



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

TRADE DIPLOMA IN ELECTRICAL ENGINEERING

EEE555 – COMPUTER TECHNOLOGY

SUPPLEMENTARY EXAMINATION – SEMESTER 1, 2019

DAY/DATE: as per timetable. TIME: 3 HOURS 10 MINUTES

ROOM: as per timetable. MAXIMUM MARKS: 100

**INSTRUCTIONS TO STUDENTS**

1. *There are Two (2) sections (A - B). All sections are compulsory.*
2. *Write your answers legibly in the answer booklet provided.*
3. *A time of three (3) hours is allowed to complete this paper. Extra 10 minutes allowed to read the paper.*
4. *You may use blue or black ball pen to write your answers.*
5. *Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string provided.*
6. *Write your student identification number on each page used.*
7. *Begin each section on a fresh new page and use both sides of the sheets.*
8. *No GSM mobiles or smartphones allowed during the examination*
9. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

## SECTION A: MULTIPLE CHOICE

[20 MARKS]

1. What is the full form of ALU?
  - A. Arithmetic and Logical Unit
  - B. Arithmetics and Logic unit
  - C. Arithmetic and Logic Unit
  - D. Arithmetic and Logical Unit
  
2. A PC having clock rate of 2 and CPU clock cycle for a program is 4 then execution time of this computer for a program will be
  - A. 1
  - B. 1.5
  - C. 1.75
  - D. 2.
  
3. EDSAC stands for \_\_\_\_\_.
  - A. Electronic Delay Storage Automatic Calculator
  - B. Electronic Delay Storage Automatic Computer
  - C. Electronic Data Storage Automatic Calculator
  - D. Electronic Data Storage Automatic Computer
  
4. Which architecture is followed by general purpose microprocessors?
  - A. Harvard architecture
  - B. Von Neumann architecture
  - C. None of the mentioned
  - D. All of the mentioned
  
5. Which programming language consists of only binary instructions such as 0s and 1s?
  - A. Assembly language
  - B. Booleans
  - C. Mnemonics
  - D. Machine language

6. The decoded instruction is stored in \_\_\_\_\_.
- A. IR
  - B. PC
  - C. Registers
  - D. MDR
7. The instruction -> Add LOCA,R0 does,
- A. Adds the value of LOCA to R0 and stores in the temp register
  - B. Adds the value of R0 to the address of LOCA
  - C. Adds the values of both LOCA and R0 and stores it in R0
  - D. Adds the value of LOCA with a value in accumulator and stores it in R0
8. What is the decimal value of the hexadecimal number 777?
- A. 19
  - B. 1911
  - C. 191
  - D. 19111
9. Programs written in low-level language usually execute \_\_\_\_\_ than programs written in high-level language.
- A. more accurately
  - B. less accurately
  - C. faster
  - D. slower
10. Convert the binary number 1011010 to hexadecimal.
- A. 5A
  - B. 5C.
  - C. 5F
  - D.5B
11. Convert the decimal number 151.75 to binary
- A. 10000111.11
  - B. 11010011.01
  - C. 00111100.00
  - D. 10010111.11

12. Number system which contain 8 different symbols 0, 1, 2., 3, 4, 5, 6, and 7, is
- A. hexadecimal system
  - B. binary system
  - C. octal system
  - D. quinary system
13. Which architecture involves both the volatile and the non-volatile memory?
- A. Harvard architecture
  - B. Von Neumann architecture
  - C. None of the mentioned
  - D. All of the mentioned
14. Convert 35 from hexadecimal to decimal.
- A. 45
  - B. 53
  - C. 58
  - D. 59
15. Power of binary system for positional values is.
- A. 2
  - B. 10
  - C. 8
  - D. 16
16. Programs written in assembly language
- A. Are not portable
  - B. Make use of mnemonics
  - C. Run faster and require less storage space than those written in HLLs
  - D. All of the above.
17. Advantages of using Assembly Language rather than an HLL include
- A. Assembly programs are simpler to translate and occupy less storage space
  - B. Assembly are easier to code in.
  - C. Assembly language programs are portable.
  - D. Assembly is simpler to translate and easier to code in.

18. Which electronic components were used in first generation computers?
- A. Transistors
  - B. Integrated circuits
  - C. VLSI microprocessor
  - D. Vacuum Tubes
19. In 32-bit addressing mode, address field or
- A. 2 bytes
  - B. 3 bytes
  - C. 4 bytes
  - D. 5 bytes
20. \_\_\_\_\_ are used to overcome the difference in data transfer speeds of various devices.
- A. Speed enhancing circuitry
  - B. Bridge circuits
  - C. Multiple Buses
  - D. Buffer registers

**SECTION B:****SHORT ANSWERS****[80 MARKS]**

## QUESTION 1

## NUMBER SYSTEMS

[15 MARKS]

a) Using the radix conversion algorithm, convert the following decimal integers into their 4 digit hexadecimal equivalents in format 0xXXXX:

i. 3000 (2 marks)

ii. 62500 (2 marks)

b) Calculate the range of decimal values for 8-Bits two's complement binary values.

(1 mark)

c) Compute the decimal value of the binary number 1011 1101 0101 0110 if the given number represents:

i. Unsigned integer (2 marks)

ii. 2's complement integer (2 marks)

d) Represent the decimal value -123 as signed, 10-bit number using each of the following binary formats:

i. Sign-and-magnitude (2 marks)

ii. 2's complement (2 marks)

e) Consider the binary numbers in the following addition problem to be signed 6-bit values in the 2's complement representation. Perform the operation, specifying whether an overflow occurs.

i.  $010110 + 001001$  (2 marks)

## QUESTION 2

## PERFORMANCE MEASURE

[10 MARKS]

- a) The following measurement made on two different machines running a given set of benchmark programs. Assume that the clock rate of the CPU is 200MHz.

Instruction Category	No. of instructions (in millions)	No. of cycles per instructions
Machine(A)		
ALU	8	1
Load & store	4	3
Branch	2	4
Others	4	3
Machine(B)		
ALU	10	1
Load & store	8	2
Branch	2	4
Others	4	3

- i. Compute the overall CPI for both machines. (2 marks)
  - ii. Compute the MIPS for machine A and Machine B. (2 marks)
  - iii. Calculate CPU time for machine A and B. (2 marks)
  - iv. Compare and comment on MIPS and CPU of both machines. (2 marks)
- b) Calculate the number of bits needed to distinctly address 64K words of memory? (2 marks)

QUESTION 3

INSTRUCTION SET

[15 MARKS]

- a. What are the two groups of signals generated by a control unit inside a microprocessor? (1 mark)
  
- b. Write and illustrate the three basic steps needed in order for that CPU to perform a write operation into a specified memory location. (7 marks)
  
- c. Write and illustrate the three basic steps needed in order for that CPU to perform a read operation into a specified memory location. (7 marks)



QUESTION 4

CENTRAL PROCESSOR UNIT

[20 MARKS]

- a. Draw a clearly labelled generalized microprocessor block diagram showing all the components. (12 marks)
  
- b. With the aid of a diagram, outline the differences between Harvard architecture and Von-Neumann memory architecture? (4 marks)
  
- c. What are the functions of the following registers in any microprocessor?
  - i. Program Counter (2 marks)
  
  - ii. Buffer register (2 marks)

- a. The block diagram showing a simple machine (microprocessor) is given in figure 1. This machine is an accumulator-based processor, which has five 16-bit registers: program counter (PC), Instruction register (IR), Address Register (AR), Accumulator (AC), and Data Register (DR). The memory unit is made up of 4096 words of storage. The word size is 16 bits.

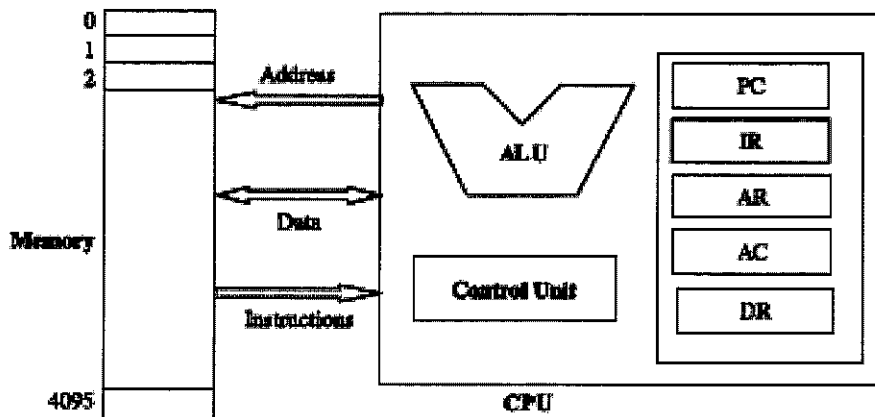


Figure 1: A simple machine

The instruction set of the simple machine is given in the following table.

TABLE 3.4 Assembly Language for the Simple Processor

Mnemonic	Operand	Meaning of instruction
STOP		Stop execution
LD	x	Load operand from memory (location x) into AC
ST	x	Store contents of AC in memory (location x)
MOVAC		Copy the contents AC to DR
MOV		Copy the contents of DR to AC
ADD		Add DR to AC
SUB		Subtract DR from AC
AND		And bitwise DR to AC
NOT		Complement contents of AC
BRA	adr	Jump to instruction with address adr
BZ	adr	Jump to instruction adr if AC $\neq$ 0

Figure 2: Instruction set for the simple machine

Operation code	Operand	Meaning of instruction
0000		Stop execution
0001	<i>adr</i>	Load operand from memory (location <i>adr</i> ) into AC
0010	<i>adr</i>	Store contents of AC in memory (location <i>adr</i> )
0011		Copy the contents AC to DR
0100		Copy the contents of DR to AC
0101		Add DR to AC
0110		Subtract DR from AC
0111		And bitwise DR to AC
1000		Complement contents of AC
1001	<i>adr</i>	Jump to instruction with address <i>adr</i>
1010	<i>adr</i>	Jump to instruction <i>adr</i> if AC = 0

Figure 3: Instruction set for the simple processor.

- i. Calculate the size of the address bus in bits of this simple machine. (2 marks)
- ii. Write a machine language program with descriptions that adds the contents of memory locations 12 (0x00C), initialized to 350 and memory location 14(0x00E), initialized to 96, store the result in location 16 (0x010), initialized to 0. (18 marks)

-----THE END-----

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