



MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT311: COMPUTER ARCHITECTURE

DATE:

TIME:

INSTRUCTIONS

Answer Question ONE (Compulsory) and any other TWO questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Explain the functions of the following components of von Neumann computer architecture (4 marks)
 - i) Arithmetic and Logic Unit (ALU)
 - ii) System RAM
- b) Write the **TWO's** and **ONE's** Complement of -53_{10} (4 marks)
- c) Convert -210.25_{10} into IEEE 754 binary floating point single precision representation (4 marks)
- d) With aid of diagrams explain the difference between register and stack addressing modes (6 marks)
- e) Explain the function of the following CPU registers (4 marks)
 - a. Program counter
 - b. Index register
- d) Describe the difference between CISC and RISC architectures (6 marks)
- e) Explain how Cache memory helps to speed up instruction execution by the CPU (2 marks)

QUESTION TWO (20MARKS)

- a) With aid of diagrams explain the difference between Set Associative and Fully Set Associative cache mappings (6 marks)
- b) State **THREE** elements of an instruction (3 marks)
- c) Describe the computer memory hierarchy (8 marks)
- d) State one advantage and two disadvantages of assembly programming languages (3 marks)

QUESTION THREE (20 MARKS)

- a) State the Amdahl's Law (2 marks)
- b) Floating point instructions are improved to run twice as fast, but only 10% of the time was spent on these instructions originally.
 - a. How much faster is the new machine? (4 marks)
 - b. How much faster would the new machine be if floating point instructions become 80 times faster? (4 marks)
- c) Explain the difference between Hardwired and Micro-Programed Control Units (6 marks)
- d) With aid of block diagrams explain the differences Von Neumann and Harvard Computer architectures. (4 marks)

QUESTION FOUR (20 MARKS)

Assume that to spell check a large file, 820,000,000 instructions are needed. The instructions in the program are broken down into 4 different classes, and each class requires N clock cycles to execute. Specific information is given in the table below.

Instruction class	t	Number of instructions
Branch	3	150,000,000
Store	4	185,000,000
Load	5	260,000,000
ALU	4	225,000,000

Question A: (10 marks)

If the total execution time for this program is found to be 1.57 seconds, what is the clock cycle time of the computer in nanoseconds on which it was run?

Question B: (10 marks)

Assume that as part of the 820,000,000 instruction spell check, 25% of all load instructions are immediately followed by an ALU / R-type instruction that uses the data that was just loaded. To speed up this program, we are contemplating adding a new type of instruction – an ALU instruction where one of the source operands is a value from memory.

- This new instruction will replace the previous, 2 instruction sequence.

- It will take 7 clock cycles.

Will this change offer any speedup over the original design? If so, how much?

NB: Assume that the clock rate does not change

QUESTION FIVE (20 MARKS)

- a) Briefly explain CPU instruction execution cycle (6 marks)
- b) Convert 2.25 into IEEE 754 binary floating point double precision representation (5 marks)
- c) Explain three ways in which CPU execution time can be decreased (6 marks)
- d) Explain the difference between dynamic and Static RAM (3 marks)