

THE UNIVERSITY OF ZAMBIA, SCHOOL OF NATURAL SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

2019/2020 CSC 2111 TEST 2

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**INSTRUCTIONS:** Answer ALL questions.      **DURATION: 2 HRS**

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**QUESTION ONE**

Consider a machine with a byte addressable main memory of  $2^{16}$  bytes and block size of 8 bytes.

- i. What is the *number* and *range* of addressable locations in the main memory?  
[4 marks]
- ii. Assuming that a direct mapped cache consisting of 32 lines is used with this machine,
  - a. How is a main memory address divided into tag, line, and word values?  
[6 marks]
  - b. Into what line would bytes with each of the following addresses be stored?  
[6 marks]
    - i. 0001 0001 0001 1011
    - ii. 1100 0011 0011 0100
    - iii. 1101 0000 0001 1101
  - c. Suppose the byte with address 0001 1010 0001 1010 is stored in the cache. What are the addresses of the other bytes stored along with it?  
[4 marks]

**QUESTION TWO**

Assuming that a four-way set-associative mapped cache consisting of 32 lines is used with the machine from question one,

- a. How is a main memory address divided into tag, set, and word number?  
[6 marks]
- b. Into what set would bytes with each of the following addresses be stored?  
[4 marks]
  - i. 0001 0001 0011 1011
  - ii. 1100 0011 0010 0100

iii. 1101 0000 0001 1101

iv. 1010 1010 1010 1010

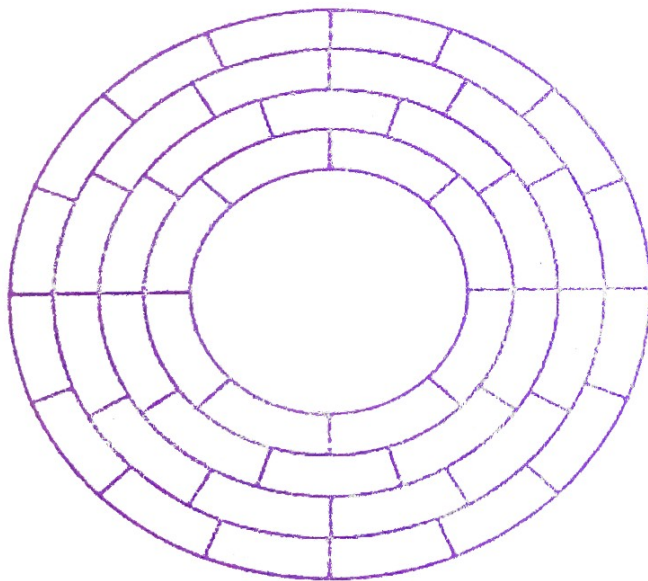
### QUESTION THREE

In relation to main memory error correction functions:

- Develop a SEC code for a 10-bit data word. (set up a table) [10 marks]
- Generate the code for the data word 0101101011. [5 marks]
- Show that the code will correctly identify an error in data bit 5. [5 marks]

### QUESTION FOUR

Discuss the disk layout below. [10]



$$\begin{array}{ccccc} 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ 16 & 8 & 4 & 2 & 1 \end{array}$$