KATHMANDU UNIVERSITY
End Semester Examination
September 2024

Marks Scored:

Level : BIT
Year : I

Course : COMP 105
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 22 SEP 2024

SECTION "A"
[20Q. × 0.5 = 10 marks]

***Choose and encircle the most appropriate answer. Symbols have their usual meanings.***

1. In analog-to-digital conversion the sequence of operations is
   a. Sampling, coding, Quantization
   b. Coding, Quantization, Sampling
   c. Sampling, Coding, Quantization
   d. Quantization, Sampling, Coding

2. The binary equivalent of octal number 705 is:
   a. 1110101 b. 1010111 c. 111000101 d. 11100101

3. If A and B are inputs to the two input X-OR gates, which of the following expressions for output is correct?
   a. $\bar{A}B + A\bar{B}$ b. $\bar{A}\bar{B} + A\bar{B}$ c. $\bar{A}B - A\bar{B}$ d. $\bar{A}\bar{B} + AB$

4. The NAND gate output will be low if the two inputs are
   a. 0 0 b. 0 1 c. 1 0 d. 1 1

5. The Boolean expression $\bar{A}B + A\bar{B} + AB$ is equivalent to
   a. $A + B$ b. $\bar{A} + B$ c. $\bar{B} + A$ d. $A . B$

6. Which theorem states the following statements?
   $A + B = B + A$
   $A. B = B. A$
   a. Distributive law
   b. Associative law
   c. Commutative law
   d. De-Morgan's Theorems

7. Which of the following expressions represents the Boolean function $F = A + B'C$ in the sum of minterms
   a. $F(A, B, C) = \Sigma(0, 2, 3, 4, 5)$ b. $F(A,B,C) = \Sigma(1,4,5,6,7)$
   c. $F(A,B,C) = \Sigma(1, 3, 5, 6, 7)$ d. $F(A,B,C) = \Sigma(2,4,5,6,7)$

8. The number of control lines for an 8–to–1 multiplexer is
   a. 2 b. 3 c. 4 d. 5

9. A mod-N counter counts up to
   a. N b. 2 N c. N-1 d. N+1

10. Which of the following expressions is correct for the given K-Map?

| AB\CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 1 | 0 | 0 |
| 01 | 1 | 1 | 0 | 0 |
| 11 | 1 | 0 | 0 | 0 |
| 10 | 1 | 0 | 0 | 0 |

a. $F = \bar{C}\,\bar{D} + \bar{A}\,C$
b. $F = \bar{C}\,\bar{D} + \bar{A}\,\bar{C}$
c. $F = \bar{C}\,\bar{D} + AC$
d. $F = C\,D + \bar{A}\,\bar{C}$

11. For JK flip flop with J=1, K=0, the output after the clock pulse will be
a. Low b. High c. No change d. Invalid

12. A 4-bit serial input serial output shift register requires ________ .
a. 4 SR flip–flops b. 4 JK flip-flops c. 4 D flip-flops d. 4 T flip-flops

13. A half-adder circuit does not have a
a. Carry in b. carry out c. two inputs d. two outputs

14. The binary value $(1010)_2$ has a ____________________ gray code.
a. 1111 b. 1001 c. 1011 d. 1110

15. A ring counter uses ____________ .
a. D-flip flop b. T-flip flop c. SR flip-flop d. JK flip flop

16. The characteristic equation for the T flip-flop is given by
a. $Q\,(t+1) = T\bar{Q} + \bar{T}\,Q$
b. $Q\,(t+1) = T\bar{Q} + TQ$
c. $Q\,(t+1) = Q\bar{T} + \bar{T}\,Q$
d. $Q\,(t+1) = \bar{T}\,\bar{Q} + TQ$

17. The 2's complement of the number 1101101 is ______________________ .
a. 0110010 b. 0010011 c. 110011 d. 100110

18. Which one of the following is the fastest memory?
a. Hard Disk b. Cache c. RAM d. Pen Drive

19. A 6-bit up-counter counts up to ____________________ .
a. 16 b. 15 c. 32 d. 63

20. The simplified expression for the carry value of the full adder having inputs A, B, and C respectively, is _________________ .
a. A + B + C b. XY + XZ + YZ c. X Z + Y Z d. XY + XZ

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SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Briefly discuss the process of analog-to-digital conversion. [4]

2. What do you mean by universal gates? How does a NOR gate act as a universal gate? Discuss the De- Morgan's theorem. [1+2+1]

3. With the function table find the expression for a priority encoder and draw the internal diagram. [4]

4. Draw the block diagram of the four-bit Johnson's counter and discuss its working principle.

5. Design a logic circuit for mod-6 synchronous up-counter and explain the operation using a timing diagram.

6. Draw the internal diagram of the JK flip-flop, and find its truth table and Boolean expression.

7. Find the Boolean expressions for sum, and carry, and construct a logic circuit for a full adder.

SECTION "C"
[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8.
   a. Draw the block diagram of a 3-bit SISO (Serial-In, Serial-Out) shift register and verify its operation for the data "110" with the timing diagram. [2+2]
   b. Draw the state diagram for the 3-bit UP counter and represent it using a state transition diagram. Assume JK flip-flops have been used. [1+3]

9.
   a. Design a logic circuit for a 3-bit binary to gray-code converter. Show the truth table and solve using a K-map. [5]
   b. Simplify the following Boolean function using K-map. [3]
      $F(w, x, y, z) = \Sigma(1, 3, 7, 11, 15)$
      Which has the don't care conditions $D(w, x, y, z) = \Sigma(0, 2, 5)$

10.
   a. Express the Boolean function $F = A + \bar{B}C$ in a sum of min-terms. [3]
   b. Convert $(10AF)_{16}$ into binary and find the octal equivalent of the resulting binary number. [1+2]
   c. Briefly discuss the categories RAM. [2]