

COMPUTER ARITHMETIC

1. The Octal equivalent of the binary number 1011101011 is:

- (1) 7353
- (2) 1353
- (3) 5651
- (4) 5657

Answer: 2

Explanation:

Group all the bits in the binary number in sets of three, starting from the far right. Add zeros to the left of the last digit if you don't have enough digits to make a set of three.

Original Binary: 1011101011

Grouping: 1 011 101 011

Adding Zeros for Groups of Three: 001 011 101 011

001=1, 011=3, 101=5, 011=3

So final answer will be 1353

2. Let P and Q be two propositions, $\neg(P \leftrightarrow Q)$ is equivalent to:

- (1) $P \leftrightarrow \neg Q$
- (2) $\neg P \leftrightarrow Q$
- (3) $\neg P \leftrightarrow \neg Q$
- (4) $Q \rightarrow P$

Answer: 1, 2

Explanation:

| P | Q | $\neg P$ | $\neg Q$ | $Q \rightarrow P$ | $\neg(P \leftrightarrow Q)$ | $P \leftrightarrow \neg Q$ | $\neg P \leftrightarrow Q$ | $\neg P \leftrightarrow \neg Q$ |
|---|---|----------|----------|-------------------|-----------------------------|----------------------------|----------------------------|---------------------------------|
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |

So both options 1 and 2 are correct.

Important Logical Equivalences.

The logical equivalences below are important equivalences that should be memorized.

Identity Laws:

$$p \wedge T \Leftrightarrow p$$

$$p \vee F \Leftrightarrow p$$

Domination Laws:

$$p \vee T \Leftrightarrow T$$

$$p \wedge F \Leftrightarrow F$$

Idempotent Laws:

$$p \vee p \Leftrightarrow p$$

$$p \wedge p \Leftrightarrow p$$

Double Negation Law:

$$\neg(\neg p) \Leftrightarrow p$$

Commutative Laws:

$$p \vee q \Leftrightarrow q \vee p$$

$$p \wedge q \Leftrightarrow q \wedge p$$

Associative Laws:

$$(p \vee q) \vee r \Leftrightarrow p \vee (q \vee r)$$

$$(p \wedge q) \wedge r \Leftrightarrow p \wedge (q \wedge r)$$

Distributive Laws:

$$p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$$

$$p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$$

De Morgan's Laws:

$$\neg(p \wedge q) \Leftrightarrow \neg p \vee \neg q$$

$$\neg(p \vee q) \Leftrightarrow \neg p \wedge \neg q$$

Absorption Laws:

$$p \wedge (p \vee q) \Leftrightarrow p$$

$$p \vee (p \wedge q) \Leftrightarrow p$$

Implication Law:

$$(p \rightarrow q) \Leftrightarrow (\neg p \vee q)$$

Contrapositive Law:

$$(p \rightarrow q) \Leftrightarrow (\neg q \rightarrow \neg p)$$

Tautology:

$$p \vee \neg p \Leftrightarrow T$$

Contradiction:

$$p \wedge \neg p \Leftrightarrow F$$

Equivalence:

$$(p \rightarrow q) \wedge (q \rightarrow p) \Leftrightarrow (p \leftrightarrow q)$$

3. Negation of the proposition $\exists x H(x)$ is:

(1) $\exists x \neg H(x)$

(2) $\forall x \neg H(x)$

(3) $\forall x H(x)$

(4) $\neg x H(x)$

Answer: 2

4. In propositional logic if $(P \rightarrow Q) \wedge (R \rightarrow S)$ and $(P \vee R)$ are two premises such that

$$\frac{\frac{(P \rightarrow Q) \wedge (R \rightarrow S)}{P \vee R}}{Y}$$

Y is the premise:

- (1) $P \vee R$
- (2) $P \vee S$
- (3) $Q \vee R$
- (4) $Q \vee S$

Answer: 4

5. ECL is the fastest of all logic families. High Speed in ECL is possible because transistors are used in difference amplifier configuration, in which they are never driven into
- (1) Race condition
 - (2) Saturation
 - (3) Delay
 - (4) High impedance

Answer: 2

Explanation:

Emitter-coupled logic (ECL) is the fastest of all logic families and therefore is used in applications where very high speed is essential. High speeds have become possible in ECL because the transistors are used in difference amplifier configuration, in which they are never driven into saturation and thereby the storage time is eliminated.

6. A binary 3-bit down counter uses J-K flip-flops, FF_i with inputs J_i, K_i and outputs $Q_i, i=0,1,2$ respectively. The minimized expression for the input from following, is

- I. $J_0=K_0=0$
- II. $J_0=K_0=1$
- III. $J_1=K_1=Q_0$
- IV. $J_1=K_1=Q_0'$
- V. $J_2=K_2=Q_1Q_0$
- VI. $J_2=K_2=Q_1'Q_0'$

- (1) I, III, V
- (2) I, IV, VI
- (3) II, III, V
- (4) II, IV, VI

Answer: 4

7. Convert the octal number 0.4051 into its equivalent decimal number.

- (1) 0.5100098
- (2) 0.2096
- (3) 0.52
- (4) 0.4192

Answer: 1

Explanation:

$$(0.4051)_8 = 4 \times 8^{-1} + 0 \times 8^{-2} + 5 \times 8^{-3} + 1 \times 8^{-4}$$

= 0.5100098

8. The hexadecimal equivalent of the octal number 2357 is:

- (1) 2EE
- (2) 2FF
- (3) 4EF
- (4) 4FE

Answer: 3

Explanation:

$(2357)_8$ can be converted into binary just digit by digit.

= 010 011 101 111

Now we can regroup the bits into groups of 4 and convert to hexadecimal.

= 0100 1110 1111

= 4EF

9. The octal number 326.4 is equivalent to

- (A) $(214.2)_{10}$ and $(D6.8)_{16}$
- (B) $(212.5)_{10}$ and $(D6.8)_{16}$
- (C) $(214.5)_{10}$ and $(D6.8)_{16}$
- (D) $(214.5)_{10}$ and $(D6.4)_{16}$

Answer: C

10. Which of the following is the most efficient to perform arithmetic operations on the numbers?

- (A) Sign-magnitude
- (B) 1's complement
- (C) 2's complement
- (D) 9's complement

Answer: C

11. The IEEE-754 double-precision format to represent floating point numbers, has a length of bits.

- (A) 16
- (B) 32
- (C) 48
- (D) 64

Answer: D

12. Which of the following arguments are not valid?

(a) "If Gora gets the job and works hard, then he will be promoted. If Gora gets promotion, then he will be happy. He will not be happy, therefore, either he will not get the job or he will not work hard".

(b) "Either Puneet is not guilty or Pankaj is telling the truth. Pankaj is not telling the truth, therefore, Puneet is not guilty".

(c) If n is a real number such that $n > 1$, then $n^2 > 1$. Suppose that $n^2 > 1$, then $n > 1$.

Codes:

- (A) (a) and (c)
- (B) (b) and (c)
- (C) (a), (b) and (c)
- (D) (a) and (b)

Answer: Marks to all

13. Let $P(m,n)$ be the statement "m divides n" where the Universe of discourse for both the variables is the set of positive integers. Determine the truth values of the following propositions.

- (a) $\exists m \forall n P(m,n)$
- (b) $\forall n P(1,n)$
- (c) $\forall m \forall n P(m,n)$
- (A) (a)-True; (b)-True; (c)-False
- (B) (a)-True; (b)-False; (c)-False
- (C) (a)-False; (b)-False; (c)-False
- (D) (a)-True; (b)-True; (c)-True

Answer: A

14. Match the following terms:

List - I

List - II

- (a) Vacuous proof based on the fact that p is false
(b) Trivial proof based on the fact that q is true
(c) Direct proof that proceeds by showing that q must be true when p is true.
(d) Indirect proof that proceeds by showing that p must be false when q is false.
- (i) A proof that the implication $p \rightarrow q$ is true
(ii) A proof that the implication $p \rightarrow q$ is true
(iii) A proof that the implication $p \rightarrow q$ is true
(iv) A proof that the implication $p \rightarrow q$ is true

Codes:

- (a) (b) (c) (d)
(A) (i) (ii) (iii) (iv)
(B) (ii) (iii) (i) (iv)
(C) (iii) (ii) (iv) (i)
(D) (iv) (iii) (ii) (i)

Answer: A

15. Which of the following property/ies a Group G must hold, in order to be an Abelian group?

- (a) The distributive property
(b) The commutative property
(c) The symmetric property

Codes:

- (A) (a) and (b) (B) (b) and (c)
(C) (a) only (D) (b) only

Answer: D

16. Consider the following statements :

- (a) Boolean expressions and logic networks correspond to labelled acyclic digraphs.
(b) Optimal Boolean expressions may not correspond to simplest networks.
(c) 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 statement(s) is/ are correct?

- (A) (a) only (B) (b) only
(C) (a) and (b) (D) (a), (b) and (c)

Answer: D

17. Consider a full-adder with the following input values:

- (a) $x=1$, $y=0$ and $C_i(\text{carry input}) = 0$
(b) $x=0$, $y=1$ and $C_i = 1$

Compute the values of S(sum) and C_0 (carry output) for the above input values.

- (A) $S=1$, $C_0=0$ and $S=0$, $C_0=1$ (B) $S=0$, $C_0=0$ and $S=1$, $C_0=1$
(C) $S=1$, $C_0=1$ and $S=0$, $C_0=0$ (D) $S=0$, $C_0=1$ and $S=1$, $C_0=0$

Answer: A

18. "If my computations are correct and I pay the electric bill, then I will run out of money. If I don't pay the electric bill, the power will be turned off. Therefore, if I don't run out of money and the power is still on, then my computations are incorrect."

Convert this argument into logical notations using the variables c, b, r, p for propositions of computations, electric bills, out of money and the power respectively. (Where \neg means NOT)

- (A) if $(c \wedge b) \rightarrow r$ and $\neg b \rightarrow \neg p$, then $(\neg r \wedge p) \rightarrow \neg c$
- (B) if $(c \vee b) \rightarrow r$ and $\neg b \rightarrow \neg p$, then $(r \wedge p) \rightarrow c$
- (C) if $(c \wedge b) \rightarrow r$ and $\neg p \rightarrow \neg b$, then $(\neg r \vee p) \rightarrow \neg c$
- (D) if $(c \vee b) \rightarrow r$ and $\neg b \rightarrow \neg p$, then $(\neg r \wedge p) \rightarrow \neg c$

Answer: A

19. Match the following:

List - I

List - II

- | | |
|--|----------------------------|
| (a) $(p \rightarrow q) \Leftrightarrow (\neg q \rightarrow \neg p)$ | (i) Contrapositive |
| (b) $[(p \wedge q) \rightarrow r] \Leftrightarrow [p \rightarrow (q \rightarrow r)]$ | (ii) Exportation law |
| (c) $(p \rightarrow q) \Leftrightarrow [(p \wedge \neg q) \rightarrow o]$ | (iii) Reductio ad absurdum |
| (d) $(p \Leftrightarrow q) \Leftrightarrow [(p \rightarrow q) \wedge (q \rightarrow p)]$ | (iv) Equivalence |

Codes:

- | | | | |
|-----------|-------|-------|------|
| (a) | (b) | (c) | (d) |
| (A) (i) | (ii) | (iii) | (iv) |
| (B) (ii) | (iii) | (i) | (iv) |
| (C) (iii) | (ii) | (iv) | (i) |
| (D) (iv) | (ii) | (iii) | (i) |

Answer: A

20. Consider a proposition given as:

" $x \geq 6$, if $x^2 \geq 25$ and its proof as:

If $x \geq 6$, then $x^2 = x \cdot x = 6 \cdot 6 = 36 \geq 25$

Which of the following is correct w.r.to the given proposition and its proof ?

- (a) The proof shows the converse of what is to be proved.
- (b) The proof starts by assuming what is to be shown.
- (c) The proof is correct and there is nothing wrong.

- (A) (a) only (B) (c) only
- (C) (a) and (b) (D) (b) only

Answer: C

21. The Excess-3 decimal code is a self-complementing code because

- (A) The binary sum of a code and its 9's complement is equal to 9.
- (B) It is a weighted code.
- (C) Complement can be generated by inverting each bit pattern.
- (D) The binary sum of a code and its 10's complement is equal to 9.

Answer: A, C

22. The range of representable normalized numbers in the floating point binary fractional representation in a 32-bit word with 1-bit sign, 8-bit excess 128 biased exponent and 23 bit mantissa is

- (A) 2^{-128} to $(1 - 2^{-23}) \times 2^{127}$
- (B) $(1 - 2^{-23}) \times 2^{-127}$ to 2^{128}
- (C) $(1 - 2^{-23}) \times 2^{-127}$ to 2^{23}
- (D) 2^{-129} to $(1 - 2^{-23}) \times 2^{127}$

Answer: D

23. The size of the ROM required to build an 8-bit adder/subtractor with mode control, carry input, carry output and two's complement overflow output is given as

- (A) $2^{16} \times 8$ (B) $2^{18} \times 10$
(C) $2^{16} \times 10$ (D) $2^{18} \times 8$

Answer: B

24. How many different truth tables of the compound propositions are there that involve the propositions p & q ?

- (A) 2 (B) 4
(C) 8 (D) 16

Answer: D

25. A Boolean function F is called self-dual if and only if

$$F(x_1, x_2, \dots, x_n) = F(\bar{x}_1, \bar{x}_2, \dots, \bar{x}_n)$$

How many Boolean functions of degree n are self-dual ?

- (A) 2^n (B) $(2)^{2^n}$
(C) $(2)^{n^2}$ (D) $(2)^{2^{n-1}}$

Answer: D

26. Which of the following statement(s) is(are) not correct ?

- i. The 2's complement of 0 is 0.
- ii. In 2's complement, the left most bit cannot be used to express a quantity.
- iii. For an n-bit word (2's complement) which includes the sign bit, there are 2^{n-1} positive integers, 2^{n+1} negative integers and one 0 for a total of 2^n unique states.
- iv. In 2's complement the significant information is contained in the 1's of positive numbers and 0's of the negative numbers.

- (A) i and iv (B) i and ii
(C) iii (D) iv

Answer: C

27. The notation $\exists!xP(x)$ denotes the proposition "there exists a unique x such that P(x) is true".

Give the truth values of the following statements :

I. $\exists!xP(x) \rightarrow \exists xP(x)$

II. $\exists!x \neg P(x) \rightarrow \neg \forall xP(x)$

- (A) Both I and II are true (B) Both I and II are false
(C) I-false, II-true (D) I-true, II-false

Answer: A

28. The dual of a Boolean expression is obtained by interchanging

- (A) Boolean sums and Boolean products
(B) Boolean sums and Boolean products or interchanging 0's and 1's
(C) Boolean sums and Boolean products and interchanging 0's & 1's
(D) Interchanging 0's and 1's

Answer: C

29. Given that $(292)_{10} = (1204)_x$ in some number system x. The base x of that number system is

- (A) 2 (B) 8
(C) 10 (D) None of the above

Answer: D

Explanation:

$$6|292$$

$$6|48| 4$$

$$6|8| 0$$

$$6|1| 2$$

$$6|1| 1$$

Solution: $(1204)_6$

So here, $x=6$

30. The sum of products expansion for the function

$F(x, y, z) = (x + y)z'$ is given as

(A) $x'y'z + xyz' + x'yz'$

(B) $xyz + xyz' + xy'z'$

(C) $xy'z' + x'y'z' + xyz'$

(D) $xyz' + xy'z' + x'yz'$

Answer: D

Explanation:

Use Boolean identities to expand the product and simplify.

$$F(x, y, z) = (x + y)z'$$

$$= xz' + yz' \quad \text{Distributive law}$$

$$= x1z' + 1yz' \quad \text{Identity law}$$

$$= x(y+y')z' + (x+x')yz' \quad \text{Unit property}$$

$$= xyz' + xy'z' + xyz' + x'yz' \quad \text{Distributive law}$$

$$= xyz' + xy'z' + x'yz' \quad \text{Idempotent law}$$

31. Let $P(m, n)$ be the statement

"m divides n" where the universe of discourse for both the variables is the set of positive integers. Determine the truth values of each of the following propositions:

I. $\forall m \forall n P(m, n)$,

II. $\exists m \forall n P(m, n)$

(A) Both I and II are true

(B) Both I and II are false

(C) I - false & II - true

(D) I - true & II - false

Answer: C

32. Big - O estimate for

$f(x) = (x + 1) \log(x^2 + 1) + 3x^2$ is given as

(A) $O(x \log x)$ (B) $O(x^2)$

(C) $O(x^3)$ (D) $O(x^2 \log x)$

Answer: B

Explanation:

Big-O notation of $f(x) = (x+1) \log(x^2+1) + 3x^2$

Note $(x+1)$ is $O(x)$ and $x^2+1 \leq 2x^2$ when $x > 1$

So, $\log x^2+1 \leq \log(2x^2) = \log 2 + \log x^2 = \log 2 + 2 \log x$
 $\leq 3 \log x$ if $x > 2$

Thus, $\log x^2+1$ is $O(\log x)$

The first part of $f(x)$ is $O(x \log x)$

Also, $3x^2$ is $O(x^2)$

So, $f(x)$ is $O(\max(x \log x, x^2)) = O(x^2)$ as $x \log x \leq x^2$ for $x > 1$

33. The quantification $\exists!x P(x)$ denotes the proposition "There exists a unique x such that $P(x)$ is true", express the quantification using universal and existential quantifications and logical operators:

- (A) $\exists x P(x) \vee \forall x \forall y ((P(x) \vee P(y)) \rightarrow x = y)$
- (B) $\forall x P(x) \wedge \forall x \forall y ((P(x) \vee P(y)) \rightarrow x = y)$
- (C) $\exists x P(x) \wedge \forall x \forall y ((P(x) \wedge P(y)) \rightarrow x = y)$
- (D) $\exists x P(x) \wedge \exists x \exists y ((P(x) \vee P(y)) \rightarrow x = y)$

Answer: C

34. If F and G are Boolean functions of degree n . Then, which of the following is true?

- (A) $F \leq F + G$ and $F G \leq F$
- (B) $G \leq F + G$ and $F G \geq G$
- (C) $F \geq F + G$ and $F G \leq F$
- (D) $G \geq F + G$ and $F G \leq F$

Answer: A

35. Match the following identities/laws to their corresponding name:

- | | |
|---------------------------|-----------------|
| (a) $x + x = x$ | |
| $x \cdot x = x$ | i. Dominance |
| (b) $x + 0 = x$ | |
| $x \cdot 1 = x$ | ii. Absorption |
| (c) $x + 1 = 1$ | |
| $x \cdot 0 = 0$ | iii. Idempotent |
| (d) $x \cdot (x + y) = x$ | iv. Identity |

Codes:

- (a) (b) (c) (d)
- (A) iii iv i ii
- (B) iv iii i ii
- (C) iv iii ii i
- (D) iii iv ii i

Answer: A

36. Which of the following shall be a compound proposition involving the propositions p , q and r , that is true when exactly two of the p , q and r are true and is false otherwise?

- (A) $(p \vee q \wedge \neg r) \vee (p \vee q \wedge r) \wedge (\neg p \wedge q \vee r)$
- (B) $(p \wedge q \vee r) \wedge (p \wedge q \wedge r) \vee (\neg q \vee \neg p \wedge \neg r)$
- (C) $(p \wedge q \wedge \neg r) \vee (p \vee \neg q \wedge r) \vee (\neg p \wedge q \wedge r)$
- (D) $(p \vee r \wedge q) \vee (p \wedge q \wedge r) \vee (\neg p \wedge q \wedge r)$

Answer: C

37. The truth value of the statements:

$\exists!x P(x) \rightarrow \exists x P(x)$ and $\exists!x \neg P(x) \rightarrow \neg \forall x P(x)$, (where the notation $\exists!x P(x)$ denotes the proposition "There exists a unique x such that $P(x)$ is true") are:

- (A) True and False
- (B) False and True
- (C) False and False
- (D) True and True

Answer: D

38. How many different Boolean functions of degree 4 are there?

- (A) 2^4 (B) 2^8
(C) 2^{12} (D) 2^{16}

Answer: D

Explanation:

$$\begin{aligned}\text{Number of Boolean expression} &= 2^{2^n} \\ &= 2^{2^4} = 2^{16}\end{aligned}$$

39. A Boolean operator Θ is defined as follows:

$$1\Theta 1=1, 1\Theta 0=0, 0\Theta 1=0 \text{ and } 0\Theta 0=1$$

What will be the truth value of the expression $(x\Theta y)\Theta z = x\Theta(y\Theta z)$?

- (A) Always false
(B) Always true
(C) Sometimes true
(D) True when x, y, z are all true

Answer: B

40. Which one of the following is decimal value of a signed binary number 1101010, if it is in 2's complement form?

- (A) -42 (B) -22
(C) -21 (D) -106

Answer: B

41. Identify the operation which is commutative but not associative ?

- (A) OR (B) NOR
(C) EX-OR (D) NAND

Answer: B or D

42. Match the following :

- | | |
|---------|---------------------------|
| a. TTL | 1. High fan out |
| b. ECL | 2. Low propagation delay |
| c. CMOS | 3. High power dissipation |

Code :

a b c

- (A) 3 2 1
(B) 1 2 3
(C) 1 3 2
(D) 3 1 2

Answer: A

43. If an integer needs two bytes of storage, then the maximum value of a signed integer is

- (A) $2^{16} - 1$ (B) $2^{15} - 1$
(C) 2^{16} (D) 2^{15}

Answer: B

44. A chip having 150 gates will be classified as

- (A) SSI (B) MSI
(C) LSI (D) VLSI

Answer: B

45. If an integer needs two bytes of storage, then the maximum value of unsigned integer is

- (A) $2^{16} - 1$ (B) $2^{15} - 1$
(C) 2^{16} (D) 2^{15}

Answer: A

46. Negative numbers cannot be represented in

- (A) signed magnitude form (B) 1's complement form
(C) 2's complement form (D) none of the above

Answer: D

47. The proposition $\sim q \vee p$ is equivalent to

- (A) $p \rightarrow q$ (B) $q \rightarrow p$
(C) $p \leftrightarrow q$ (D) $p \vee q$

Answer: B

48. The proposition $\sim p \wedge q$ is equivalent to

- (A) $p \wedge q$ (B) $q \wedge p$
(C) $p \vee q$ (D) $p \vee \sim q$

Answer: A

49. The absorption law in Boolean algebra say that

- (A) $X + X = X$
(B) $X \cdot X = X$
(C) $x + x \cdot y = x$
(D) None of the above

Answer: C

50. The number of 1's present in the binary representation of

$$10 \times 256 + 5 \times 16 + 5 \text{ is}$$

- (A) 5 (B) 6
(C) 7 (D) 8

Answer: B

51. The hexadecimal number equivalent to $(1762.46)_8$ is

- (A) 3F2.89 (B) 3F2.98
(C) 2F3.89 (D) 2F3.98

Answer: B

52. 8-bit 1's complement form of -77.25 is

- (A) 01001101.0100
(B) 01001101.0010
(C) 10110010.1011
(D) 10110010.1101

Answer: C

53. The decimal number equivalent of $(4057.06)_8$ is

- (A) 2095.75
(B) 2095.075
(C) 2095.937
(D) 2095.0937

Answer: D

54. 12-bit 2's complement of -73.75 is

- (A) 01001001.1100
(B) 11001001.1100
(C) 10110110.0100

(D) 10110110.1100

Answer: C

55. Encoding of data bits 0011 into 7-bit even Parity Hamming Code is

(A) 0011110

(B) 0101110

(C) 0010110

(D) 0011100

Answer: A

56. What is decimal equivalent of BCD 11011.1100?

(A) 22.0

(B) 22.2

(C) 20.2

(D) 21.2

Answer: B

57. The simplified form of the Boolean expression $(X+Y+XY)(X+Z)$ is

(A) $X + Y + ZX + Y$

(B) $XY - YZ$

(C) $X + YZ$

(D) $XZ + Y$

Answer: C

58. The answer of the operation $(10111)_2 * (1110)_2$ in hex equivalence is

(A) 150

(B) 241

(C) 142

(D) 101011110

Answer: C

59. How many 1's are present in the binary representation of

$$3 \times 512 + 7 \times 64 + 5 \times 8 + 3$$

(A) 8

(B) 9

(C) 10

(D) 11

Answer: B

60. The Boolean expression $x'y'z+yz+xz$ is equivalent to:

(A) x

(B) y

(C) z

(D) $x+y+z$

Answer: C

61. The characteristic equation of a JK flip flop is:

(A) $Q_{n+1} = J \cdot Q_n + K \cdot Q_n$

(B) $Q_{n+1} = J \cdot Q'_n + K' \cdot Q_n$

(C) $Q_{n+1} = Q_n J \cdot K$

(D) $Q_{n+1} = (J+K)Q_n$

Answer: B

62. In order to implement a n variable switching function, a MUX must have:

- (A) 2^n inputs
- (B) 2^{n+1} inputs
- (C) 2^{n-1} inputs
- (D) $2^n - 1$ inputs

Answer: A

63. The octal equivalent of hexadecimal $(A.B)_{16}$ is:

- (A) 47.21
- (B) 12.74
- (C) 12.71
- (D) 17.21

Answer: B

64. A reduced state table has 18 rows. The minimum number of flip flops needed to implement the sequential machine is:

- (A) 18
- (B) 9
- (C) 5
- (D) 4

Answer: C

65. A relation R in $\{1,2,3,4,5,6\}$ is given by $\{(1,2),(2,3),(3,4),(4,4),(4,5)\}$. This relation is:

- (A) reflexive
- (B) symmetric
- (C) transitive
- (D) not reflexive, not symmetric and not transitive

Answer: D

66. The dual of the switching function $x+yz$ is:

- (A) $x+yz$
- (B) $x'+y'z'$
- (C) $x(y+z)$
- (D) $x'(y'+z')$

Answer: D

67. An example of a tautology is:

- (A) $x \vee y$
- (B) $x \vee (\sim y)$
- (C) $x \vee (\sim x)$
- (D) $(x \Rightarrow y) \wedge (x \Leftarrow y)$

Answer: C

68. The octal equivalent of the hexadecimal number FF is:

- (A) 100
- (B) 150
- (C) 377
- (D) 737

Answer: C

69. The idempotent law in Boolean algebra says that:

- (A) $\sim(\sim x) = x$
- (B) $x+x = x$
- (C) $x+xy = x$

(D) $x(x+y)=x$

Answer: B

70. A WFF that is equivalent to the WFF $x \Rightarrow y$ is:

- (A) $y \Rightarrow x$ (B) $\sim y \Rightarrow x$
(C) $\sim y \Rightarrow \sim x$ (D) $y \Rightarrow \sim x$

Answer: B

71. Simplified form of Boolean expression $xy+(\sim x)z+yz$ is:

- (A) $xy+(\sim x)z$ (B) $(\sim x)y+(\sim x)z$
(C) $(\sim x)y+xz$ (D) $xy+xz$

Answer: A

72. The dual of the switching function $F=x+yz$ is given by:

- (A) $x+yz$
(B) $x(y+z)$
(C) $(\sim x)+(\sim y)(\sim z)$
(D) $(\sim x)((\sim y)+(\sim z))$

Answer: B

73. 2's complement of -100 is:

- (A) 00011100
(B) 10011101
(C) 10011100
(D) 11100100

Answer: C

74. Which of the following expression remove hazard form: $xy+zx'$?

- (A) $xy+zx'$
(B) $xy+zx'$
(C) $xy+zx'+yz$
(D) $xy+zx'+wz$

Answer: C

75. How many 1's are present in the binary representation of $15 \times 256 + 5 \times 16 + 3$:

- (A) 8
(B) 9
(C) 10
(D) 11

Answer: A

76. What is the maximum counting speed of a 4-bit binary counter which is composed of Flip-Flop with a propagation delay of 25ns?

- (A) 1MHz
(B) 10MHz
(C) 100MHz
(D) 4MHz

Answer: B

77. The hexadecimal equivalent of $(10111)_2 \times (1110)_2$ is:

- (A) 150 (B) 241
(C) 142 (D) 101011110

Answer: C

78. An example of a self complementing code is:

- (A) 8421 code (B) Gray code
(C) Excess-3 code (D) 7421 code

Answer: C

79. Which of the following logic is the fastest ?

- (A) RTL (B) ECL (C) HTL (D) HCL

Answer: B

80. The number of 1's present in the binary representation of $(3 \times 5^{12} + 7 \times 6^4 + 5 \times 8 + 3)_{10}$ is:

- (A) 8
(B) 9
(C) 10
(D) 11

Answer: B

81. Which of the following expression removes static hazard from a two level AND-OR gate implementation of $xy + zx'$

- (A) $xy + zx'$
(B) $xy + zx' + wyz$
(C) $xy + zx' + yz$
(D) $xy + zx' + wz$

Answer: C

82. In a weighted code with weight 6, 4, 2, -3 the decimal 5 is represented by:

- (A) 0101
(B) 0111
(C) 1011
(D) 1000

Answer: C

83. Which of the following is divisible by 4?

- (A) 100101100
(B) 1110001110001
(C) 11110011
(D) 10101010101010

Answer: A

84. $(101011)_2 = (53)_b$, then b is equal to:

- (A) 4 (B) 8
(C) 10 (D) 16

Answer: B

85. The logic expression $x'yz' + x'yz + xyz' + xyz$ reduces to:

- (A) $x'z$ (B) xyz
(C) y (D) yz

Answer: C

86. Which of the following binary number is the same as its 2's complement:

- (A) 1010 (B) 0101
(C) 1000 (D) 1001

Answer: C

87. An example of a binary number which is equal to its 2's complement is:

- (A) 1100 (B) 1001
(C) 1000 (D) 1111

Answer: C

88. When a tri-state logic device is in the third state, then:

- (A) it draws low current
(B) it does not draw any current
(C) it draws very high current
(D) it presents a low impedance

Answer: D

89. An example of a connective which is not associative is:

- (A) AND (B) OR
(C) EX-OR (D) NAND

Answer: D

90. Essential hazards may occur in:

- (A) Combinational logic circuits
(B) Synchronous sequential logic circuits
(C) Asynchronous sequential logic circuits working in the fundamental mode
(D) Asynchronous sequential logic circuits working in the pulse mode

Answer: C

91. The characteristic equation of a T flip-flop is:

- (A) $Q_{n+1} = TQ'_n + T'Q_n$
(B) $Q_{n+1} = T + Q_n$
(C) $Q_{n+1} = TQ_n$
(D) $Q_{n+1} = T'Q'_n$

The symbols used have the usual meaning.

Answer: A

92. The equivalent hexadecimal notation for octal number 2550276 is:

- (A) FADED (B) AEOBE
(C) ADOBE (D) ACABE

Answer: C

93. Equivalent logical expression for the Well Formed Formula (WFF),

$$\sim(\Box x) F[x]$$

is

- (A) $\Box x (\sim F[x])$ (B) $\sim(\Box x) F[x]$
(C) $\Box x (\sim F[x])$ (D) $\Box x F[x]$

Answer: C

94. Let us assume that you construct ordered tree to represent the compound proposition

$$(\sim(p \wedge q)) \leftrightarrow (\sim p \vee \sim q).$$

Then, the prefix expression and post-fix expression determined using this ordered tree are given as and respectively.

- (A) $\leftrightarrow \sim \wedge pq \vee \sim \sim pq, pq \wedge \sim p \sim q \sim \vee \leftrightarrow$
(B) $\leftrightarrow \sim \wedge pq \vee \sim p \sim q, pq \wedge \sim p \sim q \sim \vee \leftrightarrow$
(C) $\leftrightarrow \sim \wedge pq \vee \sim \sim pq, pq \wedge \sim p \sim q \vee \leftrightarrow$
(D) $\leftrightarrow \sim \wedge pq \vee \sim p \sim q, pq \wedge \sim p \sim q \vee \leftrightarrow$

95. If the proposition $\neg P \Rightarrow Q$ is true, then the truth value of the proposition $\neg P \vee (P \Rightarrow Q)$ is:
(A) True (B) Multi-Valued
(C) False (D) Cannot determined

Answer: D

96. The proposition $(p \rightarrow q) \wedge (\sim q \vee p)$ is equivalent to:

- (A) $q \rightarrow p$
(B) $p \rightarrow q$
(C) $(q \rightarrow p) \wedge (p \rightarrow q)$
(D) $(p \rightarrow q) \vee (q \rightarrow p)$

Answer: C

97. The proposition $\sim q \vee p$ is equivalent to:

- (A) (B) (C) (D)

Answer:

98. In propositional logic $P \leftrightarrow Q$ is equivalent to (Where \sim denotes NOT):

- (A) $\sim(P \vee Q) \wedge \sim(Q \vee P)$ (B) $(\sim P \vee Q) \wedge (\sim Q \vee P)$
(C) $(P \vee Q) \wedge (Q \vee P)$ (D) $\sim(P \vee Q) \rightarrow \sim(Q \vee P)$

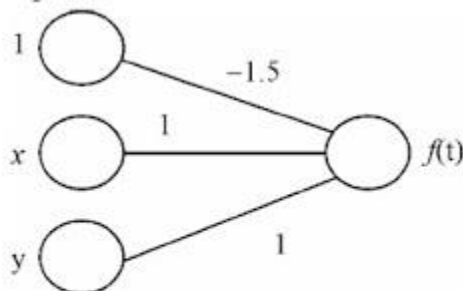
Answer: B

99. The simplified function in product of sums of Boolean function $F(W, X, Y, Z) = \Sigma(0, 1, 2, 5, 8, 9, 10)$ is

- (A) $(W' + X') (Y' + Z') (X' + Z)$
(B) $(W' + X') (Y' + Z') (X + Z)$
(C) $(W' + X') (Y' + Z) (X' + Z)$
(D) $(W' + X') (Y + Z') (X' + Z)$

Answer: A

100. Consider a single perception with weights as given in the following figure:



and $f(t)$ defined as

$$f(t) = \begin{cases} 1, & t > 0 \\ 0, & t \leq 0 \end{cases}$$

The above perception can solve

- (A) OR problem
(B) AND problem
(C) XOR problem
(D) All of the above

Answer: B

101. In Propositional Logic, given P and $P \rightarrow Q$, we can infer

- (A) $\sim Q$ (B) Q

- (C) $P \wedge Q$ (D) $\sim P \wedge Q$

Answer: B

102. Consider the compound propositions given below as:

- (a) $p \vee \sim(p \wedge q)$ (b) $(p \wedge \sim q) \vee \sim(p \wedge q)$ (c) $p \wedge (q \vee r)$

Which of the above propositions are tautologies?

- (A) (a) and (c) (B) (b) and (c)
(C) (a) and (b) (D) (a), (b) and (c)

Answer: Marks to all

103. Which of the following logic expressions is incorrect?

- (A) $1 \oplus 0 = 1$ (B) $1 \oplus 1 \oplus 1 = 1$
(C) $1 \oplus 1 \oplus 0 = 1$ (D) $1 \oplus 1 = 1$

Answer: C

104. Simplified Boolean equation for the following truth table is:

| x | y | z | F |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

- (A) $F = yz' + y'z$ (B) $F = xy' + x'y$
(C) $F = x'z + xz'$ (D) $F = x'z + xz' + xyz$

Answer: C

105. The simplified form of a Boolean equation $(AB' + AB'C + AC)(A'C' + B')$ is :

- (A) AB' (B) $AB'C$
(C) $A'B$ (D) ABC

Answer: A

106. Give a compound proposition involving propositions p, q and r that is true when exactly two of p, q and r are true and is false otherwise.

- (A) $(p \vee q \wedge \neg r) \wedge (p \wedge \neg q \wedge r) \wedge (\neg p \wedge q \wedge r)$
(B) $(p \wedge q \wedge \neg r) \wedge (p \vee q \wedge \neg r) \wedge (\neg p \wedge q \wedge r)$
(C) $(p \wedge q \wedge \neg r) \vee (p \wedge \neg q \wedge r) \wedge (\neg p \wedge q \wedge r)$
(D) $(p \wedge q \wedge \neg r) \vee (p \wedge \neg q \wedge r) \vee (\neg p \wedge q \wedge r)$

Answer: D

107. $(A + B)(AB)'$ is equivalent to

- (A) $A \square B$ (B) $A \odot B$
(C) $(A \square B) \odot A$ (D) $(A \odot B) \square A$

Answer: A

108. $AB + (A+B)'$ is equivalent to

- (A) $A \square B$
- (B) $A \circ B$
- (C) $(A \square B) \circ A$
- (D) $(A \circ B) \square \square A$

Answer: B

109. If $A \oplus B = C$, then:

- (A) $A \oplus C = B$
- (B) $B \oplus C = A$
- (C) $A \oplus B \oplus C = 1$
- (D) $A \oplus B \oplus C = 0$

Answer: A,B,D

3. Let A and B be sets in a finite universal set U. Given the following:

$|A - B|$, $|A \oplus B|$, $|A| + |B|$ and $|A \cup B|$

Which of the following is in order of increasing size ?

- (A) $|A - B| \leq |A \oplus B| \leq |A| + |B| \leq |A \cup B|$
- (B) $|A \oplus B| \leq |A - B| \leq |A \cup B| \leq |A| + |B|$
- (C) $|A \oplus B| \leq |A| + |B| \leq |A - B| \leq |A \cup B|$
- (D) $|A - B| \leq |A \oplus B| \leq |A \cup B| \leq |A| + |B|$

Answer: D