MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING, APPLIED SCIENCES AND TECHNOLOGY

DEPARTMENT: COMPUTER SCIENCE AND INFORMATION SYSTEMS

MODULE: COMPUTER ORGANISATION AND ARCHITECTURE

CODE: INSY104/BCOS113

SESSIONAL **EXAMINATIONS**
DECEMBER 2023

DURATION: 3 HOURS

EXAMINER: MS C KATSANDE

INSTRUCTIONS

1. *Answer **Any 4** questions*
2. *Each question carries 25 marks*
3. *Start a new question on a fresh page*
4. *Total marks 100*

Additional material(s): *None*

Question 1

a) Explain the key differences between computer organization and computer architecture, highlighting their respective focuses and components. **4 Marks**

b) Describe the main structural components of a Central Processing Unit (CPU). **6 Marks**

c) Explain five (5) ways in which computer manufacturers attempt to increase the performance of microprocessors. **10 Marks**

d) Characterise the Moore's law. Is it still applicable today? **5 Marks**

Question 2

a) Convert the following:

i. 110011.10011 From binary to decimal.

ii. ABCD From hexadecimal to decimal.

iii. 255.875 From decimal to hexadecimal.

iv. 239.4 From hexadecimal to binary.

v. 762.013 From octal to hexadecimal. **10 Marks**

b) Given the following Boolean expression **ABC + AB' (A'C')'**

i. Draw the logic circuit. **5 Marks**

ii. Construct the truth table. **5 Marks**

iii. Construct the Karnaugh Map (Kmap) to simplify the expression. **5 Marks**

Question 3

Design a sequential circuit with 2 JK flip-flops A and B and two inputs E and X. If E =0, the circuit remains in the same state regardless of the value of X. When E =1 and x=1, the circuit goes through the state transitions from 00 to 01 to 10 to 11 back to 00, and repeats. When E =1 and x=0, the circuit goes through the state transitions from 00 to 11 to 10 to 01 back to 00, and repeats.

Requirements:

a) Construct the state diagram.

b) Draw the state table.

c) Design the logic circuit. **25 Marks**

Question 4

a) Describe the cache level organization and explain how cache memory can improve system performance. **9 Marks**

b) Explain any six (6) reasons why Solid State Drives (SSDs) are surpassing Hard Disk Drives (HDDs) in today's technology. **6 Marks**

c) Compare and contrast RAID 6 and RAID 10 in terms of disk utilization and fault tolerance. **10 Marks**

Question 5

a) Discuss the advantages of Interrupt-driven I/O over Programmed I/O and provide examples of where Interrupt-driven I/O is commonly used. **8 Marks**

b) Data hazards can cause the pipeline to deviate from its normal performance. Explain any three types of hazards that are likely to occur a pipeline and how they are resolved. **12 Marks**

c) The design of RISC (Reduced Instruction Set Computing) architectures is based on certain characteristics of currently used programs. Enumerate at least five such characteristics and explain how they impact the design of RISC architectures. **5 Marks**

END OF EXAMINATION