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

SESSIONAL **EXAMINATIONS**
APRIL 2024

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 following concepts:

i. Computer architecture; and **[2 Marks]**

ii. Computer organization. **[2 Marks]**

b) Explain the impact of the following factors on the performance of a processor:

i. Cores ; **[2 Marks]**

ii. Clock Speed; **[2 Marks]**

iii. Instruction Set; and **[2 Marks]**

iv. Heat. **[2 Marks]**

c) Enumerate five (5) key elements considered in computer generations. **[5 Marks]**

d) Explain any four (4) ways in which computer manufacturers attempt to increase the performance of microprocessors. **[8 Marks]**

Question 2

Suppose the cash room at a store has access restricted to certain employees, each of who has a key, which produces a logic 1 at particular inputs to an unlocking circuit. Only the store manager (M) can enter alone. The assistant manager (A) and the cashier (C) also have access, but only when accompanied by each other, or by the store manager.

a) Construct a truth table for the scenario given. **[8 Marks]**

b) Derive a boolean expression from the truth table constructed in (a). **[4 Marks]**

c) Design a combinational logic circuit of the boolean expression derived in (b). **[8 Marks]**

d) Draw a Karnaugh Map (Kmap) to simplify the boolean expression derived in (b). **[5 Marks]**

Question 3

a) Convert the following:

i. 11100.011 from binary to decimal; **[3 Marks]**

ii. A64 from hexadecimal to Binary; and **[3 Marks]**

iii. 5655 From octal to hexadecimal**.** **[3 Marks]**

b) Describe the operation of a JK flip-flop with the help of a:

i. Logic Circuit. **[5 Marks]**

ii. Truth table. **[8 Marks]**

c) Explain why the JK flip-flop is an improvement from the SR flip-flop. **[3 Marks]**

Question 4

a) While browsing at Billy Bob's computer store, you overhear a customer asking Billy Bob what kind of laptop he can buy in terms of storage options, a laptop with SSDs or HDDs. Explain any five attributes that you would consider to help this customer make an informed decision. **[10 Marks]**

b) Explore the five (5) prevalent RAID levels that a computer specialist can configure on a server to enhance server performance. **[15 Marks]**

Question 5

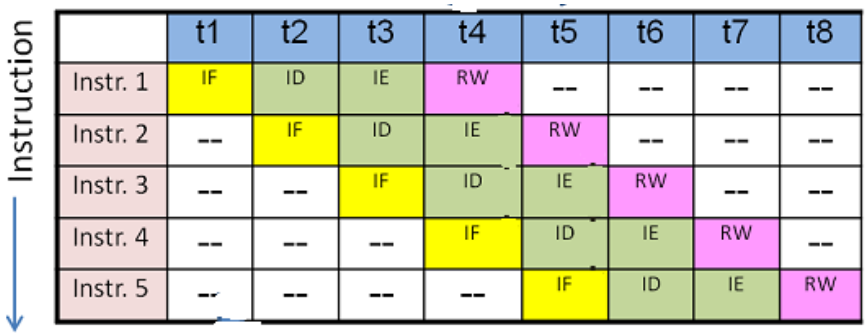
a) Explain why interrupt-driven I/O is preferred over programmed I/O for input/output operations in modern-day computers. **[5 Marks]**

b) Consider a sequence of eight (8) instructions passing through 5 stage pipeline. The Instruction Cycle has the following stages: IF = Fetches the instruction into the instruction register, ID = Decode instruction, EX = Execution, executes the specified, operation, MEM = Access memory, WB = Write back, writes back the result to the register.

Draw a timing diagram to show how the instructions passes through a 5 stage pipeline. **[10 Marks]**

c) Can we conclude that an increasing number of stages in a pipeline always provides increasing performance, assuming no hazards occur? Justify. **[4 Marks]**

d) Given the following pipeline timing diagram:



IF-Instruction Fetch; ID- Instruction Decode, IF-Instruction Execute; RW-Result Writing. Identify and explain the type of hazard that is likely to occur in the pipeline and show how it can be resolved. **[6 Marks]**

END OF EXAMINATION