MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
SECOND YEAR FIRST SEMESTER

SCHOOL OF SCIENCE & INFORMATION SCIENCES
BACHELOR OF SCIENCE (COMPUTER SCIENCE)

COURSE CODE: COM 2104
COURSE TITLE: COMPUTER ARCHITECTURE

DATE: 14TH DECEMBER 2018 **TIME: 8.30 -10.30AM**

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other TWO questions

*This paper consists of **3** printed pages. Please turn over.*

SECTION A (30Marks): Answer **all** questions from this section

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QUESTION 1

(a) Give the four structural components of a computer **(4 Marks)**

(b) List four functions of the I/O module **(4 Marks)**

(c) Supposed that you speed up all floating-point multiplications by a factor of 10. At present floating-point multiplications represent 20% of the running time of your program. Which is the overall speedup when you use the enhancement **(5 Marks)**

(d) List and explain six different types of semiconductor memory. **(6 Marks)**

(e) Explain three methods of accessing data in the memory unit **(6 Marks)**

(f) List five registers and explain their function (**5 Marks)**

SECTION B (40Marks): Answer **TWO** questions from this section

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QUESTION 2

(a) A computer is used in an I/O intensive environment; the CPU is working 75% of the time and the rest is waiting for I/O operations to complete. Consider an improvement of the CPU by a factor of 2 (it will run twice as fast as it runs now) for a fivefold increase in cost. The present cost of the CPU is 20% of the machine's cost. Is the suggested improvement cost effective? **(5 Marks)**

(b) List and briefly define the main structural components of a processor **(4 Marks)**

(c) Four benchmark programs are executed on three computers with the following results **(6 Marks)**

	Computer A	Computer B	Computer C
Program 1	1	10	20
Program 2	1000	100	20
Program 3	500	1000	50
Program 4	100	800	100

The table shows the execution time in seconds, with 100,000,000 instructions executed in each of the four programs.

(i) Calculate the MIPS values for each computer for each program.

(ii) Calculate the arithmetic and harmonic means assuming equal weights for the four programs

(iii) Rank the computers based on arithmetic mean and harmonic mean

(d) Give five types of data transfer/exchange that interconnection structures must support **(5 Marks)**

QUESTION 3

(a) Consider a 32-bit microprocessor whose bus cycle is the same duration as that of a 16-bit microprocessor. Assume that on average, 20% of the operands and instructions are 32 bits long, 40% are 16 bit long, and 40% are only 8 bits long. Calculate the improvement achieved when fetching instructions and operands with the 32-bit microprocessor. **(5 Marks)**

(b) With an aid of a diagram show the general structure of the IAS computer **(6 marks)**

(c) Consider the execution of a program which results in the execution of 2 million instructions on a 400 MHZ processor. The program consists of four major types of instructions. The instruction mix and the CPI for each instruction type are given below based on the result of a program trace experiment **(6 Marks)**

Calculate

(i) The average CPI

(ii) The MIPS rate

(d) Virtually all contemporary computer design are based on the concept developed by Jon von Neumann. Such design is referred to as von Neumann architecture which is based on three key concept, name them **(3 Marks)**

QUESTION 4

(a) Give four desirable characteristics of a benchmark program **(4 Marks)**

(b) Consider two different Machines, with two different instruction sets, both of which have a clock rate of 200MHz. The following measurement are recorded on the two machines running a given set of benchmark programs: **(6 Marks)**

Instruction Type	Instruction Count (millions)	Cycles per Instruction
Machine A		
Arithmetic and logic	8	1
Load and store	4	3
Branch	2	4
Others	4	3
Machine A		
Arithmetic and logic	10	1
Load and store	8	2
Branch	2	4
Others	4	3

Determine the effective

(i) CPI,

(ii) MIPS rate, and

(iii) The execution time for each Machine

(c) Explain four functions of an operating system **(4 Marks)**

(d) Use a block diagram to explain the computer system **(6 Marks)**

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