MAKERERE UNIVERSITY

COLLEGE OF ENGINEERING DESIGN, ART AND TECHNOLOGY

Department of Electrical and Computer Engineering

CMP 1203: COMPUTER ARCHITECTURE AND ORGANISATION

Examination 2018/2019

B.SC COMPUTER EGINEERING [first Year]

Date: 16th May 2019 Time: 2:00 to 5:00 pm.

INSTRUCTIONS: This paper contains **FIVE**. Answer **A LL** Questions in **SECTION A,** and any **THREE** Questions from **SECTION B**

All Questions carry equal marks

SECTION A

Question One (25 marks). This question is ***compulsory***

a) While browsing at a computer store on Kampala Road, you overhear a customer asking a salesman what is the fastest computer in the store that he can buy. The salesman replies, "If you really want the fastest machine, you should buy our 2.4-GHz Intel Pentium IV instead of our 1.2GHz Macintosh." Is this salesman correct? Using your knowledge from taking this semester, what would you say to help this customer? **[5 marks]**

b) Two manufacturers are selling hard disk drives. X is selling an array of twenty 250 GB disks for Shs. 400,000 and Y is selling an array of twerty 212.5 GB disks for Shs. 420,000. However, X's disk capacity is specified in unformatted decimal GB, while Y's is specified in formatted binary GB. Assuming that disk capacity reduces by 15% after formatting, which manufacturer's disk has a smaller cost per GB? Explain**. [8 marks]**

c) Justify the following statements;

i) It is impossible to define a single value as an optimum cache size. **[4 marks]**

ii) Moore's law cannot hold forever. **[4 marks]**

iii) Pipelining can increase the raw speed of a computer's processor. **[4 marks]**

SECTION B (Answer ONLY three questions from this section**)**

Question Two (25 marks)

a) What is an interrupt? List any 3 reasons that may trigger an interrupt. **[4 marks]**

b) Computer systems need to have a way to control how input/output modules communicate with the CPU. Compare and contrast programmed and interrupt driven I/O. **[10 marks]**

c) I/O modules connect to peripheral devices using different interfaces. Explain the difference between serial and parallel interfaces and give example of each. [**5 marks]**

d) A benchmark program is run on a 40 MHz processor. The executed program has 100,000 instructions as shown below. Determine the effective CPI, MIPs rate and execution time for the program. **[6 marks]**

Instruction type	**Number of instructions**	**Cycles per instruction**
Integer Arithmetic	45,000	1
Data transfer	32,000	2
Floating point	15,000	2
Control transfer	8,000	2

Question Three (25 marks)

a) Express 126_{10} and 8_{10} in 8-bit binary and add them using two's complement arithmetic. Does your answer contain an overflow? Justify your answer. **[5 marks]**

b) Draw a block diagram that shows how the system bus fits into the von Neumann architecture. Highlight the major roles of the system bus. **[9 marks]**

c) What is the benefit of using a multiple-bus architecture as opposed to a single bus architecture? **[4 marks]**

d) i) What do you understand by bus arbitration? Why is it required in computer systems? **[3 marks]**

ii) From your answer in (i) above, differentiate between centralized and distributed arbitration.

[4 marks]

Question Four (25 marks)

a) A certain computer has the ISA below

Instruction	Meaning
Load X	Load the contents of the address X into the Accumulator (AC)
Store X	Store the contents of the address X to AC and store the result in AC
Add X	Add the contents of the address X to AC and store the result in AC
Subt X	Subtract the contents of address X from AC and store result in AC
Halt	Terminate the program
Jumb X	Load the value of X into program counter (PC)

i) What is the role of the accumulator and program counter? **[2 marks]**

ii) Why is it necessary for you as a computer engineer to understand how to program in assembly language**?** **[3 marks]**

iii) Hence write a simple assembly language program using this ISA that subtracts two numbers, located in main memory, and store the result in main memory **[4marks]**

iv) Classify this machine as CISC or RISC. Justify your answer. **[3 marks]**

b) Differentiate between immediate, direct and indirect addressing. Which addressing mode is used in (a) above? **[7 marks]**

c) With the help of an example, explain what you understand by big endian. Discuss its advantages and disadvantages. **[6 marks]**

Question Five (25 marks)

a) Suppose you have a 32byte memory that is 8-way low –order interleaved and byte addressable. Draw its address structure. Clearly explain your answer. **[5 marks]**

b) List the three main characteristics that must be considered when designing a computer's memory. Why do designers often need to make a trade-off among them? **[9 marks]**

c) Explain the importance of virtual memory and briefly describe hoe it is implemented using paging. **[6marks]**

d) Discuss the concept of RAID and clearly highlight how it leads to gains in system performance. **[5 marks]**

THE END. GOOD LUCK!