UNIVERSITY OF THE PUNJAB

B.S. in Computer Science First Year : Annual–2022

Subject: Digital Logic Design Paper: 4-N Time: 30 Min. Marks: 15

Roll No. in Fig. .....

Roll No. in Words. .....

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Signature of Supdt.:

This Paper will be collected back after expiry of time limit mentioned above, then Subjective paper shall be attempted.

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

Q.1. Encircle the right answer cutting and overwriting is not allowed. (15x1=15)

1. The code where all successive numbers differ from their preceding number by single bit is

   A) Binary code B) Gray C) Excess – 3 D) BCD

2. The binary code for 59 using 84-2-1 code is:

   A) 010100011 B) 01101111 C) 10111111 D) 10110011

3. Which of the following is a universal logic gate?

   A) OR B) AND C) XOR D) NAND

4. The smallest 4-bit number written in signed 1's complement notation is:

   A) -15 B) -16 C) -7 D) -8

5. Which of the following codes is not a self-complementing code?

   A) Excess-3 Code B) 84-2-1 C) 2421 D) BCD

6. The Boolean expression A'B + AB'+ AB is equivalent to

   A) A'+B B) A+B' C) A+B D) A'+B'

7. The Boolean expression XY + X'Y + Y'Z is independent of the variable:

   A) X B) Y C) Z D. None of the given

8. The consensus term for an expression X'Y + XZ' is:

   A) X'Y B) XZ' C) YZ' D) X'YZ'

9. Sum of all minterms for a function F(A,B,C) evaluates to _____.

   A) 0 B) 1 C) A+B+C D) ABC

10. NAND gate output will be 0, if two inputs are

    A) 00 B) 01 C) 10 D) 11

11. A 32x1 multiplexer has _____ selection lines.

    A) 3 B) 5 C) 8 D) 32

12. A Boolean function F (A,B) = A'B + AB' can be written as:

    A) $\sum(1,2)$ B) $A \oplus B$ C) $\prod(0,2)$ D) All of the given

13. Demultiplexer is also called

    A) Data selector B) Data shuffler C) Data distributor D) Data encoder

14. A full adder logic circuit has:

    A) Two inputs and one output
    B) Two inputs and two outputs
    C) Three inputs and three outputs
    D) Three inputs and two outputs

15. The inputs J = 1, K=0 for JK-flip flop will result in the following output after a clock pulse:

    A) 0 B) 1 C) No change D) Unpredictable

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B.S. in Computer Science First Year : Annual–2022

Roll No. .....

Subject: Digital Logic Design Paper: 4-N Time: 2 Hrs. 30 Min. Marks: 60

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

NOTE: Attempt any FOUR questions. All questions carry equal marks.

Question # 2 **(3 each)**

a) If $(135)_x / (17)_8 = (101)_2$, then find x.
b) Let A = 110101 and B = 111010, perform A-B using 2's complement.
c) Simplify the expression **A'B'C + (AB)' + BC'** using identities and theorems of Boolean algebra.
d) Write the equation for **A<B** to compare two 3-bit numbers $A_2A_1A_0$ **and** $B_2B_1B_0$
e) Draw the logic circuit diagram of half adder.

Question # 3

a) Show the construction of a combinational circuit that increments a 4-bit number using four half adders. (5)
b) Design a digital circuit that accepts 3-bit number (A, B, C) at its input and produces the output M, such that M=1, iff majority of the inputs are 1. (10)

Question # 4

a) Obtain the simplified expression in SOP form for the following function using K-Map (7)
F (A,B,C,D) = (A + B + D').(A' + C + D).(A' + B + C).(C'+ D')
d (A,B,C,D) = ∏ (2, 5, 14)
b) Specify the truth table, output functions (in simplified form) and draw the logic circuit diagram of a 3 x 2 priority encoder. The inputs of the encoder are $D_2D_1D_0$ and the input with the lowest subscript is given the highest priority. The output will be 11 if all the inputs are 0. (8)

Question # 5

a) An 8 x 1 MUX has inputs A, B, C connected to selection inputs S_2, S_1, S_0 respectively. The data input I_0 through I_7 are: $I_0 = I_4 = 0$. $I_5 = I_6 = I_7 = 1$. $I_1 = I_2 = D$. $I_3 = D'$. Determine which Boolean function the given MUX implements. (7)
b) Draw the logic circuit diagram of JK flip flop. Also draw characteristic table, excitation table and derive characteristic equation for JK flip flop. (8)

Question # 6 (15)

Design a 3-bit **synchronous counter** using T flip flops, whose counting sequence is controlled by a control input **x**, such that:

if x = 0: 0 -> 1 -> 2 -> 3 -> 4 -> 5 -> 6 -> 7 -> Repeat (Up Counter)
if x = 1: 0-> 3 -> 5 -> 2 -> 7 -> 1 -> Repeat