RAVI MATHS TUITION CENTER ,GKM COLONY, CHENNAI- 82. PH: 8056206308

Discrete Mathematics FULL TEST

12th Standard

Maths

Reg.No. : | | | | | | |

Exam Time : 03:00:00 Hrs Total Marks : 90

ANSWER ALL THE QUESTIONS. 20 x 1 = 20

1) A binary operation on a set S is a function from
(a) S ⟶ S (b) (SxS) ⟶ S (c) S⟶ (SxS) (d) (SxS) ⟶ (SxS)

2) Subtraction is not a binary operation in
(a) R (b) Z (c) N (d) Q

3) Which one of the following is a binary operation on N?
(a) Subtraction (b) Multiplication (c) Division (d) All the above

4) In the set R of real numbers '*' is defined as follows. Which one of the following is not a binary operation on R?
(a) a*b=min (a.b) (b) a*b= max (a,b) (c) a*b= a (d) $a*b=a^b$

5) The operation * defined by $a*b=\frac{ab}{7}$ is not a binary operation on
(a) Q^+ (b) Z (c) R (d) C

6) In the set Q define a⊙b= a+b+ab. For what value of y, 3⊙(y⊙5)=7?
(a) $y=\frac{2}{3}$ (b) $y=\frac{-2}{3}$ (c) $y=\frac{-3}{2}$ (d) y=4

7) If $a*b=\sqrt{a^2+b^2}$ on the real numbers then * is
(a) commutative but not associative (b) associative but not commutative (c) both commutative and associative (d) neither commutative nor associative

8) Which one of the following statements has the truth value T?
(a) sin x is an even function (b) Every square matrix is non-singular (c) The product of complex number and its conjugate is purely imaginary (d) $\sqrt{5}$ is an irrational number

9) Which one of the following statements has truth value F?
(a) Chennai is in India or $\sqrt{2}$ is an integer (b) Chennai is in India or $\sqrt{2}$ is an irrational number (c) Chennai is in China or $\sqrt{2}$ is an integer (d) Chennai is in China or $\sqrt{2}$ is an irrational number

10) If a compound statement involves 3 simple statements, then the number of rows in the truth table is
(a) 9 (b) 8 (c) 6 (d) 3

11) Which one is the inverse of the statement (PVq)→(pΛq)?
(a) (pΛq)→(pVq) (b) ¬(pvq)→(pΛq) (c) (¬pv¬q)→(¬pΛ¬q) (d) (¬pΛ¬q)→(¬pV¬q)

12) Which one is the contrapositive of the statement (pVq)⟶r?
(a) ¬r→(¬pΛ¬q) (b) ¬r⟶(pVq) (c) r⟶(pΛq) (d) p⟶(qVr)

13) The truth table for (p ∧ q) ∨ ¬q is given below

p	q	(p ∧ q) ∨ (¬q)
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is true?

(a) (a)(b)(c)(d) (b) (a)(b)(c)(d) (c) (a)(b)(c)(d) (d) (a)(b)(c)(d)

T	T	T	T

T	F	T	T

T	T	F	F

T	F	F	F

14) In the last column of the truth table for ¬(p ∨ ¬q) the number of final outcomes of the truth value 'F' are

(a) 1 (b) 2 (c) 3 (d) 4

15) Which one of the following is incorrect? For any two propositions p and q, we have

(a) ¬ (p∨q) ≡ ¬ p ∧ ¬q (b) ¬ (p∧ q)≡¬p ∨ ¬q (c) ¬ (p ∨ q)≡¬p∨¬q (d) ¬(¬p)≡ p

16)

p	q	(p ∧ q) ⟶ ¬q
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is correct for the truth value of (p ∧ q)⟶ ¬p p?

(a)

(a)	(b)	(c)	(d)
T	T	T	T

(b)

(a)	(b)	(c)	(d)
F	T	T	T

(c)

(a)	(b)	(c)	(d)
F	F	T	T

(d)

(a)	(b)	(c)	(d)
T	T	T	F

17) The dual of ¬(p V q) V [p V (p ∧ ¬r)] is

(a) ¬(p ∧ q) ∧ [p V (p ∧ ¬r)] (b) (p ∧ q) ∧ [p ∧ (p V ¬r)] (c) ¬(p ∧ q) ∧ [p ∧ (p ∧ r)] (d) ¬(p ∧ q) ∧ [p ∧ (pV ¬r)]

18) The proposition p ∧ (¬p ∨ q) is

(a) a tautology (b) a contradiction (c) logically equivalent to p ∧ q (d) logically equivalent to p ∨ q

19) Determine the truth value of each of the following statements:

(a) 4+2=5 and 6+3=9

(b) 3+2=5 and 6+1=7

(c) 4+5=9 and1+2= 4

(d) 3+2=5 and 4+7=11

(a)

(a)	(b)	(c)	(d)
F	T	T	T

(b)

(a)	(b)	(c)	(d)
T	F	T	F

(c)

(a)	(b)	(c)	(d)
T	T	F	F

(d)

(a)	(b)	(c)	(d)
F	F	T	T

20) Which one of the following is not true?

(a) Negation of a negation of a statement is the statement itself

(b) If the last column of the truth table contains only T then it is a tautology.

(c) If the last column of its truth table contains only F then it is a contradiction

(d) If p and q are any two statements then p↔q is a tautology.

Answer any 7 questions in which question no. 30 is compulsory 7 x 2 = 14

21) Examine the binary operation (closure property) of the following operations on the respective sets (if it is not, make it binary)

$a * b = \left(\frac{a-1}{b-1}\right), \forall a, b \in Q$

22) Let $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ be any two boolean matrices of the same type. Find AvB and A^B.

23) Write the converse, inverse, and contrapositive of each of the following implication.

(i) If x and y are numbers such that x = y, then $x^2 = y^2$

(ii) If a quadrilateral is a square then it is a rectangle.

24) Verify whether the following compound propositions are tautologies or contradictions or contingency

((p V q)∧ ~p) → q

25) Verify whether the following compound propositions are tautologies or contradictions or contingency
((p⟶ q) ∧ (q ⟶ r)) ⟶ (p ⟶ r)

26) Check whether the statement p→(q→p) is a tautology or a contradiction without using the truth table.

27) Prove that p→(¬q V r) ≡ ¬pV(¬qVr) using truth table.

28) Show that p v (q ∧ r) is a contingency.

29) In the set of integers under the operation * defined by a * b = a + b - 1. Find the identity element.

30) Let S be the set of positive rational numbers and is defined by a * b = $\frac{ab}{2}$. Then find the identity element and the inverse of 2.

Answer any 7 questions in which question no. 40 is compulsory 7 x 3 = 21

31) Determine whether $*$ is a binary operation on the sets given below.
a*b=b=a.|b| on R

32) Determine whether $*$ is a binary operation on the sets given below.
(A*v)=a√b is binary on R

33) Let *be defined on R by (a*b)=a+b+ab-7. is*binary on R? If so, find $3\left(\frac{-7}{15}\right)$.

34) Let A={a+$\sqrt{5}$ b:a,b∈Z}. Check whether the usual multiplication is a binary operation on A.

35) Consider the binary operation $*$ defined on the set A = {a,b,c, d} by the following table:

*	a	b	c	d
a	a	c	b	d
b	c	d	a	a
d	d	b	a	c

Is it commutative and associative?

36) Let $A = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{pmatrix}, C = \begin{pmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{pmatrix}$ be any three boolean matrices of the same type.
Find A∧B

37) Let $A = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{pmatrix}, C = \begin{pmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{pmatrix}$ be any three boolean matrices of the same type.
Find (A∧B)∨C

38) In (z, *) where * is defined by a * b = ab, prove that * is not a binary operation on z.

39) Let G = {1, i,-1, -i} under the binary operation multiplication. Find the inverse of all the elements.

40) In (z, *) where * is defined as a * b = a + b + 2. Verify the commutative and associative axiom.

ANSWER 7 QUESTIONS. 7 x 5 = 35

41) How many rows are needed for following statement formulae?
((p ∧ q) ∨ (¬r ∨¬s)) ∧ (¬ t ∧ v))

42) Consider p⟶q : If today is Monday, then 4 + 4 = 8.
Here the component statements p and q are given by,
p: Today is Monday; q: 4 + 4 = 8.

The truth value of p→q is T because the conclusion q is T.

An important point is that p→q should not be treated by actually considering the meanings of p and q in English. Also it is not necessary that p should be related to q at all.

Chapter

43) Construct the truth table for $(p \overline{\vee} q) \wedge (p \overline{\vee} \neg q)$

44) Define an operation*on Q as follows: a*b=$\left(\frac{a+b}{2}\right)$; a,b ∈Q. Examine the closure, commutative, and associative properties satisfied by*on Q.

45) Define an operation∗ on Q as follows: a*b=$\left(\frac{a+b}{2}\right)$; a,b ∈Q. Examine the existence of identity and the existence of inverse for the operation * on Q.

46) Let A be Q\{1}. Define ∗ on A by x*y = x + y − xy . Is ∗ binary on A? If so, examine the commutative and associative properties satisfied by ∗ on A.

47) Verify

(i) closure property,

(ii) commutative property,

(iii) associative property,

(iv) existence of identity, and

(v) existence of inverse for following operation on the given set

m*n=m+n-mn; m,n ∈Z

48) Verify

(i) closure property,

(ii) commutative property,

(iii) associative property,

(iv) existence of identity, and

(v) existence of inverse for the operation $+_5$ on Z_5 using table corresponding to addition modulo 5.

49) Let M=$\left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\}\right\}$ and let ∗ be the matrix multiplication. Determine whetherM is closed under ∗ . If so, examine the existence of identity, existence of inverse properties for the operation ∗ on M.

50) Let A be Q\{1}. Define ∗ on A by x*y = x + y − xy . Is ∗ binary on A? If so, examine the existence of identity, existence of inverse properties for the operation ∗ on A.