can store data indefinitely until an input changes its state.

   A. flip-flop B. decoder

   C. multiplexer D. latch

3. The operand _____ yields true only if both of its operands are true.

   A. NOT B. AND

   C. XOR D. OR

4. A _____ is a part of a process that can execute independently and can have its own execution context.

   A. process B. thread

   C. task D. process manager

5. In modern ARM architecture, the standard instruction size is _____ bits long.

   A. 8 B. 16

   C. 32 D. 64

6. The _____ is responsible for fetching instructions and decoding them in the CPU.

   A. registers B. control unit

   C. ALU D. system bus

7. In digital circuits, _____ are used to select one out of multiple inputs based on a selection signal.

   A. multiplexers B. counters

   C. flip-flops D. encoders

8. The _____ identifies the location of the operand.

   A. opcode B. address register

   C. source operand D. data register

9. The operand _____ can yield true if at least one of its operands is true.

A. AND B. OR

C. XOR D. NOT

10. A _____ architecture is designed to use multiple instruction pipelines for parallel processing of instructions.

A. superscalar B. scalar

C. hybrid D. super-pipelined

11. The _____ holds the next instruction to be executed in a sequence.

A. instruction buffer B. memory address register

C. memory buffer register D. program counter

12. In floating-point arithmetic, when the exponent falls below the minimum possible exponent, it is called _____.

A. significand underflow B. exponent underflow

C. significand overflow D. exponent overflow

13. _____ registers are specialized for holding addresses used in memory operations.

A. general purpose B. address

C. status D. Control

14. In an optical CD, the areas that store data in the form of pits are called _____.

A. lands B. zones

C. sectors D. tracks

15. The _____ manages the execution of instructions by directing data and control signals throughout the system.

A. control unit B. CPU interconnect

C. ALU D. data path

SECTION C [70 MARKS]: Comprehension questions.

Question 1 **[15 Marks]**

A new model of Raspberry Pi Phone has 32GB of RAM. The memory in this device is divided into several words, each consisting of 2048 bytes.

a) How many bits are needed to address any single word in this memory?

Show your work step by step. (9 marks)

b) CPU is a vital computer resource and any good computing system should be design in such way to utilise CPU efficiently. Contrast programmed I/0 from I/O channel. Why the CPU usage by **I/O channel** CPU is more efficient than **Programmed I/O?** (6 marks)

Question 2 **[08 Marks]**

a) Explain your understanding of the following virtual memory concepts (4 marks)

i) swapping

ii) demand paging

b) What is the ultimate importance of virtual memory management scheme? (4 marks)

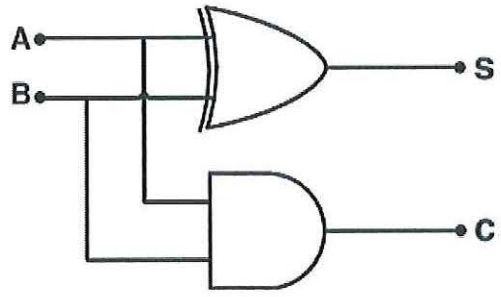
Question 3 **[14 Marks]**

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

a) Provide the name of this circuit (2 marks)

b) Within the architecture of a CPU, where exactly would you find this circuit? (2 marks)

c) Citing its components A, B, S and C, describe how this circuit work (4 marks)



d) Let's say you want to design a circuit that turns on a light (output **F**) when the two switch inputs **A** and **B** are applied.

Truth Table

A	B	F
0	0	1
0	1	0
1	0	0
1	1	1

i. Provide a canonical Boolean function (F) for the circuit above (2 marks)

ii. Suppose this Function does not require any further minimization. Create a visual representation(circuit) of this Boolean function using logic gates (4 marks)

Question 4 **[10 Marks]**

a) Instructions need specific information to execute. Identify four places within a computer where the data used by an instruction (operands) can be located (4 marks)

b) Provide an example of a low-level computer instruction and briefly describe what this instruction must specify. (6 marks)

Question 5 **[12 Marks]**

Addressing modes specify how an instruction finds its operand. Explain this with examples of:

a) Implicit addressing mode (3 marks)

b) Register Indirect addressing mode (3 marks)

c) Relative addressing mode (6 marks)

Question 6 **[11 Marks]**

a) Imagine opening Facebook on your phone. Behind the scenes, your phone's CPU follows a series of steps to make this happen. Explain the six stages the CPU goes through to process the instructions that allow you to use the app. (6 marks)

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

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