

Digital Electronics Practice Paper - I
[On Basics, Number systems, Boolean Algebra].

① Prove the following Using DeMorgan's Theorems

(a) $AB + CD = \overline{\overline{AB} \cdot \overline{CD}}$

(b) $(A+B) \cdot (C+D) = \overline{\overline{(A+B)} + \overline{(C+D)}}$

② Verify that the following operations are commutative and associative

(a) AND (b) OR (c) EX-OR

③ Consider the expression:

$Z = A \oplus B \oplus C \oplus D \oplus \dots$. Show that $Z = 1$ if an odd number of variables are 1 and that $Z = 0$ if an even number of variables are 1.

④ Realize $Y = \overline{A+B+C+D}$ using 2-input NOR gates only

⑤ Determine the decimal numbers represented by the following binary numbers:

(a) 110101 (b) 101101 (c) 11111111 (d) 00000000

Ans: (a) $(53)_{10}$ (b) $(45)_{10}$ (c) $(255)_{10}$ (d) $(0)_{10}$

⑥ Determine the binary numbers represented by the following decimal numbers:

(a) 25.5 (b) 10.625 (c) 0.6875

Ans: (a) $(25.5)_{10} = (11001.1)_{2}$

(b) $(10.625)_{10} = 1010.101$ (c) $(0.6875)_{10} = (0.1011)_{2}$

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⑦ Find two's complement of the following numbers:

(a) 01100100 (b) 10010010 (c) 11011000 (d) 01100111

Ans: (a) 10011100 (b) 01101110 (c) 00101000 (d) 10011001

⑧ Represent the following decimal numbers in two's complement format.

(a) +3 (b) +25 (c) -5 (d) -11 (e) -9

Ans: (a) 011 (b) 011001 (c) 1011 (d) 10101 (e) 1011

⑨ perform the following subtractions using 2's complement method

(a) 01000 - 01001 (b) 01100 - 00011 (c) 0011.1001 - 0001.1110

Ans: (a) -1 (b) +9 (c) +1.6875

⑩ Represent the following decimal numbers in sign-magnitude format.

(a) -7 (b) -11 (c) +12 (d) +25

Ans: (a) 1111 (b) 11011 (c) 01100 (d) 011001

⑪ Encode the following decimal numbers in BCD code:

(a) 46 (b) 327.89 (c) 20.305

Ans: (a) 0100 0110 (b) 0011 0010 0111.1000 1001

(c) 00100000.0011 0000 0101

⑫ Encode the following decimal numbers in Excess-3 code

(a) 46 (b) 327.89 (c) 20.305

Ans: (a) 0111 1001 (b) 0110 0101 1010.1011 1100

(c) 0101 0011.0110 0011 1000

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(13) Find the number of bits required to encode:

(a) 56 elements of information (b) 130 elements of information

Ans: (a) 6 (b) 8

(14) Represent the following decimal numbers in ones complement format:

(a) +3 (b) +25 (c) -5 (d) -11 (e) -9

Ans: (a) 011 (b) 011001 (c) 1010 (d) 10100 (e) 10110

(15) perform the following subtractions using 1's complement method

(a) 01000 - 01001 (b) 01100 - 00011

(c) 0011.1001 - 0001.1110

Ans: (a) -1 (b) +9 (c) +1.68625

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