TECHNICAL UNIVERSITY OF MOMBASA

INSTITUTE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR:

BSCS/ SEP2022/J-FT, BTIT/SEP2022/J-FT, BSIT/ SEP2022/J-FT, /BTAP/ SEP2022/J-FT, BSSC/ SEP2022/J-FT

CCS4301: COMPUTER ARCHITECTURE AND ORGANIZATION

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2024

TIME: 2HOURS

DATE: Pick DateDec2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE (30 MARKS)

a. Discuss the evolution of computer architecture from early computers to modern microprocessors. Focus on significant technological advancements, changes in design paradigms, and the influence of these developments on overall computing performance and capabilities. Provide examples of key architectures and their contributions to the field. [10marks]

b. Analyze the concept of memory hierarchies in computer systems. Explain the different levels of memory and their characteristics. Discuss the importance of cache memory and how cache designing impacts system performance. Include recent trends in memory technologies. 10marks]

c. Explain the concept of pipelining in computer architecture and its significance in improving instruction throughput. Describe the stages of a typical instruction pipeline and the role of each stage in the instruction execution process. What are the main benefits of pipelining compared to non-pipelined architectures? [10marks]

Question TWO (20 MARKS)

a. Define multiprogramming and multiprocessing in the context of computer architecture. Discuss the differences between these two concepts regarding resource utilization, performance, and system complexity. How do multiprogramming and multiprocessing enhance the efficiency of CPU usage, and what challenges do they present in terms of process synchronization and resource management? [10marks]
b. Discuss the significance of performance metrics and benchmarking in computer architecture. Identify key metrics used to assess CPU performance. Explain the processes and tools involved in benchmarking a computing system. Reflect on the ethical considerations and potential biases in benchmarking methodologies, and how they may influence consumer perceptions and industry standards. [10marks]

Question THREE

a. Explain the concept of the von Neumann architecture. What are its main components, and how do they interact with one another? [10marks]
b. Discuss the types of hazards that can occur in a pipelined processor and describe the techniques used to mitigate these hazards. [5marks]
c. How do multiprogramming and multiprocessing enhance the efficiency of CPU usage, and what challenges do they present in terms of process synchronization and resource management? [5marks]

Question FOUR

a. Explain the principles of parallel processing in computer architecture. [5marks]
b. Define the various models of parallelism and discuss how they are implemented in modern multi-core and many-core processors. [5marks]
c. Explain the advantages and disadvantages of parallel processing, considering applications in fields such as machine learning. [10marks]

Question FIVE

a. Discuss the importance of security in computer architecture. Analyze common security threats that arise due to architectural vulnerabilities. Evaluate the measures that can be implemented at both the architectural and software levels to mitigate these threats. Propose guidelines for designing secure systems and discuss the trade-offs between performance and security in system architecture. [10marks]

b. Explain current and emerging trends in computer architecture and the integration of artificial intelligence (AI) within hardware design. Discuss how these trends are likely to transform traditional computing paradigms and influence future applications. Discuss both the potential

benefits and the challenges that arise from these advancements, considering how they relate to existing architectural frameworks and the implications for software development. [10marks]