Previous Year GATE Questions

- Q.1 Consider the binary relation $R = \{ (x,y),(x,z),(z,x),(z,y) \}$ on the set $\{x,y,z\}$. Which one of the following is TRUE?
 - (A) R is symmetric but NOT antisymmetric
 - (B) R is Not Symmetric but antisymmetric
 - (C) R is both Symmetric and antisymmetric
 - R is neither Symmetric nor antisymmetric

[GATE 2009, 1 Mark]

- Q.2 A binary relation R on N* N is defined as follows: (a,b) R(c,d) if a \leq c or b \leq d. Consider the following propositions
 - P: R is reflexive
 - X Q: R is transitive

Which one of the following statements is TRUE?

- (A) Both P and Q are true
- (C) P is false and Q are true

- (B) P is true and Q are false
 - (D) Both P and Q are false

[GATE 2016, 2 Marks]

- Q.3 Let R be a relation on the set of ordered pairs of positive integers such that $((p,q),(r,s))\in R$ if and only p-s=q-r. Which one of the following is true about R?
 - (A) Both reflexive and symmetric

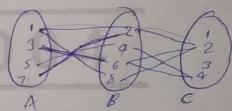
(B) Reflexive but not symmetric

(C) Not reflexive but symmetric

(C) Neither reflexive nor symmetric

[GATE 2015, 2 Marks]

- Q.4 Let R_1 be a relation from $A=\{1,3,5,7\}$ to $B=\{2,4,6,8\}$ and R_2 be another relation from B to $C=\{1,2,3,4\}$ as defined below:
 - (i) An element x in A is related to an element y in B (under R_1) if x+y is divisible by 3.
 - (ii) An element x in B is related to an element y in C (under R_2) if x+y is even but not divisible by 3. Which is the composite relation R_1R_2 from A to C?
 - (A) $R_1 R_2 = \{(1,2), (1,4), (3,3), (5,4), (7,3)\}$
 - (B) $R_1 R_2 = \{(1,2), (1,3), (3,2), (5,2), (7,3)\}$
 - (C) R_1 R_2 ={(1,2), (3,2), (3,4), (5,4), (7,2)}
 - (D) $R_1 R_2 = \{(3,2), (3,4), (5,1), (5,3), (7,1)\}$



[GATE 2004, 1 Mark]

- Q.5 Let S be a set of n elements. The number of ordered pairs in the largest and the smallest equivalence relations on S are
 - (A) n and n
- (B) n^2 and n
- (C) n^2 and 0
- (D) n and 1
- Q.6 Let R and S be any two equivalence relations on a non-empty set A. Which one of the following statements is TRUE?
 - (A) $R \cap S$, $R \cup S$ are both equivalence relations
 - (B) R ∪ S is an equivalence relations

1	C) $R \cap S$ is an equivalence relations				
	D) Neither $R \cap S$, $R \cup S$ are both equivalence relative	ione			
	e, a both equivalence relati	lions	[CATE 1000 1 Man-1-1		
Q.7	Consider the binary relation:		[GATE 1998, 1 Mark]		
	$S=\{(x,y) \mid y=x+1 \text{ and } x, y \in \{0,1,2,\}\}$				
	The reflexive transitive closure of S is				
	(A) $\{(x,y) \mid y > x \text{ and } x, y \in \{0,1,2,\}\}$				
N	(B) $\{(x,y) \mid y \ge x \text{ and } x, y \in \{0,1,2,\}\}$				
	(C) $\{(x,y) \mid y \le x \text{ and } x, y \in \{0,1,2,\dots\}\}$				
	(D) $\{(x,y) \mid y \le x \text{ and } x, y \in \{0,1,2,\}\}$				
			[GATE 2004, 1 Mark]		
Q.8	The number of different n*n symmetric matrices with	n each elements being either	r 0 or 1 is: (Note: power(2,		
	x) is same as 2 ^s)				
	(A) Power(2,n)	(B) Power $(2, n^2)$			
	(C) Power $(2, (n^2 + n)/2)$	(D) Power $(2, (n^2-n)/2)$			
			[GATE 2004, 1 Mark]		
Q.9	The binary relation $S = f(\text{empty set})$ on set $A = \{1, 2, 2, 3, 4, 2, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,$				
	(A) Neither reflexive nor symmetric	(B) Reflexive and symm	netric		
	(C) Reflexive and transitive	(D) Transitive and symn	netric		
		(21) (22) (23) (24)	[GATE 2002, 2 Marks]		
Q.10		4), (3,1,), (3,2), (3,3), (3,4)) on the set A = {1,2,3,4}		
	is A) Reflexive, symmetric and transitive				
	Neither reflexive, nor irreflexive but transitive				
	(C) Irreflexive, symmetric and transitive				
	(D) Irreflexive and antisymmetric				
	(E) menerical and analysis		[GATE 1998, 2 Marks]		
Q.11	Suppose $A = \{a,b,c,d\}$ and \prod is the following partition	on of A			
		2 4	Edl x Sd ?		
	(A) List the ordered pairs of the equivalence relatio	n included by \prod	Edl x Sd2		
	(B) Draw the graph of the above equivalence relation	on Ch A			
		COLOR	[GATE 1998, 2 Marks]		
Q.12	The number of equivalence relation on the set {1,2,	3,4) is	JAI		
	(A) 15 (B) 16	(C) 24	(D) 4		
			[GATE 1997, 1 Mark]		
Q.13	Suppose A is a finite set with n elements. The number of elements in the Largest equivalence relation of				
	A is		(D) = 1.1		
	(A) n (B') n^2	(C) 1	(D) n + 1		
			[GATE 1998, 1 Mark]		

Q.16 State whether the following statement are TRUE or FALSE: The union of two equivalence relations is also an equivalence relation. [GATE 1987, 1 Mark] Q.17 Let R be a symmetric and transitive relation on a set A. then (A) R is reflexive and hence an equivalence relations (B) R is reflexive and hence a partial order (C) R is reflexive and hence not an equivalence relations (D) None of the above [GATE 1995, 1 Mark] Q.18 The transitive closure of the relation ((1,2), (2,3), (3,4), (5,4)) on the set A = {1,2,3,4,5,} is			
(ii) R ₁ ∩ R ₂ is an equivalence relation Which of the following is correct? (A) Both assertion (i) is true but assertion (ii) is not true (B) Assertion (ii) is true but assertion (ii) is not true (C) Assertion (ii) is true [GATE 1998, 1 Mark] Q.15 Let R be a non-empty relation on a collection of sets defined ARB if and only if A ∩ B=0. Then, (pick the true statement) (A) R is reflexive and transitive (C) R is an equivalence relations (D) R is not reflexive and not symmetric [GATE 1996, 2 Marks] Q.16 State whether the following statement are TRUE or FALSE: The union of two equivalence relations is also an equivalence relation. [GATE 1987, 1 Mark] Q.17 Let R be a symmetric and transitive relation on a set A. then (A) R is reflexive and hence an equivalence relations (B) R is reflexive and hence a partial order (C) R is reflexive and hence an equivalence relations (B) R is reflexive and hence an equivalence relations (C) R is reflexive and hence an equivalence relations (D) None of the above [GATE 1995, 1 Mark] Q.18 The transitive closure of the relation \(\frac{1}{2}, \frac{2}{2}, \frac{3}{3}, \	Q.14 Let !	R ₁ and R ₂ be two equivalence relations on a set.	Consider the following assertions:
Which of the following is correct? (A) Both assertions are true (B) Assertion (i) is true but assertion (ii) is not true (D) Neither (i) nor (ii) is true [GATE 1998, 1 Mark] Q.15 Let R be a non-empty relation on a collection of sets defined ARB if and only if A ∩ B=Φ. Then, (pick the true statement) (A) R is reflexive and transitive (C) R is an equivalence relations (D) R is not reflexive and not symmetric [GATE 1996, 2 Marks] Q.16 State whether the following statement are TRUE or FALSE: The union of two equivalence relations is also an equivalence relation. Q.17 Let R be a symmetric and transitive relation on a set A. then (A) R is reflexive and hence an equivalence relations (B) R is reflexive and hence an equivalence relations (B) R is reflexive and hence an equivalence relations (C) R is reflexive and hence an equivalence relations (B) R is reflexive and hence an equivalence relations (D) None of the above [GATE 1995, 1 Marks] Q.18 The transitive closure of the relation {(1,2), (2,3), (3,4), (5,4)} on the set A = {1,2,3,4,5,} is (GATE 1995, 1 Marks) Q.19 Let A be a finite set of size n. The number of elements in the power of A*A is (A) 2²² (C) n² (D) 2² (GATE 1993, 1 Marks) Q.20 If she is my friend and you are her friend, then we are friends. Given this, the friend relationship in the context is (i) commutative (ii) transitive (iii) transitive (iii) transitive (iv) equivalence (A) (i), (iii) and (iv) Q.21 How many relations are there on a set with n-elements that are symmetric and a set with n-element are symmetric and a set with n-elements that are reflexive and symmetric? (A) 2*n(n+1)/2 and 2*n,3*n(n+1)/2 (B) 3*n(n+1)/2 and 2*n(n+1)	(i)	R₁ ∪ R₂ is an equivalence relation	
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(iii) implicative (iv)equivalence (A) (i) and (ii) (B) (iii) (c) (i), (ii), (iii) and (iv) (D) none of these Q.21 How many relations are there on a set with n-elements that are symmetric and a set with n-element are symmetric and a set with n-elements that are reflexive and symmetric? (A) $2^{n(n+1)/2}$ and $2^n . 3^{n(n-1)/2}$ (B) $3^{n(n-1)/2}$ and $2^{n(n-1)}$			
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(c) (i), (ii) and (iv) Q.21 How many relations are there on a set with n-elements that are symmetric and a set with n-element are symmetric and a set with n-elements that are reflexive and symmetric? (A) $2^{n(n+1)/2}$ and $2^n . 3^{n(n-1)/2}$ (B) $3^{n(n-1)/2}$ and $2^{n(n-1)}$			
Q.21 How many relations are there on a set with n-elements that are symmetric and a set with n-element are symmetric and a set with n-elements that are reflexive and symmetric? (A) $2^{n(n+1)/2}$ and $2^n \cdot 3^{n(n-1)/2}$ (B) $3^{n(n-1)/2}$ and $2^{n(n-1)}$			
are symmetric and a set with n-elements that are reflexive and symmetric? (A) $2^{n(n+1)/2}$ and $2^n \cdot 3^{n(n-1)/2}$ (B) $3^{n(n-1)/2}$ and $2^{n(n-1)}$	0.21		
(A) $2^{n(n+1)/2}$ and $2^n \cdot 3^{n(n-1)/2}$ (B) $3^{n(n-1)/2}$ and $2^{n(n-1)}$	are symmetric and a set with n-elements that are reflexive and symmetric?		
(A) 2 and 2 .5			
(C) 2010+11/4 and 20(0-1)/4		(C) $2^{n(n+1)/2}$ and $3^{n(n-1)/2}$	$(D)^{2^{n(n+1)/2}}$ and $2^{n(n-1)/2}$
(C) Zalar 2/12 and 3 2/12	PERSONAL PROPERTY.	(C) Za(a+1)/2 and 3a(a+1)/2	r y) 2 and 2

Q.22	The relation "divides" on a set of positive integers is		
	(A) Transitive and symmetric		
C	(B) Transitive and Anti symmetric		
	(C) Symmetric only		
	(D) Transitive only		
Q.23	Suppose that R_1 and R_2 are reflexive relations on a set A		
	Which of the following statements is correct?		
	(A) $R_1 \cap R_2$ is reflexive and $R_1 \cup R_2$ is irreflexive.		
	(B) $R_1 \cap R_2$ is irreflexive and $R_1 \cup R_2$ is reflexive.		
Z.	Both $R_1 \cap R_2$ and $R_1 \cup R_2$ is reflexive		
	(D) Both $R_1 \cap R_2$ and $R_1 \cup R_2$ is irreflexive		
Q.2		lation?	
	(A) {(0,0), (0,2), (2,0), (2,2), (2,3), (3,2), (3,3)}		
	(B) {(0,0), (1,1), (2,2), (3,3)}		
	$\{(0,0), (0,1), (0,2), (1,0), (1,1), (1,2), (2,0)\}$		
0	(D) {(0,0), (0,2), (2,3), (1,1), (2,2)} 25 Let R be the set of all binary relations on the set {1,2,3	Suppose a relation is chosen from	R at random.
Q.	The probability that the chosen relation is reflexive (ro	ound off to 3 decimal places) is	
	2(32-3)/732 = 26/79 =	(0:125) An	[GATE 2020]
Q	.26 Let $U = \{1, 2,, n\}$. Let $A = \{(x, X) x \in X, X \subseteq U\}$. Consider the following two statements	ents on A .
	I. $ A = n2^{n-1}$ II. $ A = \sum_{k=1}^{n} k \binom{n}{k}$		
	$ A = \sum_{k=1}^{n} k \binom{n}{k}$		
	Which of the above statements is/are TRUE?		
	(A) Only I	(B) Only II	
	Both I and II	(D) Neither I or II	
	Gince		[GATE 2019]