



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

**BACHELOR OF SCIENCE (TELECOMMUNICATION AND INFORMATION
TECHNOLOGY)**

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SPH 312: COMPUTER ARCHITECTURE AND ORGANISATION

DATE: 11/8/2021

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Answer Question One And Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Distinguish between the following
 - (i) Address bus and data bus
 - (ii) Direct addressing mode and indirect addressing mode (4 marks)
- b) Explain the difference between multiplexed and non multiplexed bus systems. (2 marks)
- c) How does the architecture of a typical FPGA device differ from that of a CPLD? In what way does the architecture affect the timing performance in the two cases? (6 marks)
- d) Design a circuit to take a 4bit number ABCD and produce a single output Y that is true only if the inputs represents a prime number. (10 marks)
- e) Why we need to have secondary storage devices when the computer already has a primary storage? Distinguish between magnetic tape and magnetic disk as a secondary storage device. (6 marks)
- f) Explain in brief the concept of cache memory. (2 marks)

QUESTION TWO (20 MARKS)

- a) With the help of a labeled diagram, briefly describe the operational role of the three types of bus in a microcomputer system (6 marks)
- b) Design a logic circuit whose output is HIGH whenever A and B are both HIGH as long as C and D are either both LOW or both HIGH (6 marks)

- c) Generate a logic diagram from a boolean expression below

$$C = AB + A''B'' + (A+B) \quad (8 \text{ marks})$$

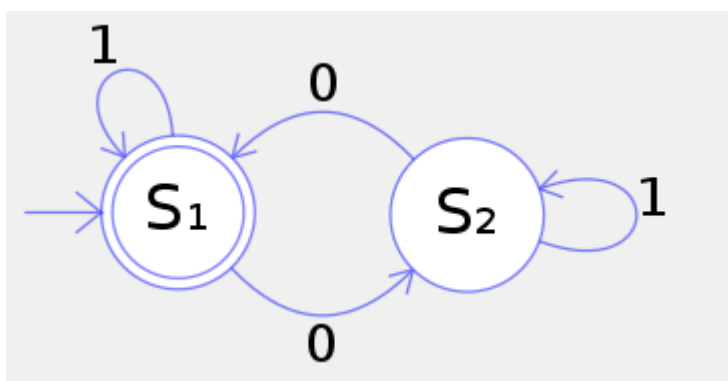
QUESTION THREE (20 MARKS)

- a) Give three differences between ROM and RAM (6 marks)
- b) Briefly describe the difference between a microprocessor and a microcomputer. What are the three main constituents of a microprocessor and what is the basic function performed by each one of them. (10 marks)
- c) Implement the following Boolean expression with the help of programmable logic array (PLA)

$$\begin{aligned} X &= AB + AC' \\ Y &= AB' + BC + AC' \end{aligned} \quad (4 \text{ marks})$$

QUESTION FOUR (20 MARKS)

- a) List the main components of a CPU describing the functioning of each. (6 marks)
- b) (i) What is the difference between a mealy machine and a moore machine?
(ii) Create a state transition table for the following FSM



(6 marks)

c) Explain the difference between

- i) Sequential access memory and a random access memory;
- ii) A memory write operation and a memory read operation;
- iii) EEPROM and UVEPROM;
- iv) Synchronous SRAM and asynchronous SRAM.

(8 marks)

QUESTION FIVE (20 MARKS)

Design a logic circuit that controls an elevator door in a three-story building. The circuit in has four inputs. M is a logic signal that indicates when the elevator is moving ($M = 1$) or stopped ($M = 0$).

$F1$, $F2$, and $F3$ are floor indicator signals that are normally LOW, and they go HIGH only when the elevator is positioned at the level of that particular floor. For example, when the elevator is lined up level with the second floor,

$F2 = 1$ and $F1 = F3 = 0$. The circuit output is the $OPEN$ signal, which is normally LOW and will go HIGH when the elevator door is to be opened.