U.G. 3rd Semester Examination - 2021

MATHEMATICS

[HONOURS]

Course Code : BMTMSEHT305

Course Title : Logic and Sets

Full Marks : 50 Time : 2 Hours

The figures in the right-hand margin indicate marks.

Answer all the questions by choosing correct alternative: $2\times25=50$

1. Which of the following is correct for A–B?

   a) $A\cap B$ b) $A^c\cap B$

   c) $A\cap B^c$ d) $A^c\cap B^c$

2. If $A=\{1,2,3,4,5\}$, then the number of proper subsets of A is

   a) 30 b) 31

   c) 32 d) 48

3. Which of the following is true?

   a) $p\vee F\equiv F$ b) $p\vee T\equiv T$

   c) $p\vee\sim p\equiv F$ d) $p\wedge\sim p\equiv T$

4. If A and B are two sets, then $A\cap(A\cup B)^c$ equals:

   a) A b) B

   c) ϕ d) None

5. Which of the following is logically equivalent to $\sim(p\vee q)$?

   a) $p\vee\sim q$ b) $\sim p\vee q$

   c) $\sim p\wedge\sim q$ d) $\sim p\vee\sim q$

6. If A and B are finite sets, then which of the following is correct?

   a) $n(A-B)=n(A)-n(B)$

   b) $n(A-B)=n(B-A)$

   c) $n(A-B)=n(B)-n(A\cap B)$

   d) $n(A-B)=n(A)-n(A\cap B)$

7. The symmetric difference of A={1, 2,3} and B={3, 4, 5} is

   a) {1, 2} b) {3, 4}

   c) {1, 2, 4, 5} d) {1, 2, 3, 4, 5}

8. If n(A)=p and n(B)=q, then n(A×B) is equal to

   a) p+q b) pq

   c) p^2 d) q^2

9. Let p: This computer is good,
q: This computer is cheap.
Then 'This computer is costly but good'. is best represented by

a) $\sim q \vee p$ b) $\sim q \wedge p$

c) $\sim p \vee \sim p$ d) $\sim q \wedge \sim p$

10. In a group 52 persons, 16 drink tea but not coffee, while 33 drink tea. How many persons drink coffee but not tea?

a) 17 b) 36

c) 23 d) 19

11. Which of the following is not a subset of $\{x \in \mathbb{R}: 1 \le x \le z\}$?

a) $\left\{x \in \mathbb{R}\ \frac{3}{2} \le x \le 2 \text{ and } x \text{ is rational}\right\}$

b) $\left\{|\cos x| + 1 : x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]\right\}$

c) $\{x \in \mathbb{R}: x^2 - 3x + 2 = 0\}$

d) $\{x \in \mathbb{R}: x^2 - 5x + 6 = 0\}$

12. Which of the following is true?

a) $A \Delta B = (A - B) \cap (B - A)$

b) $A \cap B = A \cup (A \cap B)$

c) $(A' \cap B')' = A \cup B$

d) $(A' \cup B')' = A \cap B$

13. Which of the following is the empty set?

a) $\{1, 2, 3\} \cap [0, 4]$

b) $\left\{e^x \in \mathbb{R}: x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]\right\}$

c) $\{x \in \mathbb{R}: x^2 + 1 = 0\}$

d) $\{x \in \mathbb{R}: x^3 + 1 = 0\}$

14. What is the greatest lower bound (g.l.b) of the set $\left\{\frac{1}{n}: n \in \mathbb{N}\right\}$?

a) 0 b) 1

c) ∞ d) $\frac{1}{2}$

15. Set A & B have n-elements in common. How many elements will (A×B) and (B×A) have in common?

a) 0 b) 1

c) n d) n^2

16. If A is the set of even natural numbers less than 8 and B is the set of prime numbers less than 7, then the number of relations from A to B is,

a) 2^9 b) 9^2

c) 9 d) 2^3

17. The relation ρ on $\mathbb{Z}$ defined by "apb" if and only if (a–b) is divisible by 5" for $a, b \in \mathbb{Z}$ is,

a) only reflexive

b) reflexive and transitive but not symmetric

c) equivalance relation

d) anti-symmetric

18. "Let f be a map from a set A to its power set P(A). Then $f : A \to P(A)$ is <u>not</u> surjective"–This statement is

a) Always true

b) Always false

c) Sometimes true

d) True only in one scenario

19. "P : An equivalence relation on a set determines a partition of the set". Which one of the following is correct?

a) The statement 'P' is false

b) The converse of the statement 'P' is false

c) Both 'P' and its converse are true

d) The statement 'P' is true but its converse is false

20. Which one of the following is <u>NOT</u> an infinite set?

a) The set of all bijective mappings from $\mathbb{N} \to \mathbb{R}$.

b) The set of all bijective mapping from $\mathbb{N} \to \mathbb{Z}$

c) $\{x \in \mathbb{R} : e^x \leq 1\}$

d) $\{x \in \mathbb{R} : |\cos x| = 0\}$

21. Which of the following is equivalent to the statement– "If it rains, I will take my umbrella."

a) If it does not rain, I will not take my umbrella.

b) If I take my umbrella, it will rain.

c) If I do not take my umbrella, then it must be not raining.

d) None of these

22. Let, p and q be propositions. Then which of the following is equivalent to the statement $p \Rightarrow q$?

a) $\neg p \Rightarrow \neg q$

b) $\neg q \Rightarrow \neg p$

c) a sufficient condition for p is q

d) a necessary condition for q is p

23. Which of the following is the converse of "$p \Rightarrow q$"?

a) $\neg q \Rightarrow \neg p$ b) $\neg p \vee \neg q$

c) $q \Rightarrow p$ d) $\neg p \wedge q$

24. Let P(x) be the statement "cosX>X". Then what are the truth values of the propositions P(O) and $P\left(\frac{\pi}{2}\right)$ respectively?

a) T, T b) F, F

c) T, F d) F, T

25. What is the logical expression for the following statement "you cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old".

q : you can ride the roller coaster.

r : you are under 4 feet tall.

s : you are older than 16 years old.

a) $(r \wedge \neg s) \rightarrow \neg q$ b) $(r \vee \neg s) \rightarrow \neg q$

c) $r \vee s \rightarrow q$ d) $r \vee s \rightarrow \neg q$

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