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Digital Fundamental (3130704)

Question Bank

1. Explain why the binary number system is used for most digital systems.
2. Convert the following decimal numbers to binary, octal and hexadecimal:
   a. 584
   b. 119.84
   c. 33.45
3. Convert the following numbers from the given base to the other three bases indicated.
   a. $(11101.1101)_2 = (\_\_?\_\_)_{10} = (\_\_?\_\_)_8 = (\_\_?\_\_)_{16}$
   b. $(10001.0001)_2 = (\_\_?\_\_)_{10} = (\_\_?\_\_)_8 = (\_\_?\_\_)_{16}$
   c. $(623.77)_8 = (\_\_?\_\_)_{10} = (\_\_?\_\_)_2 = (\_\_?\_\_)_{16}$
   d. $(367.52)_8 = (\_\_?\_\_)_{10} = (\_\_?\_\_)_2 = (\_\_?\_\_)_{16}$
   e. $(8E47.AB)_{16} = (\_\_?\_\_)_{10} = (\_\_?\_\_)_2 = (\_\_?\_\_)_8$
   f. $(2AC5.D)_{16} = (\_\_?\_\_)_{10} = (\_\_?\_\_)_2 = (\_\_?\_\_)_8$
4. Convert 128.286 to binary, octal and hexadecimal with an accuracy of 0.001_{10}.
5. Determine the value of base x if $(211)_x = (152)_8$.
6. Find the 9’s and 10’s complement of the following decimal numbers: 123900, 00980100, 100000, 00000000.
7. Find the 1’s and 2’s complement of the following binary numbers: 10101110, 0111000, 10000000, 00000000.
8. Convert the following decimal numbers to BCD, Binary-coded octal and binary-coded hex.
   a. 748
   b. 29.8125
9. Differentiate between positive and negative logic system.
10. What is Boolean algebra?
11. State and prove De-Morgan’s theorem.
12. Define the following:
    a) Minterm b) Maxterm
13. Differentiate between Canonical form and Standard form. Which form is preferable when implementing a Boolean function with gate? Why?
14. Reduce the expression to simplest terms:
    a) F=A’+AB’+BC
    b) F=(A+B’+C’) .(A’+B+C).BC
    c) F=((AB’+ABC)’+A(B+AB’))’
15. Prove the following.
    a) AB+ABC+AB’=A

b) $BCD+AC'D'+ABD=BCD+AC'D'+ABC'$
c) $AB+BC+A'C+A'B'C=ABC'+AB+A'C$
d) $AB+A'C+BC=AB+A'C$
e) $A+B[AC+(B+C')D]=A+BD$
f) $AB+CD+A'C'=A'+B+C'+D$

16. If $AB'+A'B = C$ then show that $AC'+A'C = B$
17. Write the expression for F if F is equal to 1 when any of the minterm m_0, m_3, m_4 or m_6 is present. Assume A is the MSB.
18. Explain the boolean function in SOP & POS form.
    a) $F = A+B'C$
    b) $Y = AB+ACD$
    c) $F= (A'+B).(B'+C)$
    d) $F= (XY+Z).(Y+XZ)$
19. Plot the K-map for following function:
    a) $F = (A'+B').(C'+D').(B'+D)$
    b) $F = (AB+CD').(AC'+BD)$
    c) $F = A'B'C'D+A'BC'D+A'B'CD+ABCD'+ABC'D$
20. Build a minimal hardware system to realize a function F that equals 1 when a 4- bit input code equals 1, 2, 5, 6, 8, 11, 12 and 14. F should be 0 for input 4, 7, 9, and 10. Remaining will never occur.
21. Realize using only NAND Gate only:
    a) $F = AB+CD+E$
    b) $F =BD+BCD+AB'C'D'+A'B'CD'$
    c) $F= (AB+A'B')(CD'+C'D)$
22. Realize using only NOR Gate only:
    a) $F = (A+B).(C+D).E$
    b) $F = X'Y+XY'+Z$
    c) $F = AB'CD'+A'BCD'+AB'C'D+A'BC'D$
23. What is a digital computer and explain its block diagram with figure.
24. Convert Decimal Number 250.5 to base 3, base 4, base 7, base 16 and base 8
25. Convert Decimal Number 255.225 to binary, octal and hexadecimal
26. Convert the following Number as directed
    a) 52 base 10 = (________) base 2
    b) 101001011 base 2 = (________) base 10
    c) 11101110 base 2 = (__________) base 8
    d) 68 base 10 = (________) base 16
27. Convert following hexadecimal number to decimal : B28, FFF, F28
28. Convert following octal to hexadecimal and binary : 414, 574,725.25
29. Convert the following number to decimal
    a) 10001.101
    b) 101011.11101

c) (0.365)8

d) A3E5

e) CDA4

f) 11101.001

g) B2D4

30. Write first 10 decimal numbers in base 11, base 7 and base 12 number system.
31. Perform subtraction with following binary number using 1's complement and 2's complement
    a) 11010-1101
    b) 10010-10011
    c) 100-110000
    d) 11010-10000
32. Explain comparison between 1's and 2's complements with appropriate example
33. Explain different types of binary codes in detail.
34. Simplify the following Boolean function to a minimum no of literal.
    (a) ABC+A'BC+A'B'C+ABC'+A'B'C' (to five literals)
    (b) xy'+y'z'+x'z'
    (c) (A'+C)(A'+C')(A+B+C'D)
    (d) (x'y'+z)'+z+xy+wz
    (e) (A+C+D)(A+C+D')(A+C'+D)(A+B') (to four literals)
    (f) A'B(D'+C'D)+B(A+A'CD)
    (g) BC+AC'+AB+BCD (to four literals)
    (h) [(CD)'+A]'+A+CD+AB (to three literals)
35. Implement the Boolean functions.(a) xyz+x'y+xyz' (b) (A+B)'(A'+B')' and F= xy+xy'+y'z with logic gates.
36. Obtain the simplified expression in sum of product for the following Boolean functions.

    (a) F= Σ(0,1,4,5,10,11,12,14) and(b) F=Σ(11,12,13,14,15).
37. Implement the functions F=Σ(1,3,7,11,15) with don't care conditions d=Σ(0,2,5) Discuss the effect of don't care conditions
38. Find the complement of the following Boolean function and reduce to a minimum number of literals.

    B'D + A'BC' + ACD + A'BC
39. Obtain the simplified expressions in sum of products using K-map:

    x'z + w'xy' + w(x'y + xy')
40. Given Boolean function

    F= x y + x' y' + y' z

    1. Implement it with only OR & NOT gates
    2. Implement it with only AND & NOT gates
41. Simplify the following Boolean function using K-Map.

    F=A'B'C'+B'CD'+A'BCD'+AB'C'

42. Simplify the following Boolean function by using K-Map.

$F = \Sigma (0,1,2,8,10,11,14,15)$

43. Simplify Boolean function $F (w,x,y,z) = \Sigma (0,1,2,4,5,6,8,9,12,13,14)$ using K-map and Implement it using (i) NAND gates only (ii) NOR gates only.
44. Simplify the following Boolean function using K-Map and draw logic diagram using NOR gates only.

$F(w,x,y,z) = \Sigma(0 ,1 , 2 , 8 ,10 ,11,14,15)$

45. Simplify the Boolean function:

(1)$F(w,x,y,z) = \Sigma (0,1,2,4,5,6,8,9,12,13,14)$

(2)$F(w,x,y) = \Sigma (0,1,3,4,5,7)$

46. Explain with figures how NAND gate and NOR gate can be used as Universal gate.
47. Simplify the Boolean function:

(1) $F = A'B'C'+B'CD'+A'BCD'+AB'C'$

(2) $F =A'B'D'+A'CD+A'BC$

$d=A'BC'D+ACD+AB'D'$ Where “d” indicates Don’t care conditions.

48. Obtain the simplified expressions in sum of products for the following Boolean functions:

$F(A,B,C,D,E) =\Sigma(0,1,4,5,16,17,21,25,29)$

49. Simplify the Boolean functions using K- map

$F(A,B,C,D,E,F) = \sum(6,9,13,18,19,25,27,29,41,45,57,61)$.

$F(A,B,C,D,E,F,G)= \sum(20,28,52,60)$

50. Implement the following Boolean functions using don’t care conditions.

$F(A,B,C,D) = \sum(0,1,2,9,11)$ $d(A,B,C,D) =\sum(8,10,14,15)$

$F= B'D + B'C +ABCD$ $d= A'BD+ AB'C'D'$

51. Compare: Combinational Circuit – Sequential Circuit
52. What’s half Adder? What’s disadvantage of it over full adder?
53. With necessary sketch explain full adder in detail. Also Explain a full adder can be designed using two half adders and a OR gate
54. Design Half Subtractor using NAND gate only.
55. Design a circuit of 4-bit input binary which indicates if the four bit input is BCD or not. If it’s BCD, then output must be high.
56. Design a combinational circuit that generates the 9’s complement of a BCD digit
57. Design a combinational circuit whose input is four bit binary number and output is the 2’s complement of the input binary number.
58. Design a combinational circuit that accepts a three bit binary number and generates an output binary number equal to the square of the input number
59. Construct a logic circuit that gives output four times of two bit binary variable input.
60. Design a Logic Circuit which has 4 bit binary input and it provides output logic 1 when input logic 1 is in odd number.
61. Two sensors are set up to measure traffic intensity on road. One sensor (A) is for measuring traffic intensity of higher level, where other sensor (B) is for measuring traffic intensity of lower level. If traffic is below the mark, Green LED glows. If traffic is above the mark, Red LED

glows and if traffic is between them, Yellow LED glows. For any fault measurement, a buzzer is connected. Design Logic circuit for the system considering sensors as input.

62. Design a 4 bit binary to BCD code converter
63. Design logic circuit for BCD to Gray code conversion for four bits input
64. Design the Combinational Circuits for Binary to Gray Code Conversion for four bits input
65. Design BCD to Excess-3 code converter using minimum number of NAND gates
66. Design a four bit binary to 5421 code converter logic circuit.
67. Design a three bit ex-3 to binary code converter circuit using NOR gates only.
68. Design a logic circuit for four bit inputs which provides output high if input is greater than 3.
69. Design a combinational circuit that generated the 9's complement of a BCD digit.
70. Design a BCD-to-decimal decoder using the unused combinations of the BCD code as don't-care conditions.
71. A combinational circuit is defined by the following three Boolean functions. Design the circuit with a decoder and external gates.

$$F_1 = x'y'z' + xz$$

$$F_2 = xy'z' + x'y$$

$$F_3 = x'y'z + xy$$

72. Draw the logic diagram of a 2-to-4-line decoder with only NOR gates. Include an enable input.
73. Construct a 5*32 decoder with four 3*8 decoders with enable and one 2*4 decoder.
74. Construct a 16*1 multiplexer with two 8*1 and one 2*1 multiplexers.
75. Implement the following Boolean functions with 8*1 multiplexers.

$$F(A, B, C, D) = \Sigma(0, 3, 5, 6, 8, 9, 14, 15)$$

76. Implement a full-adder with two 4*1 multiplexers.
77. Implement the following Boolean functions with 8*1 multiplexers.

$$F(A, B, C) = \Sigma(0, 2, 6, 7)$$

78. Discuss D-type edge- triggered flip-flop in detail.
79. Design a counter with the following binary sequence:0,4,2,1,6 and repeat (Use JK flip-flop)
80. Design a counter with the following binary sequence:0,1,3,7,6,4, and repeat.(Use T flip-flop)
81. With neat sketch explain the operation of RS latch.
82. Show the logic diagram of clocked D.
83. With logic diagram and truth table explain the working JK Flip flop. Also obtain its Characteristic equation. How JK flip-flop is the refinement of RS flip-flop?
84. Explain the working of the Master Slave J K flip-flop.
85. Write short notes on
    1. Clocked R-S flip flop
    2. JK Flip flop
    3. D Flip Flop
    4. T Flip Flop