

Professional Course Examination, November/December 2019

(1st Semester)

BACHELOR OF COMPUTER APPLICATIONS

(Digital Computer Fundamentals)

(Revised)

Full Marks : 75

Time : 3 hours

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 15)

Tick (✓) the correct answer in the brackets provided :

1×10=10

1. The 1's complement of the binary number 1010101·010 is

- (a) 0101010·110 ()
- (b) 0101010·100 ()
- (c) 0101010·111 ()
- (d) 0101010·101 ()

2. Binary code for decimal digit requires

(a) 1 bit ()

(b) 2 bits ()

(c) 3 bits ()

(d) 4 bits ()

3. Which of the following states the associative law?

(a) $x + x = x$ ()

(b) $x + y = y + x$ ()

(c) $x + (y + z) = (x + y) + z$ ()

(d) $(xy)' = x' + y'$ ()

4. The operator precedence for evaluating Boolean expressions is

(a) OR, AND, parentheses, NOT ()

(b) AND, NOT, parentheses, OR ()

(c) NOT, parentheses, AND, OR ()

(d) parentheses, NOT, AND, OR ()

5. The algebraic expression for the exclusive-NOR operation is

(a) $F = xy' + x'y$ ()

(b) $F = xy + x'y'$ ()

(c) $F = (x + y)'$ ()

(d) $F = x + y$ ()

6. The output of OR gate is 1, if

- (a) all inputs are 1 ()
- (b) all inputs are 0 ()
- (c) at least one input is 1 ()
- (d) at least one input is 0 ()

7. A combinational circuit that selects binary information from one of many input lines and directs it to a single output line is

- (a) decoder ()
- (b) multiplexer ()
- (c) adder ()
- (d) subtractor ()

8. A combinational circuit that converts binary information from n input lines to a maximum of 2^n unique output lines is

- (a) decoder ()
- (b) multiplexer ()
- (c) adder ()
- (d) subtractor ()

9. A sequential circuit that goes through a prescribed sequence of states upon the application of input pulses is called

- (a) register ()
- (b) counter ()
- (c) flip-flop ()
- (d) multiplexer ()

10. The counters in which the clock pulses are applied to the CP inputs of all flip-flops are called

- (a) synchronous counters ()
- (b) all counters ()
- (c) asynchronous counters ()
- (d) syndicate counters ()

Indicate whether the following statements are *True (T)* or *False (F)* by putting a Tick (✓) mark in the brackets provided :

1×5=5

11. The BCD equivalent for 14 is 0001 0100.

(T / F)

12. A product of sums is a Boolean expression containing OR terms, called sum terms.

(T / F)

13. A buffer inverts the input.

(T / F)

14. A half-adder can add two bits.

(T / F)

15. In a synchronous binary counter, the flip-flop in the lowest-order position is complemented with every pulse.

(T / F)

SECTION—B

(Marks : 10)

Answer the following questions :

2×5=10

16. What are alphanumeric codes?

17. Write the truth table of the function :

$$F = xy + xy' + y'z$$

18. Evaluate $(753)_{10} - (864)_{10}$ using 10's and 9's complement subtraction.

19. Distinguish between sequential and combinational circuits.

20. What is a register?

(PART : B—DESCRIPTIVE)

(Marks : 50)

The figures in the margin indicate full marks for the questions

1. (a) Draw the block diagram of a digital computer and explain its units. 6

(b) Obtain the r 's and $(r - 1)$'s complement of the following numbers : 4

(i) $(0000001)_2$

(ii) $(90090)_{10}$

OR

(c) Convert the following numbers from the given base to the bases indicated : 5+5=10

(i) Decimal 225·225 to binary, octal and hexadecimal

(ii) Binary 11010111·110 to decimal, octal and hexadecimal

2. (a) Define Boolean algebra by giving the six Huntington postulates. 6

(b) Express the following function in a sum of minterms : 4

$$F(w, x, y, z) = y'z + wxy' + wxz' + w'x'z$$

OR

(c) Define two-valued Boolean algebra. Show that the Huntington postulates are valid for the two-valued Boolean algebra. 5

(d) Using Karnaugh mapping, obtain the simplified expression in sum of products for the following Boolean function : 5

$$F = x'z' + y'z' + yz' + xyz$$

3. (a) Write the steps for subtraction with r 's complement method. Give example. 4

(b) Evaluate the following binary numbers : $2 \times 3 = 6$

(i) $1111 \div 0011$

(ii) 1011×0101

(iii) $11010 - 10000$

OR

(c) Write the graphic symbol and truth table for the following : 6

(i) OR

(ii) NAND

(iii) XOR

(d) Implement the Boolean function $F = xy + x'y' + y'z$ using AND, OR and NOT gates. 4

4. (a) Write the steps for designing a combinational circuit. 4

(b) What is a full-adder? Write the Boolean expression, truth table and logic diagram implementation for a full-adder. 6

OR

- (c) Write and explain the circuit diagram and truth table of a 3-to-8 line decoder. 5
- (d) Write and explain the block diagram, logic diagram and function table of a 4-to-1 line multiplexer. 5
5. (a) What is *R-S* flip-flop? Write the logic diagram, characteristic table and graphic symbol of a clocked *R-S* flip-flop. 5
- (b) What is a shift register? Write and explain the working of a 4-bit ripple counter. 5

OR

- (c) What is *D* flip-flop? Write the logic diagram, characteristic table and graphic symbol of a clocked *D* flip-flop. 6
- (d) What is a BCD counter? Write and explain the working of a shift register constructed using *D* flip-flop. 4
