



MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION (SCIENCE)

SPH 441: MICROPROCESSOR APPLICATIONS

DATE: 17/8/2021

TIME: 8.30-10.30 AM

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

- a) Describe the following types of buses as used in 8085 microprocessors
- Address bus (2 marks)
 - Data bus (2 marks)
 - Control bus (2 marks)
- b) Figure 1 shows memory circuit of 8085 microprocessor. Calculate
- The total size of the memory in the circuit. (2 marks)
 - The beginning and ending addresses (in hex code) of the memory in Chip 1 and Chip 2. (4 marks)

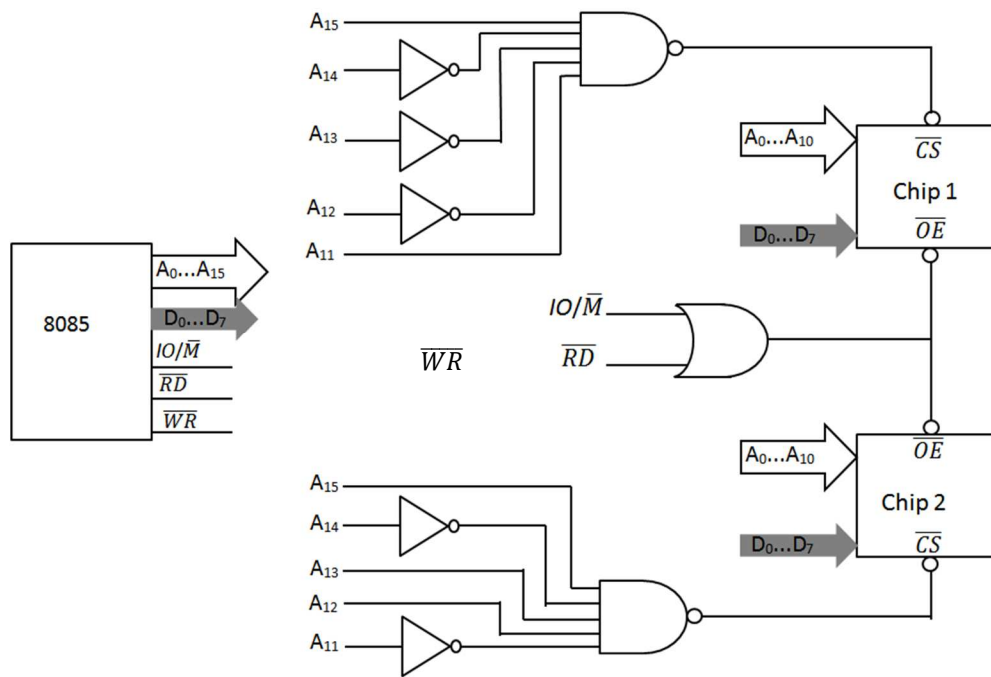


Figure 1

- c) Show how the two NAND gates in Figure 1 above can be replaced by a single 3-to-8 line decoder without changing the memory size or the memory address. Assume that the decoder has one active high enable E1 and one active low enable E2. (3 marks)
- d) State the type of memory in Chip 1 and Chip 2 in Figure 1. (1 mark)
- e) Describe the function of $IO/\overline{M}$ signal in the 8085. (3 marks)
- f) A certain microprocessor has a 16-bit address bus and an 8-bit data bus. Determine its maximum memory capacity in kilobytes (2 marks)

- g) Using timing diagrams explain the memory READ operation in 8085 microprocessor. (5 marks)
- h) Write an assembly language program based on 8085 microprocessor instruction set to search for the smallest number in a set of data. (4 marks)

SECTION B

QUESTION TWO (20 MARKS)

- a) Define and explain the following terms
- i. Addressing modes (2 marks)
 - ii. Programmers model (2 marks)
- b) Use a block diagram to show how several $4k \times 8$ bit RAM chips can be used to construct a $16k \times 8$ RAM interfaced to 8085 microprocessor. (4 marks)
- c) An 8085 microprocessor adds two numbers, 8BH and C9H; specify the contents of the accumulator and status of the flags. (4 marks)
- d) Distinguish between I/O mapped and memory mapped I/O with respect to microcomputer I/O's (4 marks)
- e) Design a memory circuit to interface two 4 k-byte RAM chips using logic gates to an 8085 microprocessor. Let the starting addresses be 7000H and A000H for chip 1 and chip 2, respectively. Assume the chips have two active low enables $\overline{OE}$ and $\overline{WE}$, and one active low chip select $\overline{CS}$. (4 marks)

QUESTION THREE (20 MARKS)

- a) State the main difference between the static RAM and dynamic RAM. (2 marks)
- b) Briefly discuss, giving examples, the following types of microprocessor addressing modes
- i. Direct addressing mode (3 marks)
 - ii. Register addressing mode (3 marks)
 - iii. Implicit addressing mode (3 marks)
- c) Explain with the aid of arithmetic/logic examples the functions of the following CPU flag registers
- i. Auxiliary carry (3 marks)
 - ii. Parity flag (3 marks)
- d) Draw a block diagram showing the signals in a typical $4k \times 8$ RAM integrated circuit (IC) (3 marks)

QUESTION FOUR (20 MARKS)

- a) List four features of 8085 microprocessor (4 marks)
- b) State the function of the following CPU registers
- i. Memory address (2 marks)
 - ii. General purpose (2 marks)
 - iii. Stack pointer (2 marks)
- c) Write a short assembly program using 8085 instruction set to perform the following instruction sequence. The program should be initialized at location 0B00H.
- i. Logically 'OR' two Hex numbers A2H and 18H
 - ii. Save the result in general purpose register
 - iii. Complement the saved result
 - iv. Store the result in location 3000H. (5 marks)
- d) State the content of memory location 3000H in (c) above after execution. (1 mark)
- e) Using a diagram, describe how the PUSH operation in the stack occurs. Assume the stack pointer is at location 31FFH. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Illustrate the meanings of the following assembly instructions of the 8085 microprocessor,
- i. LDA 1500H (2 marks)
 - ii. STA 1520H (2 marks)
- b) List and describe the four categories of 8085 instructions that are used to manipulate data. (8 marks)
- c) Draw and explain the timing diagram for a WRITE operation in 8085 microprocessor. (5 marks)
- d) The following assembly program is run on 8085 microprocessor:

Memory address in hex	Instruction
2000	LXI SP, 1000
2003	PUSH H
2004	PUSH D
2005	CALL 2050
2008	POP H
2009	HLT

State the contents of the stack pointer and program counter at the completion of execution of the program. Show working where necessary. (3 marks)