

**UG 1st Semester Examination-2024(Reg)**

IT

Paper — Core-I/Major-I-IT-II

*Full Marks : 100*

*Time : 3 hours*

**Answer all questions**

*The figures in the right-hand margin indicate marks*

**PART— I**

**1. Answer all. Write the correct answer from the given alternatives :** 1 × 10

(a) Which technique is used to simplify Boolean expressions visually ?

(i) Karnaugh Maps

(ii) De Morgan's Theorem

(iii) Quine-McCluskey

(iv) Both (i) and (ii)

( Turn Over )

(b) Which type of gate is known as "functionally complete", meaning it can be used to implement any Boolean function ?

- (i) AND
- (ii) NAND
- (iii) OR
- (iv) NOT

(c) What is the role of a compiler in programming ?

- (i) Converts high-level code into machine code
- (ii) Translates assembly language into machine code
- (iii) Debugs and optimizes code
- (iv) Executes machine-level instructions

(d) What is the function of a multiplexer (MUX) ?

- (i) It combines multiple outputs into a single input

- (ii) It selects one input from multiple inputs and forwards it to the output
  - (iii) It converts digital data into an analog signal
  - (iv) It stores data temporarily
- (e) Which addressing mode uses an index register to calculate the effective memory address ?
- (i) Immediate Addressing
  - (ii) Direct Addressing
  - (iii) Indirect Addressing
  - (iv) Indexed Addressing
- (f) Which of the following is the standard method used to represent signed numbers in a computer ?
- (i) One's complement
  - (ii) Two's complement
  - (iii) Excess notation
  - (iv) BCD (Binary Coded Decimal)

(g) Which of the following is an example of system software ?

- (i) Photoshop
- (ii) Windows operating system
- (iii) Google Chrome
- (iv) VLC Media Player

(h) Which logic gate outputs 1 only when both inputs are 1 ?

- (i) OR
- (ii) NOT
- (iii) AND
- (iv) XOR

(i) What is the main function of a T flip-flop ?

- (i) It stores data as a 1 or 0
- (ii) It changes its state with every clock pulse
- (iii) It holds the data in a gated manner
- (iv) It can only toggle between two states

(j) Which type of memory requires periodic refreshing to retain data ?

- (i) SRAM
- (ii) DRAM
- (iii) ROM
- (iv) EEPROM

PART – II

2. Answer *all* of the followings : 2 × 9

(a) How does a Graphical User Interface (GUI) differ from a Command-Line Interface (CLI) in terms of user interaction ?

(b) What is overflow in binary arithmetic and when does it occur ? Provide an example.

(c) Explain the function of an OR gate and give its truth table.

(d) What is the purpose of Bus Structures in a computer system ? Name the three types of buses typically found in a computer.

- (e) What is the main difference between EPROM and EEPROM ?
- (f) Explain the term Flash Memory and its common uses in modern electronic devices.
- (g) What is the primary difference between signed and unsigned numbers in binary representation ? How are signed numbers represented ?
- (h) Define Immediate Addressing. Give an example.
- (i) Explain relative addressing and give an example where it is commonly used in computer programs.

### PART – III

3. Answer any *eight* of the followings :  $5 \times 8$

- (a) Describe the process of performing binary addition and binary subtraction. Provide

examples of both operations and explain how the results are obtained. Additionally, discuss the occurrence of overflow in binary arithmetic.

- (b) Discuss the difference between fixed-point and floating-point number representations. Provide examples of situations where each representation would be preferable and explain why floating-point representation is used for scientific calculations.
- (c) Explain one's complement and two's complement systems of representing negative numbers in binary. Discuss how they work and highlight the advantages of using two's complement over one's complement for representing negative numbers.
- (d) Explain the working principle of a JK flip-flop. Provide the truth table for the JK flip-flop and explain how it behaves for

different input combinations. Discuss the applications of JK flip-flops in sequential circuits.

- (e) Explain the concept of Programmable Logic Devices (PLDs). Discuss the differences between PAL, CPLD and FPGA, providing examples of where each is typically used. Discuss the benefits of using programmable logic devices in digital circuit design.
- (f) Discuss the function of shift registers in digital circuits. Explain the difference between a serial-in serial-out shift register and a serial-in parallel-out shift register. Provide an example of an application where shift registers are used.
- (g) Discuss the key considerations when designing a memory system, such as

speed, size, cost and power consumption. How do these factors affect the choice of memory for different types of computers (e.g., embedded systems, desktops, supercomputers) ?

- (h) Describe the basic functional units of a computer system, including the Input Unit, Memory Unit, Arithmetic and Logic Unit (ALU), Control Unit and Output Unit. Explain the role of each unit in the overall operation of the computer.
- (i) Describe straight-line sequencing in instruction execution. How does the CPU fetch and execute instructions sequentially ?
- (j) What is indirection in computer programming ? How does the use of pointers facilitate indirection and what role does indexing play in accessing array elements ? Provide an example where indirection and pointers are used to access elements in an array.

PART— IV

4. Answer any *four* of the followings :  $8 \times 4$

(a) Discuss the different types of logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR). Explain their symbols, truth tables and the real-world applications where these gates are used in building digital circuits.

(b) What is the process of synthesizing logic functions from Boolean expressions ? Discuss how logic functions are simplified and implemented using basic gates and provide an example of how a Boolean function is converted into a logic circuit.

(c) Discuss the differences between machine language, assembly language and high-level languages. Explain the advantages and disadvantages of each and describe the process of converting high-level language code into machine code.

- (d) Discuss the characteristics of magnetic hard disks, optical disks and magnetic tape systems. Compare their speed, storage capacity and typical use cases and explain why magnetic hard disks are commonly used in modern computers.
- (e) Explain the different types of addressing modes used in computer architecture. Discuss the following modes in detail : Direct Addressing, Indirect Addressing and Indexed Addressing. Provide an example for each type to illustrate how they are used in real-world programming.