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COMPUTER SCIENCE & IT

Objective Practice Sets

Digital Logic

1 CHAPTER

Basics of Digital Logic

Multiple Choice Questions & NAT Questions

Q.1 $(10110011100011110000)_2$ in base 32 is
(a) 2214716 (b) 1192331
(c) 11976 (d) 11142316

Q.2 The hexadecimal representation of $(657)_8$ is
(a) $(1AF)_H$ (b) $(D78)_H$
(c) $(D71)_H$ (d) $(32F)_H$

Q.3 The binary equivalent of the decimal number 0.4375 is
(a) 0.0111 (b) 0.1011
(c) 0.1100 (d) 0.1010

Q.4 Zero has two representations in
(a) Sign magnitude (b) 1's complement
(c) 2's complement (d) Both (a) and (b)

Q.5 Which of the following code is a weighted code?
(a) Gray (b) Excess-3
(c) Shift counter (d) 5111

Q.6 In signal magnitude representation, the binary equivalent of 22.5625 is (the bit before comma represents the sign).
(a) 0, 10110.1011 (b) 0, 10110.1001
(c) 1, 10101.1001 (d) 1,10110.1001

Q.7 A variable takes thirteen possible values. It can be communicated using
(a) Thirteen bits (b) Three bits
(c) $\log_2^{13}$ bits (d) Four bits

Q.8 Convert $(-54)_{10}$ to hexadecimal.
(a) $(34)_{16}$ (b) $(CA)_{16}$
(c) $(54)_{16}$ (d) $(DA)_{16}$

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(a) ABE (b) DBC
(c) DE5 (d) 21B

Q.10 What is 2's complement of $(101)_3$?
(a) $(010)_3$ (b) $(011)_3$
(c) $(121)_3$ (d) $(121)_2$

Q.11 Which of the following decimal numbers can be exactly represented in binary notation with a finite number of bits?
(a) 0.1 (b) 0.2
(c) 0.4 (d) 0.5

Q.12 A particular number system has 18 symbols from 0 to 9, A, B, C, E, S, G, T. If two numbers GATE and CSE are given to an adder, then output of adder is
(a) TC7A (b) T5EA
(c) G5SA (d) T5SA

Q.13 The square of octal number 23 is
(a) 529 (b) 539
(c) 551 (d) 650

Q.14 If $(123)_5 = (X3)_Y$, then the number of possible values of x is
(a) 4 (b) 3
(c) 2 (d) 1

Q.15 If $(2.3)_{\text{base 4}} + (1.2)_{\text{base 4}} = (y)_{\text{base 4}}$, what is the value of y?
(a) 10.1 (b) 10.01
(c) 10.2 (d) 1.02

Q.16 F's complement of $(2BFD)_{16}$ is
(a) E304 (b) D403
(c) D402 (d) C403

Q.17 Which of the following weighted code will give 9's complement by complementing each individual bit?
(a) Excess-3 (b) 5421
(c) 2421 (d) Both (a) and (c)

Q.18 Consider a system which has two eight bit inputs D_1 = 01010101, D_2 = 00000000, the system produces eight bit output that is bitwise XOR of the inputs. The eight bit output of system is input to the Gray Code Converter. The decimal equivalent of the output from Gray Code converter is _____.

Q.19 Which of the following statement is Incorrect for the range of n bit binary numbers?
(a) Range of unsigned numbers is 0 to $2^n - 1$.
(b) Range of signed number is $-2^{n-1} + 1$ to $2^{n-1} - 1$.
(c) Range of signed 1's complement numbers is $-2^{n-1} + 1$ to 2^{n-1}.
(d) Range of signed 2's complement numbers is -2^{n-1} to $2^{n-1} - 1$.

Q.20 The greatest negative number which can be stored in computer that has 8-bit word length and uses 2's complement arithmetic is
(a) –256 (b) –255
(c) –128 (d) –127

Q.21 Correct $(1101)_2$ is corresponding excess-3.
(a) 00010000 (b) 01000110
(c) 00100110 (d) 00010110

Q.22 Find the value of x in the given equation
$$(2)_3 + (3)_4 = (x)_5$$

Q.23 What are the value of R_1 and R_2 respectively in the expression $(235)_{R1} = (565)_{10} = (1065)_{R2}$
(a) 8, 16 (b) 16, 8
(c) 6, 16 (d) 12, 8

Q.24 Convert $(3121.121)_4$ to base 3?
(a) 10022.100 (b) 22001.100
(c) 22001.101 (d) 10022.110

Q.25 The number of 1's in the binary representation of $(3 * 4096 + 15 * 256 + 5 * 16 + 3)$ are
(a) 8 (b) 9
(c) 10 (d) 12

Q.26 Two numbers –48 and –23 are added using 2's complement. The 2's complement of the result using 8 bit representation is _____.
(a) 10111001 (b) 01000111
(c) 01101010 (d) 11100111

Q.27 A number in 4-bit two's complement representation is $X_3\ X_2\ X_1\ X_0$. This number when stored using 8 bits will be
(a) $0\ 0\ 0\ 0\ X_3\ X_2\ X_1\ X_0$
(b) $1\ 1\ 1\ 1\ X_3\ X_2\ X_1\ X_0$
(c) $X_3\ X_3\ X_3\ X_3\ X_3\ X_2\ X_1\ X_0$
(d) $\bar{X}_3\bar{X}_3\bar{X}_3\bar{X}_3\bar{X}_3X_2X_1X_0$

Q.28 Result of the subtraction with the following unsigned decimal numbers by taking the 10's complement of the subtrahend. 1753 – 8640
(a) 3113 (b) 10393
(c) –6887 (d) –3113

Q.29 Given that $(EOB)_H - (ABF)_H = Y$. The radix 8's complement of Y is
(a) 844 (b) 1514
(c) 6264 (d) 3251

Q.30 Let A = 1111 1010 and B = 0000 1010 be two 8 bit 2's complement numbers. Their product in 2's complement is
(a) 1100 0100 (b) 1001 1100
(c) 1010 0101 (d) 1101 0101

Q.31 If $(11x1y)_8 = (12C9)_{16}$ then the values of x and y are
(a) 3 and 1 (b) 5 and 7
(c) 7 and 5 (d) 1 and 5

Q.32 $(FE35)_{16}$ XOR $(CB15)_6$ is equal to
(a) $(3320)_{16}$
(b) $(FF35)_{16}$
(c) $(FF50)_{16}$
(d) $(3520)_{16}$

Q.33 Which of the following represents $(E3)_{16}$?
(a) $(1CE)_{16} + (A2)_{16}$
(b) $(1BC)_{16} - (DE)_{16}$
(c) $(2BC)_{16} - (1DE)_{16}$
(d) $(200)_{16} - (11D)_{16}$

Q.34 $(X)_8$ is expressed in Gray code as $(11110)_2$. The value of X is _____.

Q.35 Given $(135)_{\text{base } x} + (144)_{\text{base } x} = (323)_{\text{base } x}$. The value of base x is _____.

Q.36 The minimum decimal equivalent of the number 11C.0 is _____.

Q.37 The number of 1's in 8-bits representation of –127 in 2's complement form is m and that in 1's complement form is n. What is the value of m/n?

Q.38 If $(28)_x$ in base x number system is equal to $(37)_y$ in base y number system, the possible values of x and y are:
(a) 5, 3 (b) 8, 7
(c) 3, 4 (d) 13, 9

Answers Basics of Digital Logic

1.	(a)	**2.**	(a)	**3.**	(a)	**4.**	(d)	**5.**	(d)	**6.**	(b)	**7.**	(d)	**8.**	(b)	**9.**	(d)
10.	(c)	**11.**	(d)	**12.**	(d)	**13.**	(c)	**14.**	(c)	**15.**	(a)	**16.**	(c)	**17.**	(c)	**18.**	(127)
19.	(c)	**20.**	(c)	**21.**	(b)	**22.**	(10)	**23.**	(b)	**24.**	(c)	**25.**	(c)	**26.**	(b)	**27.**	(c)
28.	(c)	**29.**	(c)	**30.**	(a)	**31.**	(a)	**32.**	(d)	**33.**	(d)	**34.**	(24)	**35.**	(6)	**36.**	(194)
37.	(2)	**38.**	(d)	**39.**	(c)	**40.**	(a)	**41.**	(a)	**42.**	(33)	**43.**	(d)	**44.**	(a)	**45.**	(a)
46.	(d)	**47.**	(1101)	**48.**	(c)	**49.**	(c)	**50.**	(15)	**51.**	(54)	**52.**	(d)	**53.**	(a, c)	**54.**	(b, d)
55.	(c, d)	**56.**	(b, c)	**57.**	(b, c)	**58.**	(a, b)	**59.**	(b, c)	**60.**	(a, b, c)						

Explanations Basics of Digital Logic

1. (a)

To convert to base 8, we group in 3's because $2^3 = 8$.

To convert to base 16, we group in 4's because $2^4 = 16$.

To convert to base 32, we group in 5's because $2^5 = 32$.

Grouping in 5's, from the right we get the answer.

So $\underset{22}{\underline{10110}}$ $\underset{14}{\underline{01110}}$ $\underset{7}{\underline{00111}}$ $\underset{16}{\underline{10000}}$

2. (a)

Octal number 657_8

Binary representation of 657_8

$$\underline{0\,0\,0\,1}\ \underline{1\,0\,1\,0}\ \underline{1\,1\,1\,1}$$

Hexadecimal representation of $(657)_8$

$= (1\,AF)_H$

3. (a)

$(0.4375)_{10}$

(i) 0.4375 ×2 → 0.8750 ↓ 0

(ii) 0.8750 ×2 → 1.7500 ↓ 1

(iii) 0.75 ×2 → 1.50 ↓ 1

(iv) 0.50 ×2 → 1.0 ↓ 1

$\therefore (0.4375)_{10} = (0.0111)_2$

Hence, (a) is correct option

4. (d)

Zero has two representations in sign magnitude:

1. MSB is 0.
2. MSB is 1.

Both of these representations have equal value i.e., 0.

In 1's complement, 0 has two representations.

1. All bits are zero. 2. All bits are 1.

5. (d)

Weighted codes are the ones in which every bit position is assigned a weight.

$\therefore$ 5111 is a weighted code where the weight for MSB is 5 and for LSB is 1.

6. (b)

Sign bit must be 0 (+ve number)

$(22)_{10} = (10110)_2$

$(0.5625)_{10} = (0.1001)_2$

$0.5625 \times 2 = 1.125$

$0.125 \times 2 = 0.25$

$0.25 \times 2 = 0.5$

$0.5 \times 2 = 1.0$

$\therefore$ Correct answer is 0, 10110.1001.

7. (d)

As there are only 13 possible values, a variable can take, we need to use $\lceil \log_2^{13} \rceil$ bits = 4 bits.

8. (b)

$(54)_{10}$ in 8 bit binary is $(00110110)_2$

$(-54)_{10}$ in 2's complement representation is $(11001010)_2$.

Now, grouping 4 digits each from LSB to MSB, we get $(CA)_{16}$.

9. (d)

$(539)_{10}$ in 2's complement representation is $(0010\ 0001\ 1011)_2$ which is equivalent to $(21B)_{16}$.

10. (c)

2's complement of $(101)_3 = 222 - 101 = (121)_3$

[$\because$ $(r-1)$'s complement]

11. (d)

0.5 is the only decimal number which has a terminating binary representation.

$$(0.5)_{10} = (0.1)_2$$
$$(0.1)_{10} = (0.00011....)_2$$
$$(0.2)_{10} = (0.00110....)_2$$
$$(0.4)_{10} = (0.01100....)_2$$

12. (d)

GATE + CSE

This is Base 18 number system

$$E + E = 14 + 14 = 28 = (1A)_{18}$$
$$T + S + \text{carry} = 17 + 15 + 1 = 33 = (1S)_{18}$$
$$A + C + \text{carry} = 10 + 12 + 1 - 23 = (15)_{18}$$
$$G + \text{carry} = 16 + 1 = (17) = T$$

$\therefore$ Answer is T5SA

13. (c)

$$(23)_8 = (19)_{10}$$
$$\text{Square of } (19)_{10} = (361)_{10}$$
$$\therefore \quad (361)_{10} = (551)_8$$

14. (c)

$$(123)_5 = (X3)_Y$$

As we can observe that

$$5^2 \times 1 + 2 \times 5^1 + 3 \times 5^0 = Y' \times X + 3XY^{\circ}$$

$$25 + 10 + \not{3} = YX + \not{3}$$
$$35 = YX$$

Since Y is the base, $Y > X$ and $Y > 3$

$\therefore$ Possible values are given by

$$X = \frac{35}{Y}$$

When $Y = 7$, $X = 5$ and $Y = 35$, $X = 1$

Hence (c) is the correct option.

Note that ($X = 7$, $Y = 5$) and ($X = 35$, $Y = 1$) are not possible.

15. (a)

$$\begin{array}{r} 1 \\ 2.3 \\ +1.2 \\ \hline 10.1 \end{array}$$

$$3 + 2 = (5)_{10} = (11)_4$$

16. (c)

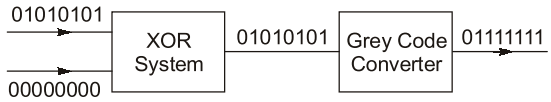
$(2BFD)_{16}$

$$\begin{array}{r} FFFF \\ -2BFD \\ \hline D402 \end{array}$$

17. (c)

Both Excess 3 codes and 2421 codes have this property and therefore, are called self complementary codes. But since the question requires weighted codes, the answer is '2421'.

18. (127)



Decimal equivalent of 01111111 = 127.

19. (c)

Range of signed 1's complement numbers is $-2^{n-1} + 1$ to $2^{n-1} - 1$.

20. (c)

Range of integers that can be represented by a n bit two's complement representation is -2^{n-1} to $(2^{n-1} - 1)$.

Here, $n = 8$

$\therefore$ The greatest negative number which can be stored $= -2^7 = -128$.

21. (b)

Excess-3 is obtained when 3 is added to every digit of the BCD code.

$(1101)_2 = (13)_{10}$

$(13)_{10}$ in BCD is

To convert to excess 3.

$$\begin{array}{r} 0001\ 0011 \\ +0011\ 0011 \\ \hline 0100\ 0110 \end{array}$$

22. (10)

$$(2)_3 = (2)_{10}$$
$$(3)_4 = (3)_{10}$$
$$(2)_{10} + (3)_{10} = (5)_{10} = (10)_5$$
$$\therefore \quad x = 10$$

23. (b)

$$(235)_{R_1} = \left(2R_1^2 + 3R_1 + 5\right)_{10} = (565)_{10}$$

Using the options, we can find out that R_1 must be 16.

$(1065)_{R2} = ((R_2)^3 + 6R_2 + 5)_{10} = (565)_{10}$

$R_2 = 8$ satisfies this equation.

Note: $(235)_{R_1} = (565)_{10} = (1065)_{R_2}$

2 CHAPTER
Boolean Algebra and Minimization

Multiple Choice Questions & NAT Questions

Q.1 The Boolean expression

$$ABCD + A\bar{B}CD + ABC\bar{D} + A\bar{B}C\bar{D}$$

is equivalent to

(a) A (b) AC

(c) ABC (d) 1

Q.2 The logic function $f = \overline{(x\bar{y}) + (\bar{x}y)}$ is same as

(a) $f = (x + y)(\bar{x} + \bar{y})$

(b) $f = \overline{(\bar{x} + \bar{y})(x + y)}$

(c) $f = \overline{(xy)}(\bar{x}\bar{y})$

(d) None of above

Q.3 The minimized expression for the given K-map (X : don't care) is

CD \ AB	00	01	11	10
00	0	0	1	1
01	0	X	X	1
11	X	X	1	X
10	1	0	1	1

(a) $A + \bar{B}C$ (b) $B + AC$

(c) $C + AB$ (d) ABC

Q.4 The Boolean expression $F = C(B + C)(A + B + C)$ when simplified will be

(a) $\bar{A} + \bar{B} + \bar{C}$ (b) C

(c) $AB + BC + CA$ (d) ABC

Q.5 Which of the following functions implements the Karnaugh map shown below?

AB \ CD	00	01	11	10
00	0	0	1	0
01	×	×	1	×
11	0	1	1	0
10	0	1	1	0

(a) $\bar{A}B + CD$ (b) $D(C + A)$

(c) $AD + \bar{A}B$ (d) $(C + D)(\bar{C} + D)(A + B)$

Q.6 Which of the following is not correct?

(a) Every Boolean expression is equivalent to an expression in sum of product form.

(b) Every Boolean expression is equivalent to an expression without V operator.

(c) Every Boolean expression is equivalent to an expression without $\wedge$ operator.

(d) Every Boolean expression is equivalent to an expression without $\neg$ operator.

Q.7 $B \oplus B \oplus B \oplus B,\ldots,n$ times = ? Where n is odd number.

(a) 0 (b) 1

(c) B (d) $\bar{B}$

Q.8 $A \odot A \odot A \odot A,\ldots,n$ times = ? Where n is even number.

(a) 0 (b) 1

(c) A (d) $\bar{A}$

Q.9 X is a binary number which is a power of 2, then the value of (X AND ($X - 1$) is

(a) 111.....11 (b) 000.....00

(c) 100.....00 (d) 00.....1

Q.10 Which of the following circuits are equivalent (i.e., they provide the same output for all the inputs)?

$F = ab + bc + ca$

$G = (a + b)(b + c)(c + a)$

H = NAND(NAND(a, b), NAND (b, c), NAND (a, c))

(a) F and H (b) F and G

(c) F, G and H (d) G and H

Q.11 If x and y are Boolean variable, which one of the following is the equivalent of $x \oplus y \oplus xy$?

(a) $x + \bar{y}$ (b) $x + y$

(c) 0 (d) 1

Q.12 The minterms for $AB + ACD$ are

(a) $\bar{A}\bar{B}CD + AB\bar{C}D + A\bar{B}C\bar{D} + ABC\bar{D} + \bar{A}BCD$

(b) $AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D} + ABCD + A\bar{B}CD$

(c) $A\bar{B}CD + AB\bar{C}D + ABC\bar{D} + \bar{A}BCD + A\bar{B}C\bar{D}$

(d) $AB\bar{C}D + A\bar{B}CD + \bar{A}BCD + ABC\bar{D} + \bar{A}\bar{B}CD$

Q.13 A Boolean expression $f(A, B, C)$ is represented in its pictorial form as shown below. The function $f(A, B, C)$ is

AB \ C	0	1
00	0	1
01	1	1
10	1	0
11	1	1

(a) $(\bar{A}C + A\bar{C} + \bar{B})'$

(b) $[\bar{B}(\bar{A} + C)(A + \bar{C})]'$

(c) $[(A + B + C)(\bar{A} + B + \bar{C})]'$

(d) $(ABC + \bar{A}B\bar{C})'$

Q.14 Which of the following functions implement the *K*-map shown below?

AB \ CD	00	01	11	10
00	0	x	1	0
01	x	1	0	1
11	1	1	0	x
10	0	1	1	0

(a) $BC' + BD + BD'$

(b) $BD + A'B + C'D$

(c) $B'D + BD' + C'D$

(d) $B'D + BD' + CD$

Q.15 The switching expression corresponding to $f(A, B, C, D) = \Sigma(0,3,4,7,8)$ and $\sum_d(10, 11, 12, 14, 15)$ where d : don't care

(a) $\bar{C}\bar{D} + B\bar{C}$ (b) $C \odot D$

(c) $C \oplus D$ (d) CD

Q.16 Consider the following statements:

1. Boolean expressions and logic gates correspond to labelled acyclic digraphs.
2. Optimal boolean expression may not correspond to simplest networks.
3. Choosing essential blocks first in a Karnaugh map and then greedily choosing the largest remaining blocks to cover may not give an optimal expression.

Which of these statements are correct?

(a) 1 only (b) 2 only

(c) 1 and 2 (d) 1, 2 and 3

Q.17 A function $f(A, B, C)$ defined by three Boolean variables A, B and C when expressed as sum of products is given by

$$F = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C}$$

where $\bar{A}, \bar{B}$ and $\bar{C}$ are complements of the respective variables. The product of sums (POS) forms of the function F is

(a) $F = (A + B + C)(A + \bar{B} + C)(\bar{A} + B + C)$

(b) $F = (\bar{A} + \bar{B} + \bar{C})(\bar{A} + B + \bar{C})(A + \bar{B} + \bar{C})$

(c) $F = (A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + B + \bar{C})$
$(\bar{A} + \bar{B} + C)(\bar{A} + \bar{B} + \bar{C})$

(d) $F = (\bar{A} + \bar{B} + C)(\bar{A} + B + C)(A + \bar{B} + C)$
$(A + B + \bar{C})(A + B + C)$

Q.18 Minimal POS obtained from
$Y = \Sigma m(0, 2, 3, 6, 7) + \Sigma d(8, 10, 11, 15)$

(a) $\bar{A}C + \bar{B}\bar{D}$ (b) $\bar{A}(C + \bar{D})(\bar{B} + C)$

(c) $(AC + \bar{B}\bar{D})$ (d) None of these

Q.19 Boolean expression

$$\overline{A + \bar{B} + C} + \overline{\bar{A} + \bar{B} + C} + \overline{A + \bar{B} + \bar{C}} + ABC$$

reduces to

(a) A (b) B

(c) C (d) $A+B+C$

Q.20 If $X = 1$ in the logic equation

$$[X + Z\{\bar{Y} + (\bar{Z} + X\bar{Y})\}]\{\bar{X} + \bar{Z}(X + Y)\} = 1$$

then

(a) $Y = X$ (b) $Y = \bar{Z}$

(c) $Z = 1$ (d) $Z = 0$

Q.21 $f(A, B, C, D) = \Pi_M(0, 1, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15)$ is a maxterm representation of Boolean function $f(A, B, C, D)$ where A is MSB and D is LSB.

(a) $(A + \bar{C} + D)(\bar{A} + B + D)$

(b) $A\bar{C}D + \bar{A}BD$

(c) $\bar{A}C\bar{D} + A\bar{B}\bar{D}$

(d) $(B + \bar{C} + D)(A + \bar{B} + \bar{C} + D)(\bar{A} + B + C + D)$

Q.22 What is the minimized logic expression corresponding to the given Karnaugh Map?

wx \ yz	00	01	11	10
00			1	
01	1	1	1	
11		1	1	1
10		1		

(a) xz

(b) $\bar{w}x\bar{y} + \bar{w}yz + w\bar{y}z + wxy$

(c) $\bar{w}x\bar{y} + \bar{w}yz + w\bar{y}\bar{z} + wx\bar{y}$

(d) $xz + \bar{w}yz + \bar{w}x\bar{y} + wxy + w\bar{y}z$

Q.23 Which of the following Boolean expressions is incorrect?

(a) $(abc)' + bc + ac = c$

(b) $(a + b)(a'(b' + c'))' + b'c' + a'c' = 1$

(c) $ab + ac + bc = ab + ac$

(d) All the these

Q.24 The Boolean function can be expressed in canonical SOP and POS forms. So for $Y = A\bar{B} + B\bar{C}$, the SOP and POS forms will be

(a) $Y = \Sigma(0, 2, 4, 6)$; $Y = \pi(1, 3, 7)$

(b) $Y = \Sigma(1, 2, 5, 7)$; $Y = \pi(0, 3, 4, 6)$

(c) $Y = \Sigma(2, 4, 5, 6)$; $Y = \pi(0, 1, 3, 7)$

(d) $Y = \Sigma(1, 2, 4, 5)$; $Y = \pi(0, 3, 6)$

Q.25 For the following Boolean equations, the value of A, B and C will be $AB + \bar{A}C = 1$, $AC + B = 0$

(a) 1, 1, 1 (b) 1, 1, 0

(c) 0, 0, 1 (d) 0, 0, 0

Q.26 The k-map for the Boolean function F of 4 boolean variables is given below where A, B, C are don't care conditions. What values of A, B, C will result in the minimal expression?

WX \ YZ	00	01	11	10
00	0	0	A	0
01	0	1	1	0
11	1	B	C	0
10	0	0	1	0

(a) $A = B = C = 1$ (b) $B = C = 1$; $A = 0$

(c) $A = C = 1$; $B = 0$ (d) $A = B = 1$; $C = 0$

Q.27 The black box in the below figure consists of a minimum complexity circuit that uses only AND, OR and NOT gates.

The function $f(x, y, z) = 1$ whenever x, y are different and 0 otherwise. In addition the 3 inputs x, y, z never contain the same value. Which one of the following equations leads to the correct design for the minimum complexity circuit?

(a) $x'y + xy'$ (b) $x + y'z$

(c) $x'y'z' + xy'z$ (d) $xy + y'z + z'$

Q.28 The SOP form of given function

$$y = \overline{(A + \bar{B} + \bar{C} + D) \cdot (\bar{A} + B)}$$ is

(a) $y = A\bar{B}\bar{C}D + \bar{A}B$

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

(c) $y = \overline{\bar{A}BC\bar{D} + A\bar{B}}$

(d) $y = \bar{A}BC\bar{D} + A\bar{B}$

Q.29 Let $f(A, B) = A \oplus B$, then simplified from of the function $f(f(x \oplus y, z), w)$ is

(a) $(x \oplus y \oplus z)\, w$ (b) $x \oplus y \oplus z \oplus w$

(c) $(x \oplus y \oplus z) + w$ (d) None of these

Q.30 The function

$$f = (A\bar{B}\bar{C} + \bar{A}B\bar{C} + ABC + \bar{A}\bar{B}C) \oplus A$$

Can be written as:

(a) $B \oplus C$ (b) $A \oplus B \oplus A$

(c) A (d) None of these

Q.31 Given $\overline{AB} + \bar{A}B = C$, final $\overline{AC} + \bar{A}C$

(a) $\bar{A} + B$ (b) $A + \bar{B}$

(c) $\bar{A} + \bar{B}$ (d) $A + B$

Q.32 Consider the following sequence of instructions:

$a = a \oplus b$

$b = a \oplus b$

$a = b \oplus a$

This sequence

(a) Retains the values of a and b

(b) Swap a and b

(c) Complements the values of a and b

(d) Negates values of a and b and then swaps them

Answers Boolean Algebra and Minimization

1.	(b)	2.	(b)	3.	(a)	4.	(b)	5.	(b)	6.	(d)	7.	(c)	8.	(b)	9.	(b)
10.	(c)	11.	(b)	12.	(b)	13.	(b)	14.	(c)	15.	(b)	16.	(d)	17.	(c)	18.	(b)
19.	(b)	20.	(d)	21.	(c)	22.	(b)	23.	(d)	24.	(c)	25.	(c)	26.	(a)	27.	(a)
28.	(d)	29.	(b)	30.	(a)	31.	(a)	32.	(b)	33.	(d)	34.	(4)	35.	(c)	36.	(2)
37.	(0)	38.	(a)	39.	(a)	40.	(b)	41.	(b)	42.	(c)	43.	(b)	44.	(a)	45.	(c)
46.	(c)	47.	(b)	48.	(c)	49.	(c)	50.	(b)	51.	(a)	52.	(14)	53.	(16)	54.	(d)
55.	(d)	56.	(a, b, d)	57.	(a, c)	58.	(a, c, d)	59.	(a, c)	60.	(a, b, c)	61.	(c, d)	62.	(a, d)		
63.	(c, d)	64.	(b, d)														

Explanations Boolean Algebra and Minimization

1. (b)

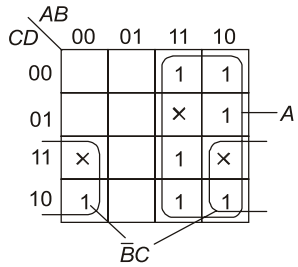
$$ABCD + A\bar{B}CD + ABC\bar{D} + A\bar{B}C\bar{D}$$
$$= ACD(B + \bar{B}) + AC\bar{D}(B + \bar{B})$$
$$= ACD + AC\bar{D} \qquad [\because B + \bar{B} = 1]$$
$$= AC(D + \bar{D})$$
$$= AC.1 \qquad [\because D + \bar{D} = 1]$$
$$= AC$$

2. (b)

Simplifying option (b)

$$f = \overline{(\bar{x} + \bar{y})(x + y)}$$
$$= \overline{x.\bar{x} + \bar{x}y + x\bar{y} + y\bar{y}} = \overline{(\bar{x}y + x\bar{y})}$$
$$[\because x\bar{x} = 0 \text{ and } y\bar{y} = 0]$$
$$[0 + x = x]$$

3. (a)



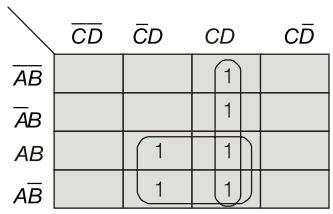
The expression is $Y = A + \bar{B}C$

4. (b)

$$f = C(B + C)(A + B + C)$$
$$[\because x + xy = x \text{ and } x(x + y) = x]$$
$$= C(B + C) = C$$

5. (b)

Solving the given K-map we have



$$f = AD + CD$$
$$f = D(C + A)$$

Hence (b) is correct option

6. (d)

Any Boolean expression can be expressed in Product of Sum or Sum of Products form. Further AND and NOT are functionally complete. Similarly OR and NOT are functionally complete. Therefore, expression can be without the OR and AND operator respectively. But without NOT, we can't get a functionally complete gate.

7. (c)

$B \oplus B = 0$

$0 \oplus B = B$

$\therefore$ $B \oplus B \ldots\ldots B \oplus B_n$ when n is odd number output B only.

8. (b)

$A \odot A = 1$

$\therefore$ $A \odot A \odot A \odot \ldots\ldots A \odot A_n$ when n is even returns 1.

9. (b)

Let, $X = 1000$

$X - 1 = 0111$

X and $(X-1) = 0000$

10. (c)

$$G = (a+b)(c+ab)$$
$$= ac + aab + bc + ab$$
$$= ac + ab + bc \quad [\because a.a = a;\ a + a = a]$$
$$H = \overline{\overline{ab}\ \overline{bc}\ \overline{ac}}$$
$$= ab + bc + ac \quad \text{[DeMorgans law]}$$

Note: NAND-NAND realization is same as AND-OR realization.

So, F, G and H are equivalent.

11. (b)

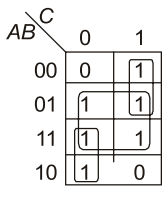
$$x \oplus y \oplus xy = (\bar{x}y + x\bar{y}) \oplus xy$$
$$[\because \text{Applying } A \oplus B = \bar{A}B + A\bar{B}]$$
$$= \overline{x\bar{y} + \bar{x}y} \cdot (xy) + (\bar{x}y + x\bar{y})\overline{(xy)}$$
$$= (\bar{x}\bar{y} + xy)(xy) + (\bar{x}y + x\bar{y})(\bar{x} + \bar{y})$$
$$[\because \text{Applying DeMorgans law}]$$
$$= 0 + xy + \bar{x}y + \bar{x}y\bar{y} + \bar{x}x\bar{y} + x\bar{y}$$
$$[\because x.\bar{x} = 0;\ y.\bar{y} = 0]$$
$$= xy + \bar{x}y + x\bar{y} \quad [\because 0.x = 0;\ 0 + x = x]$$
$$= (x + \bar{x})y + x\bar{y}$$
$$= y + x\bar{y} \quad [\because x + \bar{x} = 1;\ 1.y = y]$$
$$= x + y \quad [\because x\bar{y} + y = x + y]$$

12. (b)

$$AB + ACD$$
$$= AB(C + \bar{C})(D + \bar{D}) + A(B + \bar{B})CD$$
$$[\because x + \bar{x} = 1;\ 1.x = x]$$
$$= AB(CD + C\bar{D} + \bar{C}D + \bar{C}\bar{D}) + ABCD + A\bar{B}CD$$
$$= ABCD + ABC\bar{D} + AB\bar{C}D + AB\bar{C}\bar{D}$$
$$+ ABCD + A\bar{B}CD$$
$$= ABCD + ABC\bar{D} + AB\bar{C}D + AB\bar{C}\bar{D} + A\bar{B}CD$$
$$[\because x + x = x]$$

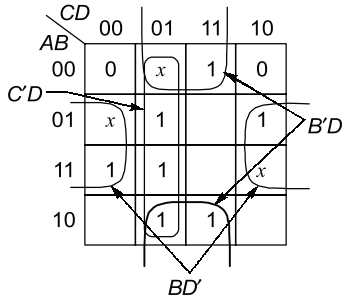
13. (b)

Representing the graph in K-map



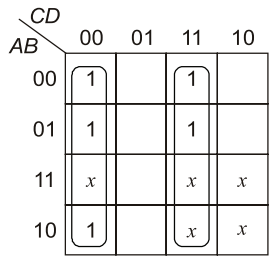
$$f(A, B, C) = B + A\bar{C} + \bar{A}C$$
$$f(A, B, C) = \overline{\left(B + A\bar{C} + \bar{A}C\right)}$$
$$f(A, B, C) = \overline{\left[\bar{B}(\bar{A} + C)(A + \bar{C})\right]}$$

14. (c)



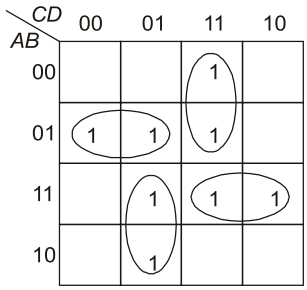
So, $B'D + BD' + C'D$

15. (b)



$\Rightarrow \bar{C}\bar{D} + CD = C \odot D$

16. (d)



Consider the K-map shown above. If we choose the essential blocks first i.e. *A'BC', AC'D, A'CD and ABC* and then the largest remaining block which is *BD*, optimal expression is not obtained since *BD* is redundant.

$\therefore$ 3 is correct.

Hence, option (d) i.e., 1, 2, 3 are correct is the answer.

17. (c)

$$F = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C}$$
$$= \Sigma m(0, 2, 4)$$
$$= \Pi M(1, 3, 5, 6, 7)$$
$$= M_1 \cdot M_3 \cdot M_5 \cdot M_6 \cdot M_7$$
$$= (A + B + \bar{C})(A + \bar{B} + \bar{C}).(\bar{A} + B + \bar{C}).$$
$$(\bar{A} + \bar{B} + C).(\bar{A} + \bar{B} + \bar{C})$$

18. (b)

CD \ AB	00	01	11	10
00	1	0	0	d
01	0	0	0	0
11	1	1	d	d
10	1	1	0	d

$\Rightarrow \quad \bar{A}(C+\bar{D})(\bar{B}+C)$

19. (b)

$$\overline{A+\bar{B}+C}+\overline{\bar{A}+\bar{B}+C}+\overline{A+\bar{B}+\bar{C}}+ABC$$

$$= \bar{A}\cdot B\cdot\bar{C}+AB\bar{C}+\bar{A}BC+ABC$$

$$= \bar{A}B(\bar{C}+C)+AB(\bar{C}+C) = \bar{A}B+AB$$

$$= B(\bar{A}+A)=B \qquad [\text{Using } x+\bar{x}=1]$$

20. (d)

$$X = 1$$

$$[1+Z\{\bar{Y}+(\bar{Z}+X\bar{Y})\}]\{\bar{1}+\bar{Z}(1+Y)\}=1$$

$$1.(0+\bar{Z}) = 1$$

$$[\because 1+A=1;\ 1.A=A;\ \bar{1}=0]$$

$$\bar{Z} = 1 \qquad [\because 0+A=A]$$

$\therefore \quad Z = 0$

21. (c)

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

$\bar{A}C\bar{D}$, $A\bar{B}\bar{D}$

$f(A, B, C, D) = A\bar{B}\bar{D}+\bar{A}C\bar{D}$

Simplifying (C)

$\bar{A}C\bar{D}+A\bar{B}\bar{D}(C+\bar{C}) = \bar{A}C\bar{D}+A\bar{B}\bar{D} \quad [\because C+\bar{C}=1]$

22. (b)

yz \ wx	00	01	11	10
00			1	
01	1	1	1	1
11		1	1	1
10		1		

$\bar{w}yz$, $\bar{w}x\bar{y}$, wxy, $w\bar{y}z$

23. (d)

(a) $(abc)' + bc + ac$

$= a' + b' + c' + bc + ac$

[Applying DeMorgans law]

$(a' + ac) + (c' + bc) + b'$

$= a' + c + c' + b + b' = 1$

$\therefore$ Incorrect.

(b) $(a + b)(a'(b' + c'))' + b'c' + a'c'$

$= (a + b)(a + (b' + c')') + b'c' + a'c'$

[Applying DeMorgans Law]

$= (a + b)(a + bc) + b'c' + a'c'$

$= a + bc + b'c' + a'c'$

$= (a + a'c') + bc + b'c'$

$= a + c' + bc + b'c'$

$= a + bc + c'(1 + b')$ $[\because (1 + b') = 1]$

$= a + bc + c'$

$= a + b + c'$

$\therefore$ Incorrect

(c) $ab + a'c + bc$

$= ab + a'c$

$\therefore$ Incorrect

24. (c)

$$Y = A\bar{B}+B\bar{C}$$

$$= A\bar{B}(C+\bar{C})+(A+\bar{A})B\bar{C}$$

$$= A\bar{B}C+A\bar{B}\bar{C}+AB\bar{C}+\bar{A}B\bar{C}$$

$$= \Sigma m(2, 4, 5, 6)$$

$$= \pi M(0, 1, 3, 7)$$

25. (c)

From $AC+B = 0 \Rightarrow B = 0$

from $AB+\bar{A}C = 1$ and $B = 0$

$\Rightarrow \quad \bar{A}C = 1 \Rightarrow A = 0$ and $C = 1$

Thus$(A, B, C) = (0, 0, 1)$

26. (a)

For minimal expression:

WX \ YZ	00	01	11	10
00	0	0	1	0
01	0	1	1	0
11	1	1	1	0
10	0	0	1	0

For $A = B = C = 1$

It will give the minimal expression.