

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL

FOR THE WARD OF BACHELOR OF SCIENCE IN APPLIED COMPUTER
SCIENCE

ACSC 102: INTRODUCTION TO DIGITAL LOGIC

STREAMS: B.Sc. (APPLIED COMP.SCI) Y1S1 TIME: 2 HOURS

DAY/DATE: MONDAY 01/02/2021

11.30 A.M. – 1.30 P.M.

INSTRUCTION: Answer question ONE and any other TWO questions.**QUESTION ONE (30 MARKS)**

- (a) Explain the impact of cache misses (both read and write misses) on the general computer performance. (3 marks)
- (b) Perform the following number system conversion.
597.485₁₀ to Binary system. (3 marks)
- (c) Construct a truth table for the Boolean expression shown below. (4 marks)

$$x(\bar{y}z + x\bar{y})$$

- (d) Briefly explain the fetch-execute cycle in instruction execution. (4 marks)
- (e) Explain the role of Program Counter and Accumulator during instruction execution. (4 marks)
- (f) Draw the combinational circuit that directly implements the following Boolean function. (4 marks)

$$F(x,y,z) = xz + (\bar{x}y + \bar{z})$$

- (g) Simplify the Boolean function using Boolean identities. Show the Boolean identities used in each step. (4 marks)

$$F(x, y, z) = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + x\bar{y}\bar{z} + xy\bar{z}$$

- (h) Find the sum of 39_{10} and -17_{10} in binary using the two's complement arithmetic. Use 8 bits to represent the binary numbers. (4 marks)

QUESTION TWO (20 MARKS)

- (a) Explain the purpose of interrupts in processor performance. (3 marks)
- (b) Design a truth table for a three –input exclusive-**OR (XOR)** operation. Design its implementation using AND, OR and NOT gates. (9 marks)
- (c) Get the simplified version of the Boolean function represented in the Kmap shown below. Design a logic diagram for the simplified function. (8 marks)

		YZ			
		00	01	11	10
WX	00	1	1	1	1
	01	1		1	1
	11			1	1
	10	1			1

QUESTION THREE(20 MARKS)

- (a) Explain what is cache coherency? (2 marks)
- (b) Create a Kmap and then simplify the following function. (8 marks)

$$F(w,x,y,z) = \bar{y}x + w\bar{y} + \bar{w}xy + \bar{w}\bar{x}y\bar{z} + w\bar{x}y\bar{z}$$

- (c) A three-input digital circuit gives a TRUE output when a majority (i.e. 2 or more) of the inputs is TRUE. Develop a truth table for the output and then draw the logic diagram for the circuit implementation using AND, OR and NOT gates. (10 marks)

QUESTION FOUR(20 MARKS)

- (a) Show that $(X + Y)(X + \bar{Y})(\bar{X} + Z) = XZ$ using Boolean identities. (7 marks)
- (b) Describe the four major internal structural components of a computer system. Use a well labeled diagram to illustrate their interconnection. (7 marks)
- (c) Describe the following cache write policies. (6 marks)
- (i) write-through
 - (ii) Write-back

QUESTION FIVE(20 MARKS)

- (a) Discuss three types of memory access techniques used in main memory and secondary memory devices. (6 marks)
- (b) Discuss the flow of program execution in the event of a raised interrupt when interrupts are enabled. Use an appropriate diagrams to illustrate your answer. (8 marks)
- (c) Perform the following number conversions:
- i) 243.25_{10} to base 4 (3 marks)
 - ii) $8FEA2_{16}$ to binary (3 marks)
-