Discrete Mathematics Question Bank

PCC CS401

February 15, 2025

1. Let A and B be two non-empty sets. Then, $(A \cup B)^c =$

   (a) $A^c \cup B^c$

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

   (c) $A \cap B$

   (d) $A \cup B$

2. Let A and B be two non-empty sets. Then, $A \triangle B =$

   (a) $A \cup B$

   (b) $A \cap B$

   (c) $(A \cup B) - (A \cap B)$

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

3. Let S be a non-empty set and ρ be a relation on S. ρ is reflexive and transitive. Then ρ is

   (a) equivalence relation

   (b) partial order relation

   (c) both

   (d) none

4. Let $\mathbb{N}$ be the set of natural numbers with the relation '$<$' with its usual meaning. Then '$<$' is

   (a) reflexive

   (b) symmetric

   (c) transitive

   (d) none

5. Let us consider the set of integers $\mathbb{Z}$ with the relation 'ρ' defined as '$a\rho b$' if and only if $(a+b)$ is an even number. Then ρ is

   (a) partial order relation

(b) equivalence relation
(c) none
(d) both

6. Let S be a non-empty set with an equivalence relation 'ρ'. Consider $a, b \in S$ such that a is not related to b. Then
   (a) $cl(a) = cl(b)$
   (b) $cl(a) \subset cl(b)$
   (c) $cl(b) \subset cl(a)$
   (d) $cl(a) \cap cl(b) = \emptyset$

7. Let S be the set of all the divisors of 12. Consider the partial order relation '$\leq$' on S as '$a \leq b$' if and only if a divides b, for $a, b \in S$. Then
   (a) $2 \leq 3$
   (b) $3 \leq 4$
   (c) $4 \leq 6$
   (d) $3 \leq 6$

8. Let us consider the set of integers $\mathbb{Z}$ with the equivalence relation 'ρ', defined as '$a\rho b$' if and only if $(a + b)$ is an even number. Then
   (a) $cl(4) = \{4\}$
   (b) $cl(4) = \{2, 4, 6, \dots\}$
   (c) $cl(4) = \mathbb{Z}$
   (d) $cl(4) = \{0, \pm 2, \pm 4, \pm 6, \dots\}$

9. Let us consider the set of integers $\mathbb{Z}$ with a relation 'ρ', defined on $\mathbb{Z}$ as '$a\rho b$' if and only if $(a - b)$ is divisible by 3, for $a, b \in \mathbb{Z}$. Then
   (a) ρ is a partial order relation
   (b) ρ is an equivalence relation
   (c) none
   (d) both

10. Let us consider the set of integers $\mathbb{Z}$ with a relation 'ρ', defined on $\mathbb{Z}$ as '$a\rho b$' if and only if a divides b, for $a, b \in \mathbb{Z}$. Then
    (a) ρ is an equivalence relation
    (b) ρ is a partial order relation
    (c) both
    (d) none

11. Let us consider the assignment $f : \mathbb{R} \to \mathbb{R}$ such that $f(x) = \frac{1}{x}$ for $x \in \mathbb{R}$. Then

    (a) f is an injective mapping

    (b) f is an onto mapping

    (c) both

    (d) none

12. Let us consider the assignment $f : \mathbb{R} \to \mathbb{R}$ such that $f(x) = x^2$ for $x \in \mathbb{R}$. Then

    (a) f is a surjective mapping

    (b) f is an injective mapping

    (c) both

    (d) none

13. Let us consider the assignment $f : \mathbb{Z} \to \mathbb{Z}$ such that $f(x) = x^2$ for $x \in \mathbb{Z}$. Then

    (a) f is a injective mapping

    (b) f is an onto mapping

    (c) both

    (d) none

14. Let us consider the assignment $f : \mathbb{N} \to \mathbb{N}$ such that $f(n) = n + 1$ for $n \in \mathbb{N}$. Then

    (a) f is an injective mapping

    (b) f is a surjective mapping

    (c) both

    (d) none

15. Let us consider the assignment $f : \mathbb{R} \to \mathbb{R}$ such that $f(n) = n + 1$ for $n \in \mathbb{R}$. Then

    (a) f is an injective mapping

    (b) f is an onto mapping

    (c) f is a bijective mapping

    (d) f is not a mapping

16. Let us consider the set of natural numbers $\mathbb{N}$ with the relation $\leq$ with its usual meaning. Then

    (a) $\text{lub}\{2, 6\} = 6$

    (b) $\text{glb}\{2, 6\} = 2$

(c) both

(d) none

17. Let us consider the poset $(\mathsf{P},)$, where P is the set of positive integers and $\leq$ stands for a $\leq b$ iff a divides b. Then

(a) lub$\{3, 4\} = 4$

(b) lub$\{3, 4\} = 3$

(c) lub$\{3, 4\} = 12$

(d) lub$\{3, 4\} = 1$

18. Let $S = \{1, 2, 3\}$ and P be the collection of all proper non-empty subsets of S. Let us define a relation $\leq$ on P as $A \leq B$ iff $A \subseteq B$. Then

(a) *glb* of $\{1\}$ and $\{2\}$ is $\emptyset$

(b) *glb* of $\{1\}$ and $\{2\}$ is $\{1\}$

(c) *glb* of $\{1\}$ and $\{2\}$ is $\{2\}$

(d) *glb* of $\{1\}$ and $\{2\}$ does not exist.

19. Let $S = \{1, 2, 3\}$ and P be the collection of all subsets of S. Let us define a relation $\leq$ on P as $A \leq B$ iff $A \subseteq B$. Then

(a) *lub* of $\{2, 3\}$ and $\{3, 1\}$ is S.

(b) *lub* of $\{2, 3\}$ and $\{3, 1\}$ does not exist.

(c) *lub* of $\{2, 3\}$ and $\{3, 1\}$ is $\{1, 2\}$

(d) *lub* of $\{2, 3\}$ and $\{3, 1\}$ is $\emptyset$

20. Let S be a non-empty set and ρ is a relation defined on S such that ρ is symmetric and transitive. Then ρ is

(a) reflexive

(b) anti-symmetric

(c) both

(d) none