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**Syllabus:** Combinatorics: Counting, Recurrence relations, Generating functions.

### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
1 Mark Count	1	0	0	0	1	1	1	0	0	0.5	1
2 Marks Count	0	0	0	0	1	2	0	1	0	0.5	2
Total Marks	1	0	0	0	3	5	1	2	0	1.5	5

## 1.1

## Balls In Bins (4)



## 1.1.1 Balls In Bins: GATE CSE 2002 | Question: 13

- a. In how many ways can a given positive integer  $n \geq 2$  be expressed as the sum of 2 positive integers (which are not necessarily distinct). For example, for  $n = 3$ , the number of ways is 2, i.e.,  $1 + 2, 2 + 1$ . Give only the answer without any explanation.
- b. In how many ways can a given positive integer  $n \geq 3$  be expressed as the sum of 3 positive integers (which are not necessarily distinct). For example, for  $n = 4$ , the number of ways is 3, i.e.,  $1 + 2 + 1, 2 + 1 + 1$  and  $1 + 1 + 2$ . Give only the answer without explanation.
- c. In how many ways can a given positive integer  $n \geq k$  be expressed as the sum of  $k$  positive integers (which are not necessarily distinct). Give only the answer without explanation.

gatecse-2002 combinatory normal descriptive balls-in-bins

Answer key

## 1.1.2 Balls In Bins: GATE CSE 2003 | Question: 34



$m$  identical balls are to be placed in  $n$  distinct bags. You are given that  $m \geq kn$ , where  $k$  is a natural number  $\geq 1$ . In how many ways can the balls be placed in the bags if each bag must contain at least  $k$  balls?

- A.  $\binom{m-k}{n-1}$
- B.  $\binom{m-kn+n-1}{n-1}$
- C.  $\binom{m-1}{n-k}$
- D.  $\binom{m-kn+n+k-2}{n-k}$

gatecse-2003 combinatory balls-in-bins normal

Answer key

## 1.1.3 Balls In Bins: GATE CSE 2022 | Question: 22



The number of arrangements of six identical balls in three identical bins is \_\_\_\_\_.

gatecse-2022 numerical-answers combinatory balls-in-bins one-mark

Answer key

## 1.1.4 Balls In Bins: GATE IT 2004 | Question: 35



In how many ways can we distribute 5 distinct balls,  $B_1, B_2, \dots, B_5$  in 5 distinct cells,  $C_1, C_2, \dots, C_5$  such that Ball  $B_i$  is not in cell  $C_i$ ,  $\forall i = 1, 2, \dots, 5$  and each cell contains exactly one ball?

- A. 44
- B. 96
- C. 120
- D. 3125

gateit-2004 combinatory normal balls-in-bins

Answer key

## 1.2

## Combinatorics (22)



## 1.2.1 Combinatorics: GATE CSE 1989 | Question: 4-i



How many substrings (of all lengths inclusive) can be formed from a character string of length  $n$ ? Assume all characters to be distinct, prove your answer.

gate1989 descriptive combinatory normal proof

[Answer key](#)

### 1.2.2 Combinatory: GATE CSE 1990 | Question: 3-iii



The number of rooted binary trees with  $n$  nodes is,

- A. Equal to the number of ways of multiplying  $(n+1)$  matrices.
- B. Equal to the number of ways of arranging  $n$  out of  $2n$  distinct elements.
- C. Equal to  $\frac{1}{(n+1)} \binom{2n}{n}$ .
- D. Equal to  $n!$ .

gate1990 normal combinatorial catalan-number multiple-selects

[Answer key](#)

### 1.2.3 Combinatory: GATE CSE 1990 | Question: 3-ix



The number of ways in which 5  $A'$ 's, 5  $B'$ 's and 5  $C'$ 's can be arranged in a row is:

- A.  $15!/(5!)^3$
- B.  $15!$
- C.  $\left(\frac{15}{5}\right)$
- D.  $15!(5!3!)$ .

gate1990 normal combinatorial

[Answer key](#)

### 1.2.4 Combinatory: GATE CSE 1991 | Question: 02-iv



Match the pairs in the following questions by writing the corresponding letters only.

A.	The number of distinct binary tree with $n$ nodes.	P.	$\frac{n!}{2}$
B.	The number of binary strings of the length of $2n$ with an equal number of 0's and 1's	Q.	$\binom{3n}{n}$
C.	The number of even permutation of $n$ objects.	R.	$\binom{2n}{n}$
D.	The number of binary strings of length $6n$ which are palindromes with $2n$ 0's.	S.	$\frac{1}{1+n} \binom{2n}{n}$

gate1991 combinatorial normal match-the-following

[Answer key](#)

### 1.2.5 Combinatory: GATE CSE 1991 | Question: 16,a



Find the number of binary strings  $w$  of length  $2n$  with an equal number of 1's and 0's and the property that every prefix of  $w$  has at least as many 0's as 1's.

gate1991 combinatorial normal descriptive catalan-number

[Answer key](#)

### 1.2.6 Combinatory: GATE CSE 1998 | Question: 1.23



How many sub strings of different lengths (non-zero) can be formed from a character string of length  $n$ ?

- A.  $n$
- B.  $n^2$
- C.  $2^n$
- D.  $\frac{n(n+1)}{2}$

gate1998 combinatorial normal

[Answer key](#)

### 1.2.7 Combinatory: GATE CSE 1999 | Question: 1.3



The number of binary strings of  $n$  zeros and  $k$  ones in which no two ones are adjacent is

- A.  $n-1 C_k$       B.  $n C_k$       C.  $n C_{k+1}$       D. None of the above

gate1999 combinatory normal

[Answer key](#)



#### 1.2.8 Combinatory: GATE CSE 1999 | Question: 2.2

Two girls have picked 10 roses, 15 sunflowers and 15 daffodils. What is the number of ways they can divide the flowers among themselves?

- A. 1638      B. 2100      C. 2640      D. None of the above

gate1999 combinatory normal

[Answer key](#)



#### 1.2.9 Combinatory: GATE CSE 2000 | Question: 5

A multiset is an unordered collection of elements where elements may repeat any number of times. The size of a multiset is the number of elements in it, counting repetitions.

- What is the number of multisets of size 4 that can be constructed from n distinct elements so that at least one element occurs exactly twice?
- How many multisets can be constructed from n distinct elements?

gatecse-2000 combinatory normal descriptive

[Answer key](#)



#### 1.2.10 Combinatory: GATE CSE 2001 | Question: 2.1

How many 4-digit even numbers have all 4 digits distinct?

- A. 2240      B. 2296      C. 2620      D. 4536

gatecse-2001 combinatory normal

[Answer key](#)



#### 1.2.11 Combinatory: GATE CSE 2003 | Question: 4

Let  $A$  be a sequence of 8 distinct integers sorted in ascending order. How many distinct pairs of sequences,  $B$  and  $C$  are there such that

- each is sorted in ascending order,
- $B$  has 5 and  $C$  has 3 elements, and
- the result of merging  $B$  and  $C$  gives  $A$

- A. 2      B. 30      C. 56      D. 256

gatecse-2003 combinatory normal

[Answer key](#)



#### 1.2.12 Combinatory: GATE CSE 2003 | Question: 5

$n$  couples are invited to a party with the condition that every husband should be accompanied by his wife. However, a wife need not be accompanied by her husband. The number of different gatherings possible at the party is

- A.  $2^n C_n \times 2^n$       B.  $3^n$       C.  $\frac{(2n)!}{2^n}$       D.  $2^n C_n$

gatecse-2003 combinatory normal

[Answer key](#)



#### 1.2.13 Combinatory: GATE CSE 2004 | Question: 75

Mala has the colouring book in which each English letter is drawn two times. She wants to paint each of these 52 prints with one of  $k$  colours, such that the colour pairs used to colour any two letters are different. Both prints of a letter can also be coloured with the same colour. What is the minimum value of  $k$  that satisfies this requirement?

A. 9

B. 8

C. 7

D. 6

gatecse-2004 combinatory

Answer key 



#### 1.2.14 Combinatory: GATE CSE 2007 | Question: 84

Suppose that a robot is placed on the Cartesian plane. At each step it is allowed to move either one unit up or one unit right, i.e., if it is at  $(i, j)$  then it can move to either  $(i + 1, j)$  or  $(i, j + 1)$ .

How many distinct paths are there for the robot to reach the point  $(10, 10)$  starting from the initial position  $(0, 0)$ ?

A.  ${}^{20}C_{10}$

B.  $2^{20}$

C.  $2^{10}$

D. None of the above

gatecse-2007 combinatory

Answer key 



#### 1.2.15 Combinatory: GATE CSE 2007 | Question: 85

Suppose that a robot is placed on the Cartesian plane. At each step it is allowed to move either one unit up or one unit right, i.e., if it is at  $(i, j)$  then it can move to either  $(i + 1, j)$  or  $(i, j + 1)$ .

Suppose that the robot is not allowed to traverse the line segment from  $(4, 4)$  to  $(5, 4)$ . With this constraint, how many distinct paths are there for the robot to reach  $(10, 10)$  starting from  $(0, 0)$ ?

A.  $2^9$

C.  ${}^8C_4 \times {}^{11}C_5$

B.  $2^{19}$

D.  ${}^{20}C_{10} - {}^8C_4 \times {}^{11}C_5$

gatecse-2007 combinatory normal discrete-mathematics

Answer key 



#### 1.2.16 Combinatory: GATE CSE 2014 Set 1 | Question: 49

A pennant is a sequence of numbers, each number being 1 or 2. An  $n$ -pennant is a sequence of numbers with sum equal to  $n$ . For example,  $(1, 1, 2)$  is a 4-pennant. The set of all possible 1-pennants is  $(1)$ , the set of all possible 2-pennants is  $(2)$ ,  $(1, 1)$  and the set of all 3-pennants is  $(2, 1)$ ,  $(1, 1, 1)$ ,  $(1, 2)$ . Note that the pennant  $(1, 2)$  is not the same as the pennant  $(2, 1)$ . The number of 10-pennants is \_\_\_\_\_

gatecse-2014-set1 combinatory numerical-answers normal

Answer key 



#### 1.2.17 Combinatory: GATE CSE 2015 Set 3 | Question: 5

The number of 4 digit numbers having their digits in non-decreasing order (from left to right) constructed by using the digits belonging to the set  $\{1, 2, 3\}$  is \_\_\_\_\_.

gatecse-2015-set3 combinatory normal numerical-answers

Answer key 



#### 1.2.18 Combinatory: GATE CSE 2019 | Question: 5

Let  $U = \{1, 2, \dots, n\}$ . Let  $A = \{(x, X) \mid x \in X, X \subseteq U\}$ . Consider the following two statements on  $|A|$ .

I.  $|A| = n2^{n-1}$

II.  $|A| = \sum_{k=1}^n k \binom{n}{k}$

Which of the above statements is/are TRUE?

A. Only I

B. Only II

C. Both I and II

D. Neither I nor II

gatecse-2019 engineering-mathematics discrete-mathematics combinatory one-mark

Answer key 



#### 1.2.19 Combinatory: GATE CSE 2020 | Question: 42

The number of permutations of the characters in LILAC so that no character appears in its original position, if the two L's are indistinguishable, is \_\_\_\_\_.

**Answer key****1.2.20 Combinatory: GATE CSE 2025 | Set 1 | Question: 20**

Let  $S$  be the set of all ternary strings defined over the alphabet  $\{a, b, c\}$ . Consider all strings in  $S$  that contain at least one occurrence of two consecutive symbols, that is, "aa", "bb" or "cc". The number of such strings of length 5 that are possible is \_\_\_\_\_. (Answer in integer).

**Answer key****1.2.21 Combinatory: GATE IT 2005 | Question: 46**

A line  $L$  in a circuit is said to have a *stuck-at-0* fault if the line permanently has a logic value 0. Similarly a line  $L$  in a circuit is said to have a *stuck-at-1* fault if the line permanently has a logic value 1. A circuit is said to have a multiple *stuck-at* fault if one or more lines have stuck at faults. The total number of distinct multiple *stuck-at* faults possible in a circuit with  $N$  lines is

- A.  $3^N$       B.  $3^N - 1$       C.  $2^N - 1$       D. 2

**Answer key****1.2.22 Combinatory: GATE IT 2008 | Question: 25**

In how many ways can  $b$  blue balls and  $r$  red balls be distributed in  $n$  distinct boxes?

A. 
$$\frac{(n+b-1)!(n+r-1)!}{(n-1)!b!(n-1)!r!}$$

B. 
$$\frac{(n+(b+r)-1)!}{(n-1)!(n-1)!(b+r)!}$$

C. 
$$\frac{n!}{b!r!}$$

D. 
$$\frac{(n+(b+r)-1)!}{n!(b+r-1)}$$

**Answer key****1.3****Counting (4)****1.3.1 Counting: GATE CSE 1994 | Question: 1.15**

The number of substrings (of all lengths inclusive) that can be formed from a character string of length  $n$  is

- A.  $n$       B.  $n^2$       C.  $\frac{n(n-1)}{2}$       D.  $\frac{n(n+1)}{2}$

**Answer key****1.3.2 Counting: GATE CSE 2021 Set 1 | Question: 19**

There are 6 jobs with distinct difficulty levels, and 3 computers with distinct processing speeds. Each job is assigned to a computer such that:

- The fastest computer gets the toughest job and the slowest computer gets the easiest job.
- Every computer gets at least one job.

The number of ways in which this can be done is \_\_\_\_\_.

[Answer key](#)

### 1.3.3 Counting: GATE CSE 2021 Set 2 | Question: 50



Let  $S$  be a set of consisting of 10 elements. The number of tuples of the form  $(A, B)$  such that  $A$  and  $B$  are subsets of  $S$ , and  $A \subseteq B$  is \_\_\_\_\_

gatecse-2021-set2 combinatory counting numerical-answers two-marks

[Answer key](#)

### 1.3.4 Counting: GATE CSE 2023 | Question: 38



Let  $U = \{1, 2, \dots, n\}$ , where  $n$  is a large positive integer greater than 1000. Let  $k$  be a positive integer less than  $n$ . Let  $A, B$  be subsets of  $U$  with  $|A| = |B| = k$  and  $A \cap B = \emptyset$ . We say that a permutation of  $U$  separates  $A$  from  $B$  if one of the following is true.

- All members of  $A$  appear in the permutation before any of the members of  $B$ .
- All members of  $B$  appear in the permutation before any of the members of  $A$ .

How many permutations of  $U$  separate  $A$  from  $B$ ?

A.  $n!$

B.  $\binom{n}{2k} (n - 2k)!$

C.  $\binom{n}{2k} (n - 2k)! (k!)^2$

D.  $2 \binom{n}{2k} (n - 2k)! (k!)^2$

gatecse-2023 combinatory counting two-marks

[Answer key](#)

## 1.4

### Generating Functions (6)



#### 1.4.1 Generating Functions: GATE CSE 1987 | Question: 10b

What is the generating function  $G(z)$  for the sequence of Fibonacci numbers?

gate1987 combinatory generating-functions descriptive

[Answer key](#)

#### 1.4.2 Generating Functions: GATE CSE 2005 | Question: 50



Let  $G(x) = \frac{1}{(1-x)^2} = \sum_{i=0}^{\infty} g(i)x^i$ , where  $|x| < 1$ . What is  $g(i)$ ?

A.  $i$

B.  $i + 1$

C.  $2i$

D.  $2^i$

gatecse-2005 normal generating-functions

[Answer key](#)

#### 1.4.3 Generating Functions: GATE CSE 2016 Set 1 | Question: 26



The coefficient of  $x^{12}$  in  $(x^3 + x^4 + x^5 + x^6 + \dots)^3$  is \_\_\_\_\_.

gatecse-2016-set1 combinatory generating-functions normal numerical-answers

[Answer key](#)

#### 1.4.4 Generating Functions: GATE CSE 2017 Set 2 | Question: 47



If the ordinary generating function of a sequence  $\{a_n\}_{n=0}^{\infty}$  is  $\frac{1+z}{(1-z)^3}$ , then  $a_3 - a_0$  is equal to \_\_\_\_\_.

gatecse-2017-set2 combinatory generating-functions numerical-answers normal

[Answer key](#)

#### 1.4.5 Generating Functions: GATE CSE 2018 | Question: 1



Which one of the following is a closed form expression for the generating function of the sequence  $\{a_n\}$ , where  $a_n = 2n + 3$  for all  $n = 0, 1, 2, \dots$ ?

A.  $\frac{3}{(1-x)^2}$

B.  $\frac{3x}{(1-x)^2}$

C.  $\frac{2-x}{(1-x)^2}$

D.  $\frac{3-x}{(1-x)^2}$

gatecse-2018 generating-functions normal combinatory one-mark

Answer key 

#### 1.4.6 Generating Functions: GATE CSE 2022 | Question: 26

Which one of the following is the closed form for the generating function of the sequence  $\{a_n\}_{n \geq 0}$  defined below? 

$$a_n = \begin{cases} n+1, & n \text{ is odd} \\ 1, & \text{otherwise} \end{cases}$$

A.  $\frac{x(1+x^2)}{(1-x^2)^2} + \frac{1}{1-x}$

C.  $\frac{2x}{(1-x^2)^2} + \frac{1}{1-x}$

B.  $\frac{x(3-x^2)}{(1-x^2)^2} + \frac{1}{1-x}$

D.  $\frac{x}{(1-x^2)^2} + \frac{1}{1-x}$

gatecse-2022 combinatory generating-functions two-marks

Answer key 

#### 1.5

#### Modular Arithmetic (2)

##### 1.5.1 Modular Arithmetic: GATE CSE 2016 Set 2 | Question: 29



The value of the expression  $13^{99} \pmod{17}$  in the range 0 to 16, is \_\_\_\_\_.

gatecse-2016-set2 modular-arithmetic normal numerical-answers

Answer key 

##### 1.5.2 Modular Arithmetic: GATE CSE 2019 | Question: 21



The value of  $3^{51} \pmod{5}$  is \_\_\_\_\_

gatecse-2019 numerical-answers combinatory modular-arithmetic one-mark

Answer key 

#### 1.6

#### Pigeonhole Principle (2)

##### 1.6.1 Pigeonhole Principle: GATE CSE 2000 | Question: 1.1



The minimum number of cards to be dealt from an arbitrarily shuffled deck of 52 cards to guarantee that three cards are from same suit is

A. 3

B. 8

C. 9

D. 12

gatecse-2000 easy pigeonhole-principle combinatory

Answer key 

##### 1.6.2 Pigeonhole Principle: GATE CSE 2005 | Question: 44



What is the minimum number of ordered pairs of non-negative numbers that should be chosen to ensure that there are two pairs  $(a, b)$  and  $(c, d)$  in the chosen set such that,  $a \equiv c \pmod{3}$  and  $b \equiv d \pmod{5}$

A. 4

B. 6

C. 16

D. 24

gatecse-2005 set-theory&algebra normal pigeonhole-principle

Answer key 

#### 1.7

#### Recurrence Relation (7)

##### 1.7.1 Recurrence Relation: GATE CSE 1996 | Question: 9



The Fibonacci sequence  $\{f_1, f_2, f_3, \dots, f_n\}$  is defined by the following recurrence:

$$f_{n+2} = f_{n+1} + f_n, n \geq 1; f_2 = 1; f_1 = 1$$

Prove by induction that every third element of the sequence is even.

gate1996 recurrence-relation proof descriptive

[Answer key](#)

### 1.7.2 Recurrence Relation: GATE CSE 2016 Set 1 | Question: 2



Let  $a_n$  be the number of  $n$ -bit strings that do **NOT** contain two consecutive 1's. Which one of the following is the recurrence relation for  $a_n$ ?

- A.  $a_n = a_{n-1} + 2a_{n-2}$   
 B.  $a_n = a_{n-1} + a_{n-2}$   
 C.  $a_n = 2a_{n-1} + a_{n-2}$   
 D.  $a_n = 2a_{n-1} + 2a_{n-2}$

gatecse-2016-set1 combinatorics recurrence-relation easy

[Answer key](#)

### 1.7.3 Recurrence Relation: GATE CSE 2016 Set 1 | Question: 27



Consider the recurrence relation  $a_1 = 8, a_n = 6n^2 + 2n + a_{n-1}$ . Let  $a_{99} = K \times 10^4$ . The value of  $K$  is \_\_\_\_\_.

gatecse-2016-set1 combinatorics recurrence-relation normal numerical-answers

[Answer key](#)

### 1.7.4 Recurrence Relation: GATE CSE 2022 | Question: 41



Consider the following recurrence:

$$\begin{aligned} f(1) &= 1; \\ f(2n) &= 2f(n)-1, \quad \text{for } n \geq 1; \\ f(2n+1) &= 2f(n)+1, \quad \text{for } n \geq 1. \end{aligned}$$

Then, which of the following statements is/are TRUE?

- A.  $f(2^n-1) = 2^n-1$   
 B.  $f(2^n) = 1$   
 C.  $f(5 \cdot 2^n) = 2^{n+1} + 1$   
 D.  $f(2^n+1) = 2^n + 1$

gatecse-2022 combinatorics recurrence-relation multiple-selects two-marks

[Answer key](#)

### 1.7.5 Recurrence Relation: GATE CSE 2023 | Question: 5



The Lucas sequence  $L_n$  is defined by the recurrence relation:

$$L_n = L_{n-1} + L_{n-2}, \quad \text{for } n \geq 3,$$

with  $L_1 = 1$  and  $L_2 = 3$ .

Which one of the options given is TRUE?

- A.  $L_n = \left(\frac{1+\sqrt{5}}{2}\right)^n + \left(\frac{1-\sqrt{5}}{2}\right)^n$   
 B.  $L_n = \left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{3}\right)^n$   
 C.  $L_n = \left(\frac{1+\sqrt{5}}{2}\right)^n + \left(\frac{1-\sqrt{5}}{3}\right)^n$   
 D.  $L_n = \left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n$

gatecse-2023 combinatorics recurrence-relation one-mark

[Answer key](#)

### 1.7.6 Recurrence Relation: GATE IT 2004 | Question: 34



Let  $H_1, H_2, H_3, \dots$  be harmonic numbers. Then, for  $n \in \mathbb{Z}^+$ ,  $\sum_{j=1}^n H_j$  can be expressed as

- A.  $nH_{n+1} - (n+1)$   
 B.  $(n+1)H_n - n$   
 C.  $nH_n - n$   
 D.  $(n+1)H_{n+1} - (n+1)$

gateit-2004 recurrence-relation combinatorics normal

[Answer key](#)

### 1.7.7 Recurrence Relation: GATE IT 2007 | Question: 76



Consider the sequence  $\langle x_n \rangle$ ,  $n \geq 0$  defined by the recurrence relation  $x_{n+1} = c \cdot x_n^2 - 2$ , where  $c > 0$ .

Suppose there exists a **non-empty, open** interval  $(a, b)$  such that for all  $x_0$  satisfying  $a < x_0 < b$ , the sequence

converges to a limit. The sequence converges to the value?

A.  $\frac{1+\sqrt{1+8c}}{2c}$

B.  $\frac{1-\sqrt{1+8c}}{2c}$

C. 2

D.  $\frac{2}{2c-1}$

gateit-2007 combinatory normal recurrence-relation

[Answer key](#) 

1.8

Summation (3)



#### 1.8.1 Summation: GATE CSE 1994 | Question: 15

Use the patterns given to prove that

A.  $\sum_{i=0}^{n-1} (2i + 1) = n^2$

(You are not permitted to employ induction)

$$\begin{array}{ccccccc} & \cdot & \cdot & \cdot & & & \\ & \cdot & \cdot & & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & & \cdot & \cdot & \cdot \end{array} \text{etc}$$

1            4            9

B. Use the result obtained in (A) to prove that  $\sum_{i=1}^n i = \frac{n(n+1)}{2}$

gate1994 combinatory proof summation descriptive

[Answer key](#) 



#### 1.8.2 Summation: GATE CSE 2008 | Question: 24

Let  $P = \sum_{\substack{1 \leq i \leq 2k \\ i \text{ odd}}} i$  and  $Q = \sum_{\substack{1 \leq i \leq 2k \\ i \text{ even}}} i$ , where  $k$  is a positive integer. Then

A.  $P = Q - k$

B.  $P = Q + k$

C.  $P = Q$

D.  $P = Q + 2k$

gatecse-2008 combinatory easy summation

[Answer key](#) 



#### 1.8.3 Summation: GATE CSE 2015 Set 1 | Question: 26

$$\sum_{x=1}^{99} \frac{1}{x(x+1)} = \text{_____}.$$

gatecse-2015-set1 combinatory normal numerical-answers summation

[Answer key](#) 

## Answer Keys

1.1.1	N/A	1.1.2	B	1.1.3	7	1.1.4	A	1.2.1	N/A
1.2.2	A;C	1.2.3	A	1.2.4	N/A	1.2.5	N/A	1.2.6	D
1.2.7	D	1.2.8	D	1.2.9	N/A	1.2.10	B	1.2.11	C
1.2.12	B	1.2.13	C	1.2.14	A	1.2.15	D	1.2.16	89
1.2.17	15	1.2.18	C	1.2.19	12	1.2.20	195:195	1.2.21	B
1.2.22	A	1.3.1	D	1.3.2	65 : 65	1.3.3	59049 : 59049	1.3.4	D
1.4.1	N/A	1.4.2	B	1.4.3	10	1.4.4	15	1.4.5	D
1.4.6	A	1.5.1	4	1.5.2	2	1.6.1	C	1.6.2	C
1.7.1	N/A	1.7.2	B	1.7.3	197.9 : 198.1	1.7.4	A;B;C	1.7.5	A
1.7.6	B	1.7.7	B	1.8.1	N/A	1.8.2	A	1.8.3	0.99



**Syllabus:** Connectivity, Matching, Coloring.

#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
1 Mark Count	0	0	1	1	0	1	1	0	0	0.5	1
2 Marks Count	0	0	1	2	1	3	1	0	0	1	3
Total Marks	0	0	3	5	2	7	3	0	0	2.5	7

## 2.1

## Counting (3)

## 2.1.1 Counting: GATE CSE 2001 | Question: 2.15



How many undirected graphs (not necessarily connected) can be constructed out of a given set  $V = \{v_1, v_2, \dots, v_n\}$  of  $n$  vertices?

- A.  $\frac{n(n-1)}{2}$       B.  $2^n$       C.  $n!$       D.  $2^{\frac{n(n-1)}{2}}$

gatecse-2001 graph-theory normal counting

Answer key

## 2.1.2 Counting: GATE CSE 2004 | Question: 79



How many graphs on  $n$  labeled vertices exist which have at least  $\frac{(n^2-3n)}{2}$  edges?

- A.  $\binom{\frac{n^2-n}{2}}{C_{\binom{\frac{n^2-3n}{2}}{2}}}$   
 B.  $\sum_{k=0}^{\left(\frac{n^2-3n}{2}\right)} \cdot (n^2-n) C_k$   
 C.  $\binom{\frac{n^2-n}{2}}{C_n}$   
 D.  $\sum_{k=0}^n \cdot \binom{\frac{n^2-n}{2}}{C_k}$

gatecse-2004 graph-theory combinatorics normal counting

Answer key

## 2.1.3 Counting: GATE CSE 2012 | Question: 38



Let  $G$  be a complete undirected graph on 6 vertices. If vertices of  $G$  are labeled, then the number of distinct cycles of length 4 in  $G$  is equal to

- A. 15      B. 30      C. 90      D. 360

gatecse-2012 graph-theory normal marks-to-all counting

Answer key

## 2.2

## Degree of Graph (12)

## 2.2.1 Degree of Graph: GATE CSE 1987 | Question: 9c



Show that the number of odd-degree vertices in a finite graph is even.

gate1987 graph-theory degree-of-graph descriptive proof

Answer key

## 2.2.2 Degree of Graph: GATE CSE 1991 | Question: 16-b



Show that all vertices in an undirected finite graph cannot have distinct degrees, if the graph has at least two vertices.

gate1991 graph-theory degree-of-graph descriptive proof

Answer key

## 2.2.3 Degree of Graph: GATE CSE 1995 | Question: 24



Prove that in finite graph, the number of vertices of odd degree is always even.

**Answer key****2.2.4 Degree of Graph: GATE CSE 2003 | Question: 40**

A graph  $G = (V, E)$  satisfies  $|E| \leq 3|V| - 6$ . The min-degree of  $G$  is defined as  $\min_{v \in V} \{\text{degree}(v)\}$ . Therefore, min-degree of  $G$  cannot be

A. 3

B. 4

C. 5

D. 6

**Answer key****2.2.5 Degree of Graph: GATE CSE 2006 | Question: 71**

The  $2^n$  vertices of a graph  $G$  corresponds to all subsets of a set of size  $n$ , for  $n \geq 6$ . Two vertices of  $G$  are adjacent if and only if the corresponding sets intersect in exactly two elements.

The number of vertices of degree zero in  $G$  is:

A. 1

B.  $n$ C.  $n + 1$ D.  $2^n$ **Answer key****2.2.6 Degree of Graph: GATE CSE 2006 | Question: 72**

The  $2^n$  vertices of a graph  $G$  corresponds to all subsets of a set of size  $n$ , for  $n \geq 6$ . Two vertices of  $G$  are adjacent if and only if the corresponding sets intersect in exactly two elements.

The maximum degree of a vertex in  $G$  is:

A.  $\binom{n}{2} \cdot 2^{\frac{n}{2}}$ B.  $2^{n-2}$ C.  $2^{n-3} \times 3$ D.  $2^{n-1}$ **Answer key****2.2.7 Degree of Graph: GATE CSE 2009 | Question: 3**

Which one of the following is **TRUE** for any simple connected undirected graph with more than 2 vertices?

- A. No two vertices have the same degree.
- B. At least two vertices have the same degree.
- C. At least three vertices have the same degree.
- D. All vertices have the same degree.

**Answer key****2.2.8 Degree of Graph: GATE CSE 2010 | Question: 1**

Let  $G = (V, E)$  be a graph. Define  $\xi(G) = \sum_d i_d * d$ , where  $i_d$  is the number of vertices of degree  $d$  in  $G$ . If  $S$  and  $T$  are two different trees with  $\xi(S) = \xi(T)$ , then

A.  $|S| = 2|T|$   
C.  $|S| = |T|$ B.  $|S| = |T| - 1$   
D.  $|S| = |T| + 1$ **Answer key****2.2.9 Degree of Graph: GATE CSE 2010 | Question: 28**

The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?

- I. 7, 6, 5, 4, 4, 3, 2, 1
- II. 6, 6, 6, 6, 3, 3, 2, 2
- III. 7, 6, 6, 4, 4, 3, 2, 2

IV. 8, 7, 7, 6, 4, 2, 1, 1

- A. I and II      B. III and IV      C. IV only      D. II and IV

gatecse-2010 graph-theory degree-of-graph

Answer key 



#### 2.2.10 Degree of Graph: GATE CSE 2013 | Question: 25

Which of the following statements is/are TRUE for undirected graphs?

P: Number of odd degree vertices is even.  
Q: Sum of degrees of all vertices is even.

- A. P only      B. Q only  
C. Both P and Q      D. Neither P nor Q

gatecse-2013 graph-theory easy degree-of-graph

Answer key 



#### 2.2.11 Degree of Graph: GATE CSE 2014 Set 1 | Question: 52

An ordered  $n$ -tuple  $(d_1, d_2, \dots, d_n)$  with  $d_1 \geq d_2 \geq \dots \geq d_n$  is called *graphic* if there exists a simple undirected graph with  $n$  vertices having degrees  $d_1, d_2, \dots, d_n$  respectively. Which one of the following 6-tuples is NOT graphic?

- A.  $(1, 1, 1, 1, 1, 1)$       B.  $(2, 2, 2, 2, 2, 2)$   
C.  $(3, 3, 3, 1, 0, 0)$       D.  $(3, 2, 1, 1, 1, 0)$

gatecse-2014-set1 graph-theory normal degree-of-graph

Answer key 



#### 2.2.12 Degree of Graph: GATE CSE 2017 Set 2 | Question: 23

$G$  is an undirected graph with  $n$  vertices and 25 edges such that each vertex of  $G$  has degree at least 3. Then the maximum possible value of  $n$  is \_\_\_\_\_.

gatecse-2017-set2 graph-theory numerical-answers degree-of-graph

Answer key 

### 2.3

#### Graph Coloring (11)



##### 2.3.1 Graph Coloring: GATE CSE 2002 | Question: 1.4

The minimum number of colours required to colour the vertices of a cycle with  $n$  nodes in such a way that no two adjacent nodes have the same colour is

- A. 2      B. 3  
C. 4      D.  $n - 2 \lfloor \frac{n}{2} \rfloor + 2$

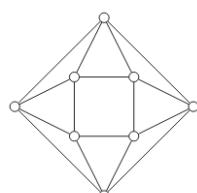
gatecse-2002 graph-theory graph-coloring normal

Answer key 



##### 2.3.2 Graph Coloring: GATE CSE 2004 | Question: 77

The minimum number of colours required to colour the following graph, such that no two adjacent vertices are assigned the same color, is



- A. 2      B. 3      C. 4      D. 5

gatecse-2004 graph-theory graph-coloring easy

[Answer key](#)

### 2.3.3 Graph Coloring: GATE CSE 2009 | Question: 2

What is the chromatic number of an  $n$  vertex simple connected graph which does not contain any odd length cycle? Assume  $n > 2$ .

- A. 2      B. 3      C.  $n - 1$       D.  $n$

gatecse-2009 graph-theory graph-coloring normal

[Answer key](#)



### 2.3.4 Graph Coloring: GATE CSE 2016 Set 2 | Question: 03

The minimum number of colours that is sufficient to vertex-colour any planar graph is \_\_\_\_\_.

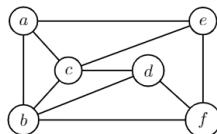
gatecse-2016-set2 graph-theory graph-coloring normal numerical-answers

[Answer key](#)



### 2.3.5 Graph Coloring: GATE CSE 2018 | Question: 18

The chromatic number of the following graph is \_\_\_\_\_



graph-theory graph-coloring numerical-answers gatecse-2018 one-mark

[Answer key](#)

### 2.3.6 Graph Coloring: GATE CSE 2020 | Question: 52

Graph  $G$  is obtained by adding vertex  $s$  to  $K_{3,4}$  and making  $s$  adjacent to every vertex of  $K_{3,4}$ . The minimum number of colours required to edge-colour  $G$  is \_\_\_\_\_

gatecse-2020 numerical-answers graph-theory graph-coloring two-marks

[Answer key](#)



### 2.3.7 Graph Coloring: GATE CSE 2023 | Question: 45

Let  $G$  be a simple, finite, undirected graph with vertex set  $\{v_1, \dots, v_n\}$ . Let  $\Delta(G)$  denote the maximum degree of  $G$  and let  $\mathbb{N} = \{1, 2, \dots\}$  denote the set of all possible colors. Color the vertices of  $G$  using the following greedy strategy: for  $i = 1, \dots, n$

$\text{color}(v_i) \leftarrow \min \{j \in \mathbb{N} : \text{no neighbour of } v_i \text{ is colored } j\}$

Which of the following statements is/are TRUE?

- A. This procedure results in a proper vertex coloring of  $G$ .
- B. The number of colors used is at most  $\Delta(G) + 1$ .
- C. The number of colors used is at most  $\Delta(G)$ .
- D. The number of colors used is equal to the chromatic number of  $G$ .

gatecse-2023 graph-theory graph-coloring multiple-selects two-marks

[Answer key](#)



### 2.3.8 Graph Coloring: GATE CSE 2024 | Set 1 | Question: 41

The chromatic number of a graph is the minimum number of colours used in a *proper* colouring of the graph. Let  $G$  be any graph with  $n$  vertices and chromatic number  $k$ . Which of the following statements is/are always TRUE?

- A.  $G$  contains a complete subgraph with  $k$  vertices
- B.  $G$  contains an independent set of size at least  $n/k$
- C.  $G$  contains at least  $k(k - 1)/2$  edges



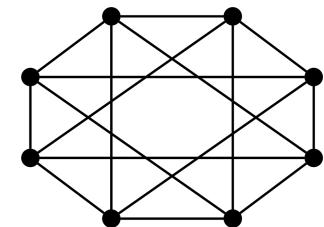
- D.  $G$  contains a vertex of degree at least  $k$

gatecse2024-set1 multiple-selects graph-theory graph-coloring two-marks

[Answer key](#)

### 2.3.9 Graph Coloring: GATE CSE 2024 | Set 2 | Question: 50

The chromatic number of a graph is the minimum number of colours used in a proper colouring of the graph. The chromatic number of the following graph is \_\_\_\_\_.



gatecse2024-set2 graph-theory numerical-answers graph-coloring two-marks

[Answer key](#)

### 2.3.10 Graph Coloring: GATE IT 2006 | Question: 25

Consider the undirected graph  $G$  defined as follows. The vertices of  $G$  are bit strings of length  $n$ . We have an edge between vertex  $u$  and vertex  $v$  if and only if  $u$  and  $v$  differ in exactly one bit position (in other words,  $v$  can be obtained from  $u$  by flipping a single bit). The ratio of the chromatic number of  $G$  to the diameter of  $G$  is,

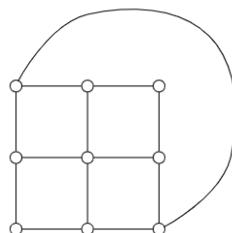
- A.  $\frac{1}{(2^{n-1})}$       B.  $(\frac{1}{n})$       C.  $(\frac{2}{n})$       D.  $(\frac{3}{n})$

gateit-2006 graph-theory graph-coloring normal

[Answer key](#)

### 2.3.11 Graph Coloring: GATE IT 2008 | Question: 3

What is the chromatic number of the following graph?



- A. 2      B. 3      C. 4      D. 5

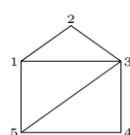
gateit-2008 graph-theory graph-coloring normal

[Answer key](#)

## 2.4

### Graph Connectivity (40)

#### 2.4.1 Graph Connectivity: GATE CSE 1987 | Question: 9d



Specify an adjacency-lists representation of the undirected graph given above.

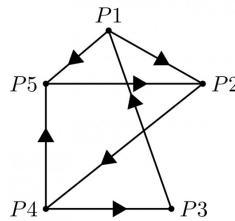
gate1987 graph-theory easy graph-connectivity descriptive

[Answer key](#)

#### 2.4.2 Graph Connectivity: GATE CSE 1988 | Question: 2xvi



Write the adjacency matrix representation of the graph given in below figure.



gate1988 descriptive graph-theory graph-connectivity

[Answer key](#)

#### 2.4.3 Graph Connectivity: GATE CSE 1990 | Question: 1-viii



A graph which has the same number of edges as its complement must have number of vertices congruent to \_\_\_\_\_ or \_\_\_\_\_ modulo 4

gate1990 graph-theory graph-connectivity fill-in-the-blanks

[Answer key](#)

#### 2.4.4 Graph Connectivity: GATE CSE 1991 | Question: 01,xv



The maximum number of possible edges in an undirected graph with  $n$  vertices and  $k$  components is \_\_\_\_\_.

gate1991 graph-theory graph-connectivity normal fill-in-the-blanks

[Answer key](#)

#### 2.4.5 Graph Connectivity: GATE CSE 1992 | Question: 03,iii



How many edges can there be in a forest with  $p$  components having  $n$  vertices in all?

gate1992 graph-theory graph-connectivity descriptive

[Answer key](#)

#### 2.4.6 Graph Connectivity: GATE CSE 1993 | Question: 8.1



Consider a simple connected graph  $G$  with  $n$  vertices and  $n$  edges ( $n > 2$ ). Then, which of the following statements are true?

- A.  $G$  has no cycles
- B. The graph obtained by removing any edge from  $G$  is not connected
- C.  $G$  has at least one cycle
- D. The graph obtained by removing any two edges from  $G$  is not connected
- E. None of the above

gate1993 graph-theory graph-connectivity easy multiple-selects

[Answer key](#)

#### 2.4.7 Graph Connectivity: GATE CSE 1994 | Question: 1.6, ISRO2008-29



The number of distinct simple graphs with up to three nodes is

- A. 15
- B. 10
- C. 7
- D. 9

gate1994 graph-theory graph-connectivity combinatory normal isro2008 counting

[Answer key](#)

#### 2.4.8 Graph Connectivity: GATE CSE 1994 | Question: 2.5



The number of edges in a regular graph of degree  $d$  and  $n$  vertices is \_\_\_\_\_

**Answer key****2.4.9 Graph Connectivity: GATE CSE 1994 | Question: 24**

An independent set in a graph is a subset of vertices such that no two vertices in the subset are connected by an edge. An incomplete scheme for a greedy algorithm to find a maximum independent set in a tree is given below:

```
V: Set of all vertices in the tree;
I := ∅
while V ≠ ∅ do
begin
    select a vertex u ∈ V such that
    _____;
    V := V - {u};
    if u is such that
    _____ then I := I ∪ {u}
end;
Output(I);
```

- Complete the algorithm by specifying the property of vertex  $u$  in each case.
- What is the time complexity of the algorithm?

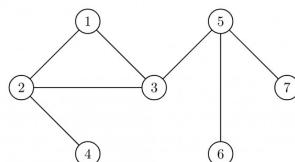
**Answer key****2.4.10 Graph Connectivity: GATE CSE 1995 | Question: 1.25**

The minimum number of edges in a connected cyclic graph on  $n$  vertices is:

- $n - 1$
- $n$
- $n + 1$
- None of the above

**Answer key****2.4.11 Graph Connectivity: GATE CSE 1999 | Question: 1.15**

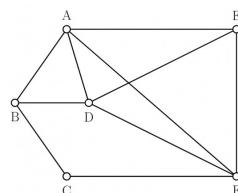
The number of articulation points of the following graph is



- 0
- 1
- 2
- 3

**Answer key****2.4.12 Graph Connectivity: GATE CSE 1999 | Question: 5**

Let  $G$  be a connected, undirected graph. A cut in  $G$  is a set of edges whose removal results in  $G$  being broken into two or more components, which are not connected with each other. The size of a cut is called its cardinality. A min-cut of  $G$  is a cut in  $G$  of minimum cardinality. Consider the following graph:



- Which of the following sets of edges is a cut?
  - $\{(A,B), (E,F), (B,D), (A,E), (A,D)\}$
  - $\{(B,D), (C,F), (A,B)\}$

- b. What is cardinality of min-cut in this graph?  
 c. Prove that if a connected undirected graph  $G$  with  $n$  vertices has a min-cut of cardinality  $k$ , then  $G$  has at least  $(\frac{n \times k}{2})$  edges.

gate1999 graph-theory graph-connectivity normal descriptive proof

[Answer key](#)



#### 2.4.13 Graph Connectivity: GATE CSE 2002 | Question: 1.25, ISRO2008-30, ISRO2016-6

The maximum number of edges in a  $n$ -node undirected graph without self loops is

- A.  $n^2$       B.  $\frac{n(n-1)}{2}$       C.  $n - 1$       D.  $\frac{(n+1)(n)}{2}$

gatecse-2002 graph-theory easy isro2008 isro2016 graph-connectivity

[Answer key](#)



#### 2.4.14 Graph Connectivity: GATE CSE 2003 | Question: 8, ISRO2009-53

Let  $G$  be an arbitrary graph with  $n$  nodes and  $k$  components. If a vertex is removed from  $G$ , the number of components in the resultant graph must necessarily lie down between

- A.  $k$  and  $n$   
 C.  $k - 1$  and  $n - 1$   
 B.  $k - 1$  and  $k + 1$   
 D.  $k + 1$  and  $n - k$

gatecse-2003 graph-theory graph-connectivity normal isro2009

[Answer key](#)



#### 2.4.15 Graph Connectivity: GATE CSE 2004 | Question: 81

Let  $G_1 = (V, E_1)$  and  $G_2 = (V, E_2)$  be connected graphs on the same vertex set  $V$  with more than two vertices. If  $G_1 \cap G_2 = (V, E_1 \cap E_2)$  is not a connected graph, then the graph  $G_1 \cup G_2 = (V, E_1 \cup E_2)$

- A. cannot have a cut vertex  
 C. must have a cut-edge (bridge)  
 B. must have a cycle  
 D. has chromatic number strictly greater than those of  $G_1$  and  $G_2$

gatecse-2004 graph-theory normal graph-connectivity

[Answer key](#)



#### 2.4.16 Graph Connectivity: GATE CSE 2005 | Question: 11

Let  $G$  be a simple graph with 20 vertices and 100 edges. The size of the minimum vertex cover of  $G$  is 8. Then, the size of the maximum independent set of  $G$  is:

- A. 12      B. 8      C. less than 8      D. more than 12

gatecse-2005 graph-theory normal graph-connectivity

[Answer key](#)



#### 2.4.17 Graph Connectivity: GATE CSE 2006 | Question: 73

The  $2^n$  vertices of a graph  $G$  corresponds to all subsets of a set of size  $n$ , for  $n \geq 6$ . Two vertices of  $G$  are adjacent if and only if the corresponding sets intersect in exactly two elements.

The number of connected components in  $G$  is:

- A.  $n$       B.  $n + 2$       C.  $2^{\frac{n}{2}}$       D.  $\frac{2^n}{n}$

gatecse-2006 graph-theory normal graph-connectivity

[Answer key](#)



#### 2.4.18 Graph Connectivity: GATE CSE 2007 | Question: 23

Which of the following graphs has an Eulerian circuit?

- A. Any  $k$ -regular graph where  $k$  is an even number.  
 C. The complement of a cycle on 25 vertices.  
 B. A complete graph on 90 vertices.  
 D. None of the above

gatecse-2007 graph-theory normal graph-connectivity

[Answer key](#)

#### 2.4.19 Graph Connectivity: GATE CSE 2008 | Question: 42



$G$  is a graph on  $n$  vertices and  $2n - 2$  edges. The edges of  $G$  can be partitioned into two edge-disjoint spanning trees. Which of the following is NOT true for  $G$ ?

- A. For every subset of  $k$  vertices, the induced subgraph has at most  $2k - 2$  edges.
- B. The minimum cut in  $G$  has at least 2 edges.
- C. There are at least 2 edge-disjoint paths between every pair of vertices.
- D. There are at least 2 vertex-disjoint paths between every pair of vertices.

gatecse-2008 graph-connectivity normal

[Answer key](#)

#### 2.4.20 Graph Connectivity: GATE CSE 2013 | Question: 26



The line graph  $L(G)$  of a simple graph  $G$  is defined as follows:

- There is exactly one vertex  $v(e)$  in  $L(G)$  for each edge  $e$  in  $G$ .
- For any two edges  $e$  and  $e'$  in  $G$ ,  $L(G)$  has an edge between  $v(e)$  and  $v(e')$ , if and only if  $e$  and  $e'$  are incident with the same vertex in  $G$ .

Which of the following statements is/are TRUE?

- (P) The line graph of a cycle is a cycle.
- (Q) The line graph of a clique is a clique.
- (R) The line graph of a planar graph is planar.
- (S) The line graph of a tree is a tree.

- A. P only      B. P and R only      C. R only      D. P, Q and S only

gatecse-2013 graph-theory normal graph-connectivity

[Answer key](#)

#### 2.4.21 Graph Connectivity: GATE CSE 2014 Set 1 | Question: 51



Consider an undirected graph  $G$  where self-loops are not allowed. The vertex set of  $G$  is  $\{(i, j) \mid 1 \leq i \leq 12, 1 \leq j \leq 12\}$ . There is an edge between  $(a, b)$  and  $(c, d)$  if  $|a - c| \leq 1$  and  $|b - d| \leq 1$ . The number of edges in this graph is \_\_\_\_\_.

gatecse-2014-set1 graph-theory numerical-answers normal graph-connectivity

[Answer key](#)

#### 2.4.22 Graph Connectivity: GATE CSE 2014 Set 2 | Question: 3



The maximum number of edges in a bipartite graph on 12 vertices is \_\_\_\_\_

gatecse-2014-set2 graph-theory graph-connectivity numerical-answers normal

[Answer key](#)

#### 2.4.23 Graph Connectivity: GATE CSE 2014 Set 3 | Question: 51



If  $G$  is the forest with  $n$  vertices and  $k$  connected components, how many edges does  $G$  have?

- A.  $\lfloor \frac{n}{k} \rfloor$       B.  $\lceil \frac{n}{k} \rceil$       C.  $n - k$       D.  $n - k + 1$

gatecse-2014-set3 graph-theory graph-connectivity normal

[Answer key](#)

#### 2.4.24 Graph Connectivity: GATE CSE 2015 Set 2 | Question: 50



In a connected graph, a bridge is an edge whose removal disconnects the graph. Which one of the following statements is true?

- A. A tree has no bridges  
 B. A bridge cannot be part of a simple cycle  
 C. Every edge of a clique with size  $\geq 3$  is a bridge (A clique is any complete subgraph of a graph)  
 D. A graph with bridges cannot have cycle

gatecse-2015-set2 graph-theory graph-connectivity easy

[Answer key](#)



#### 2.4.25 Graph Connectivity: GATE CSE 2019 | Question: 12

Let  $G$  be an undirected complete graph on  $n$  vertices, where  $n > 2$ . Then, the number of different Hamiltonian cycles in  $G$  is equal to

- A.  $n!$       B.  $(n - 1)!$       C. 1      D.  $\frac{(n-1)!}{2}$

gatecse-2019 engineering-mathematics discrete-mathematics graph-theory graph-connectivity one-mark

[Answer key](#)



#### 2.4.26 Graph Connectivity: GATE CSE 2019 | Question: 38

Let  $G$  be any connected, weighted, undirected graph.

- I.  $G$  has a unique minimum spanning tree, if no two edges of  $G$  have the same weight.  
 II.  $G$  has a unique minimum spanning tree, if, for every cut of  $G$ , there is a unique minimum-weight edge crossing the cut.

Which of the following statements is/are TRUE?

- A. I only      B. II only      C. Both I and II      D. Neither I nor II

gatecse-2019 engineering-mathematics discrete-mathematics graph-theory graph-connectivity two-marks minimum-spanning-tree algorithms graph-algorithms

[Answer key](#)



#### 2.4.27 Graph Connectivity: GATE CSE 2021 Set 1 | Question: 36

Let  $G = (V, E)$  be an undirected unweighted connected graph. The *diameter* of  $G$  is defined as:

$$\text{diam}(G) = \max_{u,v \in V} \{\text{the length of shortest path between } u \text{ and } v\}$$

Let  $M$  be the adjacency matrix of  $G$ .

Define graph  $G_2$  on the same set of vertices with adjacency matrix  $N$ , where

$$N_{ij} = \begin{cases} 1 & \text{if } M_{ij} > 0 \text{ or } P_{ij} > 0, \text{ where } P = M^2 \\ 0 & \text{otherwise} \end{cases}$$

Which one of the following statements is true?

- A.  $\text{diam}(G_2) \leq \lceil \text{diam}(G)/2 \rceil$   
 B.  $\lceil \text{diam}(G)/2 \rceil < \text{diam}(G_2) < \text{diam}(G)$   
 C.  $\text{diam}(G_2) = \text{diam}(G)$   
 D.  $\text{diam}(G) < \text{diam}(G_2) \leq 2 \text{ diam}(G)$

gatecse-2021-set1 graph-theory graph-connectivity two-marks

[Answer key](#)



#### 2.4.28 Graph Connectivity: GATE CSE 2022 | Question: 20

Consider a simple undirected graph of 10 vertices. If the graph is disconnected, then the maximum number of edges it can have is \_\_\_\_\_.

gatecse-2022 numerical-answers graph-theory graph-connectivity one-mark

[Answer key](#)

### 2.4.29 Graph Connectivity: GATE CSE 2022 | Question: 27

Consider a simple undirected unweighted graph with at least three vertices. If  $A$  is the adjacency matrix of the graph, then the number of 3-cycles in the graph is given by the trace of

- A.  $A^3$
- B.  $A^3$  divided by 2
- C.  $A^3$  divided by 3
- D.  $A^3$  divided by 6

gatecse-2022 graph-theory graph-connectivity two-marks

Answer key 

### 2.4.30 Graph Connectivity: GATE CSE 2022 | Question: 42

Which of the properties hold for the adjacency matrix  $A$  of a simple undirected unweighted graph having  $n$  vertices?

- A. The diagonal entries of  $A^2$  are the degrees of the vertices of the graph.
- B. If the graph is connected, then none of the entries of  $A^{n-1} + I_n$  can be zero.
- C. If the sum of all the elements of  $A$  is at most  $2(n - 1)$ , then the graph must be acyclic.
- D. If there is at least a 1 in each of  $A$ 's rows and columns, then the graph must be connected.

gatecse-2022 graph-theory graph-connectivity multiple-selects two-marks

Answer key 

### 2.4.31 Graph Connectivity: GATE CSE 2024 | Set 1 | Question: 24

The number of spanning trees in a *complete* graph of 4 vertices labelled A, B, C, and D is \_\_\_\_\_.

gatecse2024-set1 numerical-answers graph-theory graph-connectivity one-mark

Answer key 

### 2.4.32 Graph Connectivity: GATE CSE 2024 | Set 2 | Question: 41

Let  $G$  be an undirected connected graph in which every edge has a positive integer weight. Suppose that every spanning tree in  $G$  has even weight. Which of the following statements is/are TRUE for every such graph  $G$ ?

- A. All edges in  $G$  have even weight
- B. All edges in  $G$  have even weight OR all edges in  $G$  have odd weight
- C. In each cycle  $C$  in  $G$ , all edges in  $C$  have even weight
- D. In each cycle  $C$  in  $G$ , either all edges in  $C$  have even weight OR all edges in  $C$  have odd weight

gatecse2024-set2 graph-theory multiple-selects graph-connectivity two-marks

Answer key 

### 2.4.33 Graph Connectivity: GATE CSE 2024 | Set 2 | Question: 7

Let  $A$  be the adjacency matrix of a simple undirected graph  $G$ . Suppose  $A$  is its own inverse. Which one of the following statements is *always* TRUE?

- A.  $G$  is a cycle
- B.  $G$  is a perfect matching
- C.  $G$  is a complete graph
- D. There is no such graph  $G$

gatecse2024-set2 graph-theory graph-connectivity one-mark

Answer key 

### 2.4.34 Graph Connectivity: GATE IT 2004 | Question: 37

What is the number of vertices in an undirected connected graph with 27 edges, 6 vertices of degree 2, 3 vertices of degree 4 and remaining of degree 3?

- A. 10
- B. 11
- C. 18
- D. 19

gateit-2004 graph-theory graph-connectivity normal

Answer key 

### 2.4.35 Graph Connectivity: GATE IT 2004 | Question: 5



What is the maximum number of edges in an acyclic undirected graph with  $n$  vertices?

- A.  $n - 1$       B.  $n$       C.  $n + 1$       D.  $2n - 1$

gateit-2004 graph-theory graph-connectivity normal

[Answer key](#)

### 2.4.36 Graph Connectivity: GATE IT 2005 | Question: 56



Let  $G$  be a directed graph whose vertex set is the set of numbers from 1 to 100. There is an edge from a vertex  $i$  to a vertex  $j$  iff either  $j = i + 1$  or  $j = 3i$ . The minimum number of edges in a path in  $G$  from vertex 1 to vertex 100 is

- A. 4      B. 7      C. 23      D. 99

gateit-2005 graph-theory graph-connectivity normal

[Answer key](#)

### 2.4.37 Graph Connectivity: GATE IT 2006 | Question: 11



If all the edge weights of an undirected graph are positive, then any subset of edges that connects all the vertices and has minimum total weight is a

- A. Hamiltonian cycle      B. grid      C. hypercube      D. tree

gateit-2006 graph-theory graph-connectivity normal

[Answer key](#)

### 2.4.38 Graph Connectivity: GATE IT 2007 | Question: 25



What is the largest integer  $m$  such that every simple connected graph with  $n$  vertices and  $n$  edges contains at least  $m$  different spanning trees ?

- A. 1      B. 2      C. 3      D.  $n$

gateit-2007 graph-theory graph-connectivity normal

[Answer key](#)

### 2.4.39 Graph Connectivity: GATE IT 2008 | Question: 27



$G$  is a simple undirected graph. Some vertices of  $G$  are of odd degree. Add a node  $v$  to  $G$  and make it adjacent to each odd degree vertex of  $G$ . The resultant graph is sure to be

- A. regular      B. complete      C. Hamiltonian      D. Euler

gateit-2008 graph-theory graph-connectivity normal

[Answer key](#)

### 2.4.40 Graph Connectivity: GATE IT 2008 | Question: 4



What is the size of the smallest MIS (Maximal Independent Set) of a chain of nine nodes?

- A. 5      B. 4      C. 3      D. 2

gateit-2008 normal graph-connectivity

[Answer key](#)

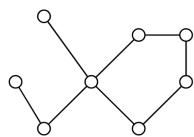
## 2.5

### Graph Isomorphism (3)

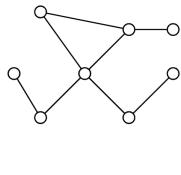


#### 2.5.1 Graph Isomorphism: GATE CSE 2012 | Question: 26

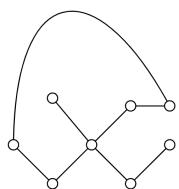
Which of the following graphs is isomorphic to



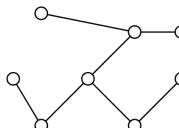
A.



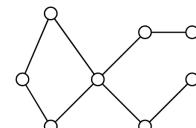
B.



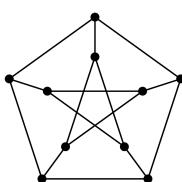
C.



D.

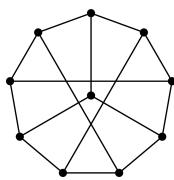


gatecse-2012 graph-theory graph-isomorphism normal

**Answer key****2.5.2 Graph Isomorphism: GATE CSE 2014 Set 2 | Question: 51**A cycle on  $n$  vertices is isomorphic to its complement. The value of  $n$  is \_\_\_\_\_.  
  
gatecse-2014-set2 graph-theory numerical-answers normal graph-isomorphism**Answer key****2.5.3 Graph Isomorphism: GATE CSE 2022 | Question: 40**The following simple undirected graph is referred to as the Peterson graph.  
  
gatecse-2022 graph-theory graph-isomorphism multiple-selects two-marks

Which of the following statements is/are TRUE?

- A. The chromatic number of the graph is 3.
- B. The graph has a Hamiltonian path.
- C. The following graph is isomorphic to the Peterson graph.



- D. The size of the largest independent set of the given graph is 3. (A subset of vertices of a graph form an independent set if no two vertices of the subset are adjacent.)

gatecse-2022 graph-theory graph-isomorphism multiple-selects two-marks

**Answer key****2.6****Graph Matching (1)****2.6.1 Graph Matching: GATE CSE 2003 | Question: 36**How many perfect matching are there in a complete graph of 6 vertices?  
  
gatecse-2003 graph-theory graph-matching normal

- A. 15
- B. 24
- C. 30
- D. 60

gatecse-2003 graph-theory graph-matching normal

**Answer key**

2.7

**Graph Planarity (13)****2.7.1 Graph Planarity: GATE CSE 1987 | Question: 2e**

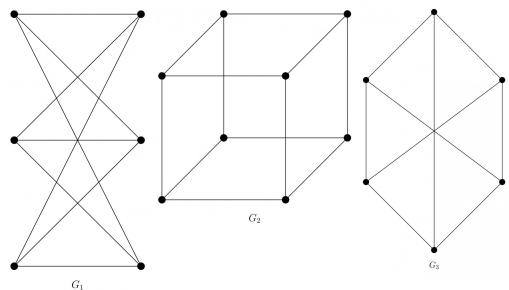
State whether the following statement is TRUE or FALSE:

There is a linear-time algorithm for testing the planarity of finite graphs.

gate1987 graph-theory graph-planarity true-false

**Answer key** **2.7.2 Graph Planarity: GATE CSE 1989 | Question: 3-vi**

Which of the following graphs is/are planar?



gate1989 normal graph-theory graph-planarity descriptive

**Answer key** **2.7.3 Graph Planarity: GATE CSE 1990 | Question: 3-xi**

A graph is planar if and only if,

- A. It does not contain a subgraph homeomorphic to  $k_5$  and  $k_{3,3}$ .
- B. It does not contain a subgraph isomorphic to  $k_5$  and  $k_{3,3}$ .
- C. It does not contain a subgraph isomorphic to  $k_5$  or  $k_{3,3}$ .
- D. It does not contain a subgraph homeomorphic to  $k_5$  or  $k_{3,3}$ .

gate1990 normal graph-theory graph-planarity multiple-selects

**Answer key** **2.7.4 Graph Planarity: GATE CSE 1992 | Question: 01,x**Maximum number of edges in a planar graph with  $n$  vertices is \_\_\_\_\_

gate1992 graph-theory graph-planarity easy fill-in-the-blanks

**Answer key** **2.7.5 Graph Planarity: GATE CSE 1992 | Question: 02,viii**

A non-planar graph with minimum number of vertices has

- |                         |                        |
|-------------------------|------------------------|
| A. 9 edges, 6 vertices  | B. 6 edges, 4 vertices |
| C. 10 edges, 5 vertices | D. 9 edges, 5 vertices |

gate1992 graph-theory normal graph-planarity

**Answer key** **2.7.6 Graph Planarity: GATE CSE 2005 | Question: 10**Let  $G$  be a simple connected planar graph with 13 vertices and 19 edges. Then, the number of faces in the planar embedding of the graph is:

- |      |      |      |       |
|------|------|------|-------|
| A. 6 | B. 8 | C. 9 | D. 13 |
|------|------|------|-------|

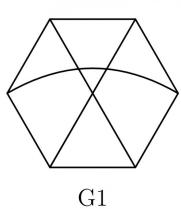
gatecse-2005 graph-theory graph-planarity

**Answer key**

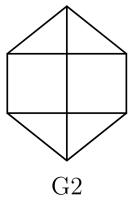
### 2.7.7 Graph Planarity: GATE CSE 2005 | Question: 47



Which one of the following graphs is NOT planar?



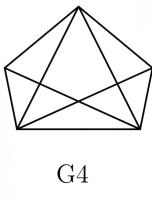
G1



G2



G3



G4

- A. G1      B. G2      C. G3      D. G4

gatecse-2005 graph-theory graph-planarity normal

Answer key

### 2.7.8 Graph Planarity: GATE CSE 2008 | Question: 23



Which of the following statements is true for every planar graph on  $n$  vertices?

- A. The graph is connected      B. The graph is Eulerian  
C. The graph has a vertex-cover of size at most  $\frac{3n}{4}$       D. The graph has an independent set of size at least  $\frac{n}{3}$

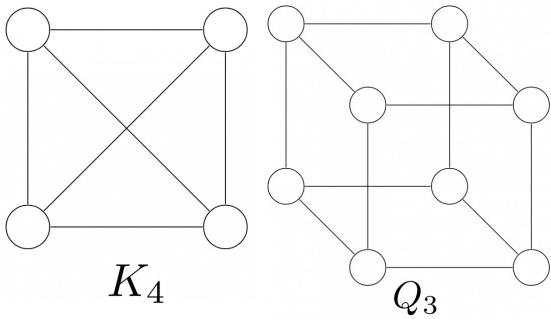
gatecse-2008 graph-theory normal graph-planarity

Answer key

### 2.7.9 Graph Planarity: GATE CSE 2011 | Question: 17



$K_4$  and  $Q_3$  are graphs with the following structures.



Which one of the following statements is **TRUE** in relation to these graphs?

- A.  $K_4$  is a planar while  $Q_3$  is not      B. Both  $K_4$  and  $Q_3$  are planar  
C.  $Q_3$  is planar while  $K_4$  is not      D. Neither  $K_4$  nor  $Q_3$  is planar

gatecse-2011 graph-theory graph-planarity normal

Answer key

### 2.7.10 Graph Planarity: GATE CSE 2012 | Question: 17



Let  $G$  be a simple undirected planar graph on 10 vertices with 15 edges. If  $G$  is a connected graph, then the number of **bounded** faces in any embedding of  $G$  on the plane is equal to

- A. 3      B. 4      C. 5      D. 6

gatecse-2012 graph-theory graph-planarity normal

Answer key

### 2.7.11 Graph Planarity: GATE CSE 2014 Set 3 | Question: 52



Let  $\delta$  denote the minimum degree of a vertex in a graph. For all planar graphs on  $n$  vertices with  $\delta \geq 3$ , which one of the following is **TRUE**?

- A. In any planar embedding, the number of faces is at least  $\frac{n}{2} + 2$   
B. In any planar embedding, the number of faces is less than  $\frac{n}{2} + 2$

- C. There is a planar embedding in which the number of faces is less than  $\frac{n}{2} + 2$   
 D. There is a planar embedding in which the number of faces is at most  $\frac{n}{\delta+1}$

gatecse-2014-set3 graph-theory graph-planarity normal

[Answer key](#)

### 2.7.12 Graph Planarity: GATE CSE 2015 Set 1 | Question: 54



Let  $G$  be a connected planar graph with 10 vertices. If the number of edges on each face is three, then the number of edges in  $G$  is \_\_\_\_\_.

gatecse-2015-set1 graph-theory graph-connectivity normal graph-planarity numerical-answers

[Answer key](#)

### 2.7.13 Graph Planarity: GATE CSE 2021 Set 1 | Question: 16



In an undirected connected planar graph  $G$ , there are eight vertices and five faces. The number of edges in  $G$  is \_\_\_\_\_.

gatecse-2021-set1 graph-theory graph-planarity numerical-answers easy one-mark

[Answer key](#)

## Answer Keys

2.1.1	D	2.1.2	D	2.1.3	X	2.2.1	N/A	2.2.2	N/A
2.2.3	N/A	2.2.4	D	2.2.5	C	2.2.6	C	2.2.7	B
2.2.8	C	2.2.9	D	2.2.10	C	2.2.11	C	2.2.12	16
2.3.1	D	2.3.2	C	2.3.3	A	2.3.4	4	2.3.5	3
2.3.6	7	2.3.7	A;B	2.3.8	B;C	2.3.9	2	2.3.10	C
2.3.11	B	2.4.1	N/A	2.4.2	N/A	2.4.3	N/A	2.4.4	N/A
2.4.5	N/A	2.4.6	C;D	2.4.7	C	2.4.8	N/A	2.4.9	N/A
2.4.10	B	2.4.11	D	2.4.12	N/A	2.4.13	B	2.4.14	C
2.4.15	B	2.4.16	A	2.4.17	B	2.4.18	C	2.4.19	D
2.4.20	A	2.4.21	506	2.4.22	36	2.4.23	C	2.4.24	B
2.4.25	C;D	2.4.26	C	2.4.27	A	2.4.28	36	2.4.29	D
2.4.30	A	2.4.31	16	2.4.32	D	2.4.33	B	2.4.34	D
2.4.35	A	2.4.36	B	2.4.37	D	2.4.38	C	2.4.39	D
2.4.40	C	2.5.1	B	2.5.2	5	2.5.3	A;B;C	2.6.1	A
2.7.1	Q-Q	2.7.2	N/A	2.7.3	D	2.7.4	N/A	2.7.5	C
2.7.6	B	2.7.7	A	2.7.8	C	2.7.9	B	2.7.10	D
2.7.11	A	2.7.12	24	2.7.13	11 : 11				



**Syllabus:** Propositional and first order logic.

#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
<b>1 Mark Count</b>	0	1	0	1	1	0	1	1	0	0.63	1
<b>2 Marks Count</b>	1	0	0	0	0	0	0	0	0	0.13	1
<b>Total Marks</b>	2	1	0	1	1	0	1	1	0	0.88	2

### 3.1

#### First Order Logic (34)



##### 3.1.1 First Order Logic: GATE CSE 1989 | Question: 14a

Symbolize the expression "Every mother loves her children" in predicate logic.

gate1989 descriptive first-order-logic mathematical-logic

Answer key

##### 3.1.2 First Order Logic: GATE CSE 1991 | Question: 15,b



Consider the following first order formula:

$$\left( \begin{array}{c} \forall x \exists y : R(x, y) \\ \wedge \\ \forall x \forall y : (R(x, y) \implies \neg R(y, x)) \\ \wedge \\ \forall x \forall y \forall z : (R(x, y) \wedge R(y, z) \implies R(x, z)) \\ \wedge \\ \forall x : \neg R(x, x) \end{array} \right)$$

Does it have finite models?

Is it satisfiable? If so, give a countable model for it.

gate1991 mathematical-logic first-order-logic descriptive

Answer key

##### 3.1.3 First Order Logic: GATE CSE 1992 | Question: 92,xv



Which of the following predicate calculus statements is/are valid?

- A.  $(\forall(x))P(x) \vee (\forall(x))Q(x) \implies (\forall(x))(P(x) \vee Q(x))$
- B.  $(\exists(x))P(x) \wedge (\exists(x))Q(x) \implies (\exists(x))(P(x) \wedge Q(x))$
- C.  $(\forall(x))(P(x) \vee Q(x)) \implies (\forall(x))P(x) \vee (\forall(x))Q(x)$
- D.  $(\exists(x))(P(x) \vee Q(x)) \implies \sim(\forall(x))P(x) \vee (\exists(x))Q(x)$

gate1992 mathematical-logic normal first-order-logic

Answer key

##### 3.1.4 First Order Logic: GATE CSE 2003 | Question: 32



Which of the following is a valid first order formula? (Here  $\alpha$  and  $\beta$  are first order formulae with  $x$  as their only free variable)

- A.  $((\forall x)[\alpha] \Rightarrow (\forall x)[\beta]) \Rightarrow (\forall x)[\alpha \Rightarrow \beta]$

- B.  $(\forall x)[\alpha] \Rightarrow (\exists x)[\alpha \wedge \beta]$   
 C.  $((\forall x)[\alpha \vee \beta] \Rightarrow (\exists x)[\alpha]) \Rightarrow (\forall x)[\alpha]$   
 D.  $(\forall x)[\alpha \Rightarrow \beta] \Rightarrow (((\forall x)[\alpha]) \Rightarrow (\forall x)[\beta])$

gatecse-2003 mathematical-logic first-order-logic normal

Answer key 



### 3.1.5 First Order Logic: GATE CSE 2003 | Question: 33

Consider the following formula and its two interpretations  $I_1$  and  $I_2$ .

$$\alpha : (\forall x) [P_x \Leftrightarrow (\forall y) [Q_{xy} \Leftrightarrow \neg Q_{yy}]] \Rightarrow (\forall x) [\neg P_x]$$

$I_1$  : Domain: the set of natural numbers

$P_x$  = ' $x$  is a prime number'

$Q_{xy}$  = ' $y$  divides  $x$ '

$I_2$  : same as  $I_1$  except that  $P_x$  = ' $x$  is a composite number'.

Which of the following statements is true?

- A.  $I_1$  satisfies  $\alpha$ ,  $I_2$  does not  
 B.  $I_2$  satisfies  $\alpha$ ,  $I_1$  does not  
 C. Neither  $I_1$  nor  $I_2$  satisfies  $\alpha$   
 D. Both  $I_1$  and  $I_2$  satisfies  $\alpha$

gatecse-2003 mathematical-logic difficult first-order-logic

Answer key 



### 3.1.6 First Order Logic: GATE CSE 2004 | Question: 23, ISRO2007-32

Identify the correct translation into logical notation of the following assertion.

Some boys in the class are taller than all the girls

Note: taller( $x, y$ ) is true if  $x$  is taller than  $y$ .

- A.  $(\exists x)(\text{boy}(x) \rightarrow (\forall y)(\text{girl}(y) \wedge \text{taller}(x, y)))$   
 B.  $(\exists x)(\text{boy}(x) \wedge (\forall y)(\text{girl}(y) \wedge \text{taller}(x, y)))$   
 C.  $(\exists x)(\text{boy}(x) \rightarrow (\forall y)(\text{girl}(y) \rightarrow \text{taller}(x, y)))$   
 D.  $(\exists x)(\text{boy}(x) \wedge (\forall y)(\text{girl}(y) \rightarrow \text{taller}(x, y)))$

gatecse-2004 mathematical-logic easy isro2007 first-order-logic

Answer key 



### 3.1.7 First Order Logic: GATE CSE 2005 | Question: 41

What is the first order predicate calculus statement equivalent to the following?

"Every teacher is liked by some student"

- A.  $\forall(x) [\text{teacher}(x) \rightarrow \exists(y) [\text{student}(y) \rightarrow \text{likes}(y, x)]]$   
 B.  $\forall(x) [\text{teacher}(x) \rightarrow \exists(y) [\text{student}(y) \wedge \text{likes}(y, x)]]$   
 C.  $\exists(y) \forall(x) [\text{teacher}(x) \rightarrow [\text{student}(y) \wedge \text{likes}(y, x)]]$   
 D.  $\forall(x) [\text{teacher}(x) \wedge \exists(y) [\text{student}(y) \rightarrow \text{likes}(y, x)]]$

gatecse-2005 mathematical-logic easy first-order-logic

Answer key 

### 3.1.8 First Order Logic: GATE CSE 2006 | Question: 26



Which one of the first order predicate calculus statements given below correctly expresses the following English statement?

**Tigers and lions attack if they are hungry or threatened.**

- A.  $\forall x[(\text{tiger}(x) \wedge \text{lion}(x)) \rightarrow (\text{hungry}(x) \vee \text{threatened}(x)) \rightarrow \text{attacks}(x)]$
- B.  $\forall x[(\text{tiger}(x) \vee \text{lion}(x)) \rightarrow (\text{hungry}(x) \vee \text{threatened}(x)) \wedge \text{attacks}(x)]$
- C.  $\forall x[(\text{tiger}(x) \vee \text{lion}(x)) \rightarrow \text{attacks}(x) \rightarrow (\text{hungry}(x) \vee \text{threatened}(x))]$
- D.  $\forall x[(\text{tiger}(x) \vee \text{lion}(x)) \rightarrow (\text{hungry}(x) \vee \text{threatened}(x)) \rightarrow \text{attacks}(x)]$

gatecse-2006 mathematical-logic normal first-order-logic

[Answer key](#)

### 3.1.9 First Order Logic: GATE CSE 2007 | Question: 22



Let  $\text{Graph}(x)$  be a predicate which denotes that  $x$  is a graph. Let  $\text{Connected}(x)$  be a predicate which denotes that  $x$  is connected. Which of the following first order logic sentences **DOES NOT** represent the statement:

"Not every graph is connected"

- A.  $\neg \forall x (\text{Graph}(x) \implies \text{Connected}(x))$
- B.  $\exists x (\text{Graph}(x) \wedge \neg \text{Connected}(x))$
- C.  $\neg \forall x (\neg \text{Graph}(x) \vee \text{Connected}(x))$
- D.  $\forall x (\text{Graph}(x) \implies \neg \text{Connected}(x))$

gatecse-2007 mathematical-logic easy first-order-logic

[Answer key](#)

### 3.1.10 First Order Logic: GATE CSE 2008 | Question: 30



Let  $\text{fsa}$  and  $\text{pda}$  be two predicates such that  $\text{fsa}(x)$  means  $x$  is a finite state automaton and  $\text{pda}(y)$  means that  $y$  is a pushdown automaton. Let  $\text{equivalent}$  be another predicate such that  $\text{equivalent}(a, b)$  means  $a$  and  $b$  are equivalent. Which of the following first order logic statements represent the following?

Each finite state automaton has an equivalent pushdown automaton

- A.  $(\forall x \text{fsa}(x)) \implies (\exists y \text{pda}(y) \wedge \text{equivalent}(x, y))$
- B.  $\neg \forall y (\exists x \text{fsa}(x) \implies \text{pda}(y) \wedge \text{equivalent}(x, y))$
- C.  $\forall x \exists y (\text{fsa}(x) \wedge \text{pda}(y) \wedge \text{equivalent}(x, y))$
- D.  $\forall x \exists y (\text{fsa}(y) \wedge \text{pda}(x) \wedge \text{equivalent}(x, y))$

gatecse-2008 easy mathematical-logic first-order-logic

[Answer key](#)

### 3.1.11 First Order Logic: GATE CSE 2009 | Question: 23



Which one of the following is the most appropriate logical formula to represent the statement?

"Gold and silver ornaments are precious".

The following notations are used:

- $G(x)$  :  $x$  is a gold ornament
- $S(x)$  :  $x$  is a silver ornament
- $P(x)$  :  $x$  is precious

- A.  $\forall x(P(x) \implies (G(x) \wedge S(x)))$
- B.  $\forall x((G(x) \wedge S(x)) \implies P(x))$
- C.  $\exists x((G(x) \wedge S(x)) \implies P(x))$
- D.  $\forall x((G(x) \vee S(x)) \implies P(x))$

gatecse-2009 mathematical-logic easy first-order-logic

[Answer key](#)

### 3.1.12 First Order Logic: GATE CSE 2009 | Question: 26



Consider the following well-formed formulae:

- I.  $\neg\forall x(P(x))$
- II.  $\neg\exists x(P(x))$
- III.  $\neg\exists x(\neg P(x))$
- IV.  $\exists x(\neg P(x))$

Which of the above are equivalent?

- A. I and III      B. I and IV      C. II and III      D. II and IV

gatecse-2009    mathematical-logic    normal    first-order-logic

[Answer key](#) 

### 3.1.13 First Order Logic: GATE CSE 2010 | Question: 30



Suppose the predicate  $F(x,y,t)$  is used to represent the statement that person  $x$  can fool person  $y$  at time  $t$ .

Which one of the statements below expresses best the meaning of the formula,

$$\forall x \exists y \exists t (\neg F(x, y, t))$$

- A. Everyone can fool some person at some time
- B. No one can fool everyone all the time
- C. Everyone cannot fool some person all the time
- D. No one can fool some person at some time

gatecse-2010    mathematical-logic    easy    first-order-logic

[Answer key](#) 

### 3.1.14 First Order Logic: GATE CSE 2011 | Question: 30



Which one of the following options is CORRECT given three positive integers  $x, y$  and  $z$ , and a predicate

$$P(x) = \neg(x = 1) \wedge \forall y (\exists z (x = y * z) \Rightarrow (y = x) \vee (y = 1))$$

- A.  $P(x)$  being true means that  $x$  is a prime number
- B.  $P(x)$  being true means that  $x$  is a number other than 1
- C.  $P(x)$  is always true irrespective of the value of  $x$
- D.  $P(x)$  being true means that  $x$  has exactly two factors other than 1 and  $x$

gatecse-2011    mathematical-logic    normal    first-order-logic

[Answer key](#) 

### 3.1.15 First Order Logic: GATE CSE 2012 | Question: 13



What is the correct translation of the following statement into mathematical logic?

"Some real numbers are rational"

- |   |  |
|---|--|
| A. $\exists x (\text{real}(x) \vee \text{rational}(x))$   | B. $\forall x (\text{real}(x) \rightarrow \text{rational}(x))$ |
| C. $\exists x (\text{real}(x) \wedge \text{rational}(x))$ | D. $\exists x (\text{rational}(x) \rightarrow \text{real}(x))$ |

gatecse-2012    mathematical-logic    easy    first-order-logic

[Answer key](#) 

### 3.1.16 First Order Logic: GATE CSE 2013 | Question: 27



What is the logical translation of the following statement?

"None of my friends are perfect."

- |   |  |
|---|--|
| A. $\exists x (F(x) \wedge \neg P(x))$      | B. $\exists x (\neg F(x) \wedge P(x))$ |
| C. $\exists x (\neg F(x) \wedge \neg P(x))$ | D. $\neg \exists x (F(x) \wedge P(x))$ |

gatecse-2013    mathematical-logic    easy    first-order-logic

[Answer key](#) 

### 3.1.17 First Order Logic: GATE CSE 2013 | Question: 47



Which one of the following is **NOT** logically equivalent to  $\neg \exists x (\forall y(\alpha) \wedge \forall z(\beta))$  ?

- A.  $\forall x (\exists z(\neg\beta) \rightarrow \forall y(\alpha))$
- B.  $\forall x (\forall z(\beta) \rightarrow \exists y(\neg\alpha))$
- C.  $\forall x (\forall y(\alpha) \rightarrow \exists z(\neg\beta))$
- D.  $\forall x (\exists y(\neg\alpha) \rightarrow \exists z(\neg\beta))$

mathematical-logic normal marks-to-all gatecse-2013 first-order-logic

Answer key

### 3.1.18 First Order Logic: GATE CSE 2014 Set 1 | Question: 1



Consider the statement

"Not all that glitters is gold"

Predicate  $\text{glitters}(x)$  is true if  $x$  glitters and predicate  $\text{gold}(x)$  is true if  $x$  is gold. Which one of the following logical formulae represents the above statement?

- A.  $\forall x : \text{glitters}(x) \Rightarrow \neg \text{gold}(x)$
- B.  $\forall x : \text{gold}(x) \Rightarrow \text{glitters}(x)$
- C.  $\exists x : \text{gold}(x) \wedge \neg \text{glitters}(x)$
- D.  $\exists x : \text{glitters}(x) \wedge \neg \text{gold}(x)$

gatecse-2014-set1 mathematical-logic first-order-logic

Answer key

### 3.1.19 First Order Logic: GATE CSE 2014 Set 3 | Question: 53



The CORRECT formula for the sentence, "not all Rainy days are Cold" is

- A.  $\forall d (\text{Rainy}(d) \wedge \neg \text{Cold}(d))$
- B.  $\forall d (\neg \text{Rainy}(d) \rightarrow \text{Cold}(d))$
- C.  $\exists d (\neg \text{Rainy}(d) \rightarrow \text{Cold}(d))$
- D.  $\exists d (\text{Rainy}(d) \wedge \neg \text{Cold}(d))$

gatecse-2014-set3 mathematical-logic easy first-order-logic

Answer key

### 3.1.20 First Order Logic: GATE CSE 2015 Set 2 | Question: 55



Which one of the following well-formed formulae is a tautology?

- A.  $\forall x \exists y R(x,y) \leftrightarrow \exists y \forall x R(x,y)$
- B.  $(\forall x [\exists y R(x,y) \rightarrow S(x,y)]) \rightarrow \forall x \exists y S(x,y)$
- C.  $[\forall x \exists y (P(x,y) \rightarrow R(x,y))] \leftrightarrow [\forall x \exists y (\neg P(x,y) \vee R(x,y))]$
- D.  $\forall x \forall y P(x,y) \rightarrow \forall x \forall y P(y,x)$

gatecse-2015-set2 mathematical-logic normal first-order-logic

Answer key

### 3.1.21 First Order Logic: GATE CSE 2016 Set 2 | Question: 27



Which one of the following well-formed formulae in predicate calculus is **NOT** valid ?

- A.  $(\forall_x p(x) \implies \forall_x q(x)) \implies (\exists_x \neg p(x) \vee \forall_x q(x))$
- B.  $(\exists_x p(x) \vee \exists_x q(x)) \implies \exists_x (p(x) \vee q(x))$
- C.  $\exists_x (p(x) \wedge q(x)) \implies (\exists_x p(x) \wedge \exists_x q(x))$
- D.  $\forall_x (p(x) \vee q(x)) \implies (\forall_x p(x) \vee \forall_x q(x))$

gatecse-2016-set2 mathematical-logic first-order-logic normal

Answer key

### 3.1.22 First Order Logic: GATE CSE 2017 Set 1 | Question: 02



Consider the first-order logic sentence  $F : \forall x (\exists y R(x,y))$ . Assuming non-empty logical domains, which of the

sentences below are *implied* by  $F$ ?

- I.  $\exists y(\exists xR(x,y))$
- II.  $\exists y(\forall xR(x,y))$
- III.  $\forall y(\exists xR(x,y))$
- IV.  $\neg\exists x(\forall y\neg R(x,y))$

A. IV only

B. I and IV only

C. II only

D. II and III only

gatecse-2017-set1 mathematical-logic first-order-logic

Answer key 



### 3.1.23 First Order Logic: GATE CSE 2018 | Question: 28

Consider the first-order logic sentence

$$\varphi \equiv \exists s \exists t \exists u \forall v \forall w \forall x \forall y \psi(s, t, u, v, w, x, y)$$

where  $\psi(s, t, u, v, w, x, y)$  is a quantifier-free first-order logic formula using only predicate symbols, and possibly equality, but no function symbols. Suppose  $\varphi$  has a model with a universe containing 7 elements.

Which one of the following statements is necessarily true?

- A. There exists at least one model of  $\varphi$  with universe of size less than or equal to 3
- B. There exists no model of  $\varphi$  with universe of size less than or equal to 3
- C. There exists no model of  $\varphi$  with universe size of greater than 7
- D. Every model of  $\varphi$  has a universe of size equal to 7

gatecse-2018 mathematical-logic normal first-order-logic two-marks

Answer key 



### 3.1.24 First Order Logic: GATE CSE 2019 | Question: 35

Consider the first order predicate formula  $\varphi$ :

$$\forall x[(\forall z z|x \Rightarrow ((z=x) \vee (z=1))) \rightarrow \exists w(w>x) \wedge (\forall z z|w \Rightarrow ((w=z) \vee (z=1)))]$$

Here  $a | b$  denotes that ' $a$  divides  $b$ ', where  $a$  and  $b$  are integers. Consider the following sets:

- $S_1 : \{1, 2, 3, \dots, 100\}$
- $S_2 : \text{Set of all positive integers}$
- $S_3 : \text{Set of all integers}$

Which of the above sets satisfy  $\varphi$ ?

A.  $S_1$  and  $S_2$

B.  $S_1$  and  $S_3$

C.  $S_2$  and  $S_3$

D.  $S_1, S_2$  and  $S_3$

gatecse-2019 engineering-mathematics discrete-mathematics mathematical-logic first-order-logic two-marks

Answer key 



### 3.1.25 First Order Logic: GATE CSE 2020 | Question: 39

Which one of the following predicate formulae is NOT logically valid?

Note that  $W$  is a predicate formula without any free occurrence of  $x$ .

- A.  $\forall x(p(x) \vee W) \equiv \forall x(p(x)) \vee W$
- B.  $\exists x(p(x) \wedge W) \equiv \exists x(p(x)) \wedge W$
- C.  $\forall x(p(x) \rightarrow W) \equiv \forall x(p(x)) \rightarrow W$
- D.  $\exists x(p(x) \rightarrow W) \equiv \forall x(p(x)) \rightarrow W$

gatecse-2020 first-order-logic mathematical-logic two-marks

Answer key 



### 3.1.26 First Order Logic: GATE CSE 2023 | Question: 16

Geetha has a conjecture about integers, which is of the form

$$\forall x(P(x) \implies \exists y Q(x, y)),$$

where  $P$  is a statement about integers, and  $Q$  is a statement about pairs of integers. Which of the following (one or more) option(s) would *imply* Geetha's conjecture?

- A.  $\exists x(P(x) \wedge \forall y Q(x, y))$
- B.  $\forall x \forall y Q(x, y)$
- C.  $\exists y \forall x(P(x) \implies Q(x, y))$
- D.  $\exists x(P(x) \wedge \exists y Q(x, y))$

gatecse-2023 mathematical-logic first-order-logic multiple-selects one-mark

[Answer key](#) 

### 3.1.27 First Order Logic: GATE CSE 2025 | Set 1 | Question: 38



Which of the following predicate logic formulae/formula is/are CORRECT representation(s) of the statement: "Everyone has exactly one mother"?

The meanings of the predicates used are:

- $\text{mother}(y, x)$ :  $y$  is the mother of  $x$
- $\text{noteq}(x, y)$ :  $x$  and  $y$  are not equal

- A.  $\forall x \exists y \exists z(\text{mother}(y, x) \wedge \neg \text{mother}(z, x))$
- B.  $\forall x \exists y[\text{mother}(y, x) \wedge \forall z(\text{noteq}(z, y) \rightarrow \neg \text{mother}(z, x))]$
- C.  $\forall x \forall y[\text{mother}(y, x) \rightarrow \exists z(\text{mother}(z, x) \wedge \neg \text{noteq}(z, y))]$
- D.  $\forall x \exists y[\text{mother}(y, x) \wedge \neg \exists z(\text{noteq}(z, y) \wedge \text{mother}(z, x))]$

gatecse2025-set1 mathematical-logic first-order-logic multiple-selects two-marks

[Answer key](#) 

### 3.1.28 First Order Logic: GATE CSE 2025 | Set 2 | Question: 5



Let  $P(x)$  be an arbitrary predicate over the domain of natural numbers. Which ONE of the following statements is TRUE?

- A.  $(P(0) \wedge (\forall x[P(x) \Rightarrow P(x + 1)])) \Rightarrow \forall x P(x))$
- B.  $(P(0) \wedge (\forall x[P(x) \Rightarrow P(x - 1)])) \Rightarrow \forall x P(x))$
- C.  $(P(1000) \wedge (\forall x[P(x) \Rightarrow P(x - 1)])) \Rightarrow \forall x P(x))$
- D.  $(P(1000) \wedge (\forall x[P(x) \Rightarrow P(x + 1)])) \Rightarrow \forall x P(x))$

gatecse2025-set2 mathematical-logic first-order-logic one-mark

[Answer key](#) 

### 3.1.29 First Order Logic: GATE IT 2004 | Question: 3



Let  $a(x, y), b(x, y)$ , and  $c(x, y)$  be three statements with variables  $x$  and  $y$  chosen from some universe. Consider the following statement:

$$(\exists x)(\forall y)[(a(x, y) \wedge b(x, y)) \wedge \neg c(x, y)]$$

Which one of the following is its equivalent?

- A.  $(\forall x)(\exists y)[(a(x, y) \vee b(x, y)) \rightarrow c(x, y)]$
- B.  $(\exists x)(\forall y)[(a(x, y) \vee b(x, y)) \wedge \neg c(x, y)]$
- C.  $\neg(\forall x)(\exists y)[(a(x, y) \wedge b(x, y)) \rightarrow c(x, y)]$
- D.  $\neg(\forall x)(\exists y)[(a(x, y) \vee b(x, y)) \rightarrow c(x, y)]$

gateit-2004 mathematical-logic normal discrete-mathematics first-order-logic

[Answer key](#) 

### 3.1.30 First Order Logic: GATE IT 2005 | Question: 36



Let  $P(x)$  and  $Q(x)$  be arbitrary predicates. Which of the following statements is always **TRUE**?

- A.  $((\forall x(P(x) \vee Q(x)))) \Rightarrow ((\forall xP(x)) \vee (\forall xQ(x)))$
- B.  $(\forall x(P(x) \Rightarrow Q(x))) \Rightarrow ((\forall xP(x)) \Rightarrow (\forall xQ(x)))$
- C.  $(\forall x(P(x)) \Rightarrow \forall x(Q(x))) \Rightarrow (\forall x(P(x) \Rightarrow Q(x)))$
- D.  $(\forall x(P(x)) \Leftrightarrow (\forall x(Q(x)))) \Rightarrow ((\forall x(P(x) \Leftrightarrow Q(x)))$

gateit-2005 mathematical-logic normal first-order-logic

[Answer key](#)

### 3.1.31 First Order Logic: GATE IT 2006 | Question: 21



Consider the following first order logic formula in which  $R$  is a binary relation symbol.

$$\forall x \forall y(R(x,y) \Rightarrow R(y,x))$$

The formula is

- A. satisfiable and valid
- B. satisfiable and so is its negation
- C. unsatisfiable but its negation is valid
- D. satisfiable but its negation is unsatisfiable

gateit-2006 mathematical-logic normal first-order-logic

[Answer key](#)

### 3.1.32 First Order Logic: GATE IT 2007 | Question: 21



Which one of these first-order logic formulae is valid?

- A.  $\forall x(P(x) \Rightarrow Q(x)) \Rightarrow (\forall xP(x) \Rightarrow \forall xQ(x))$
- B.  $\exists x(P(x) \vee Q(x)) \Rightarrow (\exists xP(x) \Rightarrow \exists xQ(x))$
- C.  $\exists x(P(x) \wedge Q(x)) \Leftrightarrow (\exists xP(x) \wedge \exists xQ(x))$
- D.  $\forall x \exists y P(x,y) \Rightarrow \exists y \forall x P(x,y)$

gateit-2007 mathematical-logic normal first-order-logic

[Answer key](#)

### 3.1.33 First Order Logic: GATE IT 2008 | Question: 21



Which of the following first order formulae is logically valid? Here  $\alpha(x)$  is a first order formula with  $x$  as a free variable, and  $\beta$  is a first order formula with no free variable.

- A.  $[\beta \rightarrow (\exists x, \alpha(x))] \rightarrow [\forall x, \beta \rightarrow \alpha(x)]$
- B.  $[\exists x, \beta \rightarrow \alpha(x)] \rightarrow [\beta \rightarrow (\forall x, \alpha(x))]$
- C.  $[(\exists x, \alpha(x)) \rightarrow \beta] \rightarrow [\forall x, \alpha(x) \rightarrow \beta]$
- D.  $[(\forall x, \alpha(x)) \rightarrow \beta] \rightarrow [\forall x, \alpha(x) \rightarrow \beta]$

gateit-2008 first-order-logic normal

[Answer key](#)

### 3.1.34 First Order Logic: GATE IT 2008 | Question: 22



Which of the following is the negation of  $[\forall x, \alpha \rightarrow (\exists y, \beta \rightarrow (\forall u, \exists v, y))]$

- A.  $[\exists x, \alpha \rightarrow (\forall y, \beta \rightarrow (\exists u, \forall v, y))]$
- B.  $[\exists x, \alpha \rightarrow (\forall y, \beta \rightarrow (\exists u, \forall v, \neg y))]$
- C.  $[\forall x, \neg \alpha \rightarrow (\exists y, \neg \beta \rightarrow (\forall u, \exists v, \neg y))]$
- D.  $[\exists x, \alpha \wedge (\forall y, \beta \wedge (\exists u, \forall v, \neg y))]$

gateit-2008 mathematical-logic normal first-order-logic

[Answer key](#)

### 3.2

### Logical Reasoning (3)

#### 3.2.1 Logical Reasoning: GATE CSE 2012 | Question: 1



Consider the following logical inferences.

$I_1$ : If it rains then the cricket match will not be played.

The cricket match was played.

Inference: There was no rain.

$I_2$ : If it rains then the cricket match will not be played.

It did not rain.

Inference: The cricket match was played.

Which of the following is **TRUE**?

- A. Both  $I_1$  and  $I_2$  are correct inferences
- B.  $I_1$  is correct but  $I_2$  is not a correct inference
- C.  $I_1$  is not correct but  $I_2$  is a correct inference
- D. Both  $I_1$  and  $I_2$  are not correct inferences

gatecse-2012 mathematical-logic easy logical-reasoning

Answer key

#### 3.2.2 Logical Reasoning: GATE CSE 2015 Set 2 | Question: 3



Consider the following two statements.

- $S_1$ : If a candidate is known to be corrupt, then he will not be elected
- $S_2$ : If a candidate is kind, he will be elected

Which one of the following statements follows from  $S_1$  and  $S_2$  as per sound inference rules of logic?

- A. If a person is known to be corrupt, he is kind
- B. If a person is not known to be corrupt, he is not kind
- C. If a person is kind, he is not known to be corrupt
- D. If a person is not kind, he is not known to be corrupt

gatecse-2015-set2 mathematical-logic normal logical-reasoning

Answer key

#### 3.2.3 Logical Reasoning: GATE CSE 2015 Set 3 | Question: 24



In a room there are only two types of people, namely Type 1 and Type 2. Type 1 people always tell the truth and Type 2 people always lie. You give a fair coin to a person in that room, without knowing which type he is from and tell him to toss it and hide the result from you till you ask for it. Upon asking the person replies the following

"The result of the toss is head if and only if I am telling the truth"

Which of the following options is correct?

- |  |  |
|--|--|
| A. The result is head                                  | B. The result is tail                                  |
| C. If the person is of Type 2, then the result is tail | D. If the person is of Type 1, then the result is tail |

gatecse-2015-set3 mathematical-logic difficult logical-reasoning

Answer key

### 3.3

### Propositional Logic (40)

#### 3.3.1 Propositional Logic: GATE CSE 1987 | Question: 10e



Show that the conclusion  $(r \rightarrow q)$  follows from the premises:  $p, (p \rightarrow q) \vee (p \wedge (r \rightarrow q))$

gate1987 mathematical-logic propositional-logic proof descriptive

Answer key

### 3.3.2 Propositional Logic: GATE CSE 1988 | Question: 2vii



Define the validity of a well-formed formula(wff)?

gate1988 descriptive mathematical-logic propositional-logic

[Answer key](#)

### 3.3.3 Propositional Logic: GATE CSE 1989 | Question: 3-v



Which of the following well-formed formulas are equivalent?

- A.  $P \rightarrow Q$
- B.  $\neg Q \rightarrow \neg P$
- C.  $\neg P \vee Q$
- D.  $\neg Q \rightarrow P$

gate1989 normal mathematical-logic propositional-logic multiple-selects

[Answer key](#)

### 3.3.4 Propositional Logic: GATE CSE 1990 | Question: 3-x



Indicate which of the following well-formed formulae are valid:

- A.  $(P \Rightarrow Q) \wedge (Q \Rightarrow R) \Rightarrow (P \Rightarrow R)$
- B.  $(P \Rightarrow Q) \Rightarrow (\neg P \Rightarrow \neg Q)$
- C.  $(P \wedge (\neg P \vee \neg Q)) \Rightarrow Q$
- D.  $(P \Rightarrow R) \vee (Q \Rightarrow R) \Rightarrow ((P \vee Q) \Rightarrow R)$

gate1990 normal mathematical-logic propositional-logic multiple-selects

[Answer key](#)

### 3.3.5 Propositional Logic: GATE CSE 1991 | Question: 03,xii



If  $F_1$ ,  $F_2$  and  $F_3$  are propositional formulae such that  $F_1 \wedge F_2 \rightarrow F_3$  and  $F_1 \wedge F_2 \rightarrow \sim F_3$  are both tautologies, then which of the following is true:

- A. Both  $F_1$  and  $F_2$  are tautologies
- B. The conjunction  $F_1 \wedge F_2$  is not satisfiable
- C. Neither is tautologous
- D. Neither is satisfiable
- E. None of the above

gate1991 mathematical-logic normal propositional-logic multiple-selects

[Answer key](#)

### 3.3.6 Propositional Logic: GATE CSE 1992 | Question: 02,xvi



Which of the following is/are a tautology?

- A.  $a \vee b \rightarrow b \wedge c$
- B.  $a \wedge b \rightarrow b \vee c$
- C.  $a \vee b \rightarrow (b \rightarrow c)$
- D.  $a \rightarrow b \rightarrow (b \rightarrow c)$

gate1992 mathematical-logic easy propositional-logic multiple-selects

[Answer key](#)

### 3.3.7 Propositional Logic: GATE CSE 1992 | Question: 15.a



Use Modus ponens ( $A, A \rightarrow B \models B$ ) or resolution to show that the following set is inconsistent:

1.  $Q(x) \rightarrow P(x) \vee \sim R(a)$
2.  $R(a) \vee \sim Q(a)$
3.  $Q(a)$
4.  $\sim P(y)$

where  $x$  and  $y$  are universally quantified variables,  $a$  is a constant and  $P, Q, R$  are monadic predicates.

gate1992 normal mathematical-logic propositional-logic descriptive

[Answer key](#)

### 3.3.8 Propositional Logic: GATE CSE 1993 | Question: 18



Show that proposition  $C$  is a logical consequence of the formula

$$A \wedge (A \rightarrow (B \vee C)) \wedge (B \rightarrow \neg A)$$

using truth tables.

gate1993 mathematical-logic normal propositional-logic proof descriptive

Answer key 



### 3.3.9 Propositional Logic: GATE CSE 1993 | Question: 8.2

The proposition  $p \wedge (\sim p \vee q)$  is:

- A. a tautology
- B. logically equivalent to  $p \wedge q$
- C. logically equivalent to  $p \vee q$
- D. a contradiction
- E. none of the above

gate1993 mathematical-logic easy propositional-logic

Answer key 



### 3.3.10 Propositional Logic: GATE CSE 1994 | Question: 3.13

Let  $p$  and  $q$  be propositions. Using only the Truth Table, decide whether

- $p \iff q$  does not imply  $p \rightarrow \neg q$

is **True or False**.

gate1994 mathematical-logic normal propositional-logic true-false

Answer key 



### 3.3.11 Propositional Logic: GATE CSE 1995 | Question: 13

Obtain the principal (canonical) conjunctive normal form of the propositional formula

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

where  $\wedge$  is logical and,  $\vee$  is inclusive or and  $\neg$  is negation.

gate1995 mathematical-logic propositional-logic normal descriptive

Answer key 



### 3.3.12 Propositional Logic: GATE CSE 1995 | Question: 2.19

If the proposition  $\neg p \rightarrow q$  is true, then the truth value of the proposition  $\neg p \vee (p \rightarrow q)$ , where  $\neg$  is negation,  $\vee$  is inclusive OR and  $\rightarrow$  is implication, is

- A. True
- B. Multiple Values
- C. False
- D. Cannot be determined

gate1995 mathematical-logic normal propositional-logic

Answer key 



### 3.3.13 Propositional Logic: GATE CSE 1996 | Question: 2.3

Which of the following is NOT True?

(Read  $\wedge$  as AND,  $\vee$  as OR,  $\neg$  as NOT,  $\rightarrow$  as one way implication and  $\leftrightarrow$  as two way implication)

- A.  $((x \rightarrow y) \wedge x) \rightarrow y$
- B.  $((\neg x \rightarrow y) \wedge (\neg x \rightarrow \neg y)) \rightarrow x$
- C.  $(x \rightarrow (x \vee y))$
- D.  $((x \vee y) \leftrightarrow (\neg x \rightarrow \neg y))$

gate1996 mathematical-logic normal propositional-logic

Answer key 



### 3.3.14 Propositional Logic: GATE CSE 1997 | Question: 3.2



Which of the following propositions is a tautology?

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

gate1997 mathematical-logic easy propositional-logic

Answer key



### 3.3.15 Propositional Logic: GATE CSE 1998 | Question: 1.5



What is the converse of the following assertion?

- I stay only if you go
- A. I stay if you go
- B. If I stay then you go
- C. If you do not go then I do not stay
- D. If I do not stay then you go

gate1998 mathematical-logic easy propositional-logic

Answer key



### 3.3.16 Propositional Logic: GATE CSE 1999 | Question: 14



Show that the formula  $[(\sim p \vee q) \Rightarrow (q \Rightarrow p)]$  is not a tautology.

Let  $A$  be a tautology and  $B$  any other formula. Prove that  $(A \vee B)$  is a tautology.

gate1999 mathematical-logic normal propositional-logic proof descriptive

Answer key



### 3.3.17 Propositional Logic: GATE CSE 2000 | Question: 2.7



Let  $a, b, c, d$  be propositions. Assume that the equivalence  $a \Leftrightarrow (b \vee \neg b)$  and  $b \Leftrightarrow c$  hold. Then the truth-value of the formula  $(a \wedge b) \rightarrow (a \wedge c) \vee d$  is always

- A. True  
B. False  
C. Same as the truth-value of  $b$   
D. Same as the truth-value of  $d$

gatecse-2000 mathematical-logic normal propositional-logic

Answer key



### 3.3.18 Propositional Logic: GATE CSE 2001 | Question: 1.3



Consider two well-formed formulas in propositional logic

$$F_1 : P \Rightarrow \neg P \quad F_2 : (P \Rightarrow \neg P) \vee (\neg P \Rightarrow P)$$

Which one of the following statements is correct?

- A.  $F_1$  is satisfiable,  $F_2$  is valid  
B.  $F_1$  unsatisfiable,  $F_2$  is satisfiable  
C.  $F_1$  is unsatisfiable,  $F_2$  is valid  
D.  $F_1$  and  $F_2$  are both satisfiable

gatecse-2001 mathematical-logic easy propositional-logic

Answer key



### 3.3.19 Propositional Logic: GATE CSE 2002 | Question: 1.8



"If  $X$  then  $Y$  unless  $Z$ " is represented by which of the following formulas in propositional logic? (" $\neg$ " is negation, " $\wedge$ " is conjunction, and " $\rightarrow$ " is implication)

- A.  $(X \wedge \neg Z) \rightarrow Y$   
B.  $(X \wedge Y) \rightarrow \neg Z$   
C.  $X \rightarrow (Y \wedge \neg Z)$   
D.  $(X \rightarrow Y) \wedge \neg Z$

gatecse-2002 mathematical-logic normal propositional-logic

Answer key



### 3.3.20 Propositional Logic: GATE CSE 2002 | Question: 5b



Determine whether each of the following is a tautology, a contradiction, or neither (" $\vee$ " is disjunction, " $\wedge$ " is conjunction, " $\rightarrow$ " is implication, " $\neg$ " is negation, and " $\leftrightarrow$ " is biconditional (if and only if).

1.  $A \leftrightarrow (A \vee A)$
2.  $(A \vee B) \rightarrow B$
3.  $A \wedge (\neg(A \vee B))$

gatecse-2002 mathematical-logic easy descriptive propositional-logic

[Answer key](#)



### 3.3.21 Propositional Logic: GATE CSE 2003 | Question: 72

The following resolution rule is used in logic programming.

Derive clause  $(P \vee Q)$  from clauses  $(P \vee R), (Q \vee \neg R)$

Which of the following statements related to this rule is FALSE?

- A.  $((P \vee R) \wedge (Q \vee \neg R)) \Rightarrow (P \vee Q)$  is logically valid
- B.  $(P \vee Q) \Rightarrow ((P \vee R) \wedge (Q \vee \neg R))$  is logically valid
- C.  $(P \vee Q)$  is satisfiable if and only if  $(P \vee R) \wedge (Q \vee \neg R)$  is satisfiable
- D.  $(P \vee Q) \Rightarrow \text{FALSE}$  if and only if both  $P$  and  $Q$  are unsatisfiable

gatecse-2003 mathematical-logic normal propositional-logic

[Answer key](#)



### 3.3.22 Propositional Logic: GATE CSE 2004 | Question: 70

The following propositional statement is  $(P \Rightarrow (Q \vee R)) \Rightarrow ((P \wedge Q) \Rightarrow R)$

- |                              |                      |
|------------------------------|----------------------|
| A. satisfiable but not valid | B. valid             |
| C. a contradiction           | D. None of the above |

gatecse-2004 mathematical-logic normal propositional-logic

[Answer key](#)



### 3.3.23 Propositional Logic: GATE CSE 2005 | Question: 40

Let  $P, Q$ , and  $R$  be three atomic propositional assertions. Let  $X$  denote  $(P \vee Q) \rightarrow R$  and  $Y$  denote  $(P \rightarrow R) \vee (Q \rightarrow R)$ . Which one of the following is a tautology?

- A.  $X \equiv Y$
- B.  $X \rightarrow Y$
- C.  $Y \rightarrow X$
- D.  $\neg Y \rightarrow X$

gatecse-2005 mathematical-logic propositional-logic normal

[Answer key](#)



### 3.3.24 Propositional Logic: GATE CSE 2006 | Question: 27

Consider the following propositional statements:

- $P_1 : ((A \wedge B) \rightarrow C) \equiv ((A \rightarrow C) \wedge (B \rightarrow C))$
- $P_2 : ((A \vee B) \rightarrow C) \equiv ((A \rightarrow C) \vee (B \rightarrow C))$

Which one of the following is true?

- |   |   |
|---|---|
| A. $P_1$ is a tautology, but not $P_2$  | B. $P_2$ is a tautology, but not $P_1$      |
| C. $P_1$ and $P_2$ are both tautologies | D. Both $P_1$ and $P_2$ are not tautologies |

gatecse-2006 mathematical-logic normal propositional-logic

[Answer key](#)



### 3.3.25 Propositional Logic: GATE CSE 2008 | Question: 31

$P$  and  $Q$  are two propositions. Which of the following logical expressions are equivalent?

- I.  $P \vee \neg Q$
  - II.  $\neg(\neg P \wedge Q)$
  - III.  $(P \wedge Q) \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$
  - IV.  $(P \wedge Q) \vee (P \wedge \neg Q) \vee (\neg P \wedge Q)$
- |                  |                       |
|------------------|-----------------------|
| A. Only I and II | B. Only I, II and III |
|------------------|-----------------------|

C. Only I, II and IV

D. All of I, II, III and IV

gatecse-2008 normal mathematical-logic propositional-logic

Answer key 

### 3.3.26 Propositional Logic: GATE CSE 2009 | Question: 24



The binary operation  $\square$  is defined as follows

P	Q	$P \square Q$
T	T	T
T	F	T
F	T	F
F	F	T

Which one of the following is equivalent to  $P \vee Q$ ?

A.  $\neg Q \square \neg P$   
C.  $\neg P \square Q$

B.  $P \square \neg Q$   
D.  $\neg P \square \neg Q$

gatecse-2009 mathematical-logic easy propositional-logic

Answer key 

### 3.3.27 Propositional Logic: GATE CSE 2014 Set 1 | Question: 53



Which one of the following propositional logic formulas is TRUE when exactly two of  $p, q$  and  $r$  are TRUE?

- A.  $((p \leftrightarrow q) \wedge r) \vee (p \wedge q \wedge \sim r)$   
B.  $(\sim(p \leftrightarrow q) \wedge r) \vee (p \wedge q \wedge \sim r)$   
C.  $((p \rightarrow q) \wedge r) \vee (p \wedge q \wedge \sim r)$   
D.  $(\sim(p \leftrightarrow q) \wedge r) \wedge (p \wedge q \wedge \sim r)$

gatecse-2014-set1 mathematical-logic normal propositional-logic

Answer key 

### 3.3.28 Propositional Logic: GATE CSE 2014 Set 2 | Question: 53



Which one of the following Boolean expressions is NOT a tautology?

- A.  $((a \rightarrow b) \wedge (b \rightarrow c)) \rightarrow (a \rightarrow c)$   
B.  $(a \rightarrow c) \rightarrow (\sim b \rightarrow (a \wedge c))$   
C.  $(a \wedge b \wedge c) \rightarrow (c \vee a)$   
D.  $a \rightarrow (b \rightarrow a)$

gatecse-2014-set2 mathematical-logic propositional-logic normal

Answer key 

### 3.3.29 Propositional Logic: GATE CSE 2014 Set 3 | Question: 1



Consider the following statements:

- P: Good mobile phones are not cheap
- Q: Cheap mobile phones are not good

L: P implies Q

M: Q implies P

N: P is equivalent to Q

Which one of the following about L, M, and N is CORRECT?

- A. Only L is TRUE.  
C. Only N is TRUE.
- B. Only M is TRUE.  
D. L, M and N are TRUE.

gatecse-2014-set3 mathematical-logic easy propositional-logic

[Answer key](#)

### 3.3.30 Propositional Logic: GATE CSE 2015 Set 1 | Question: 14



Which one of the following is NOT equivalent to  $p \leftrightarrow q$ ?

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

gatecse-2015-set1 mathematical-logic easy propositional-logic

[Answer key](#)

### 3.3.31 Propositional Logic: GATE CSE 2016 Set 1 | Question: 1



Let  $p, q, r, s$  represents the following propositions.

- $p : x \in \{8, 9, 10, 11, 12\}$
- $q : x$  is a composite number.
- $r : x$  is a perfect square.
- $s : x$  is a prime number.

The integer  $x \geq 2$  which satisfies  $\neg((p \Rightarrow q) \wedge (\neg r \vee \neg s))$  is \_\_\_\_\_.

gatecse-2016-set1 mathematical-logic normal numerical-answers propositional-logic

[Answer key](#)

### 3.3.32 Propositional Logic: GATE CSE 2016 Set 2 | Question: 01



Consider the following expressions:

- i. *false*
- ii.  $Q$
- iii. *true*
- iv.  $P \vee Q$
- v.  $\neg Q \vee P$

The number of expressions given above that are logically implied by  $P \wedge (P \Rightarrow Q)$  is \_\_\_\_\_.

gatecse-2016-set2 mathematical-logic normal numerical-answers propositional-logic

[Answer key](#)

### 3.3.33 Propositional Logic: GATE CSE 2017 Set 1 | Question: 01



The statement  $(\neg p) \Rightarrow (\neg q)$  is logically equivalent to which of the statements below?

- I.  $p \Rightarrow q$
- II.  $q \Rightarrow p$
- III.  $(\neg q) \vee p$
- IV.  $(\neg p) \vee q$

- |            |                    |
|------------|--------------------|
| A. I only  | B. I and IV only   |
| C. II only | D. II and III only |

gatecse-2017-set1 mathematical-logic propositional-logic easy

[Answer key](#)

### 3.3.34 Propositional Logic: GATE CSE 2017 Set 1 | Question: 29



Let  $p, q$  and  $r$  be propositions and the expression  $(p \rightarrow q) \rightarrow r$  be a contradiction. Then, the expression  $(r \rightarrow p) \rightarrow q$  is

- |                                  |                                 |
|----------------------------------|---------------------------------|
| A. a tautology                   | B. a contradiction              |
| C. always TRUE when $p$ is FALSE | D. always TRUE when $q$ is TRUE |

**Answer key****3.3.35 Propositional Logic: GATE CSE 2017 Set 2 | Question: 11**

Let  $p, q, r$  denote the statements "It is raining", "It is cold", and "It is pleasant", respectively. Then the statement "It is not raining and it is pleasant, and it is not pleasant only if it is raining and it is cold" is represented by

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

**Answer key****3.3.36 Propositional Logic: GATE CSE 2021 Set 1 | Question: 7**

Let  $p$  and  $q$  be two propositions. Consider the following two formulae in propositional logic.

- $S_1 : (\neg p \wedge (p \vee q)) \rightarrow q$
- $S_2 : q \rightarrow (\neg p \wedge (p \vee q))$

Which one of the following choices is correct?

- A. Both  $S_1$  and  $S_2$  are tautologies.
- B.  $S_1$  is a tautology but  $S_2$  is not a tautology
- C.  $S_1$  is not a tautology but  $S_2$  is a tautology
- D. Neither  $S_1$  nor  $S_2$  is a tautology

**Answer key****3.3.37 Propositional Logic: GATE CSE 2021 Set 2 | Question: 15**

Choose the correct choice(s) regarding the following propositional logic assertion  $S$ :

$$S : ((P \wedge Q) \rightarrow R) \rightarrow ((P \wedge Q) \rightarrow (Q \rightarrow R))$$

- A.  $S$  is neither a tautology nor a contradiction
- B.  $S$  is a tautology
- C.  $S$  is a contradiction
- D. The antecedent of  $S$  is logically equivalent to the consequent of  $S$

**Answer key****3.3.38 Propositional Logic: GATE CSE 2024 | Set 2 | Question: 2**

Let  $p$  and  $q$  be the following propositions:

$p$  : Fail grade can be given.

$q$  : Student scores more than 50% marks.

Consider the statement: "Fail grade cannot be given when student scores more than 50% marks."

Which one of the following is the CORRECT representation of the above statement in propositional logic?

- A.  $q \rightarrow \neg p$
- B.  $q \rightarrow p$
- C.  $p \rightarrow q$
- D.  $\neg p \rightarrow q$

**Answer key****3.3.39 Propositional Logic: GATE DS&AI 2024 | Question: 19**

Let  $x$  and  $y$  be two propositions. Which of the following statements is a tautology /are tautologies?

- A.  $(\neg x \wedge y) \Rightarrow (y \Rightarrow x)$

- B.  $(x \wedge \neg y) \Rightarrow (\neg x \Rightarrow y)$   
 C.  $(\neg x \wedge y) \Rightarrow (\neg x \Rightarrow y)$   
 D.  $(x \wedge \neg y) \Rightarrow (y \Rightarrow x)$

gate-ds-ai-2024 mathematical-logic propositional-logic multiple-selects one-mark

Answer key 

### 3.3.40 Propositional Logic: GATE IT 2004 | Question: 31



Let  $p, q, r$  and  $s$  be four primitive statements. Consider the following arguments:

- $P : [(\neg p \vee q) \wedge (r \rightarrow s) \wedge (p \vee r)] \rightarrow (\neg s \rightarrow q)$
- $Q : [(\neg p \wedge q) \wedge [q \rightarrow (p \rightarrow r)]] \rightarrow \neg r$
- $R : [(q \wedge r) \rightarrow p] \wedge [(\neg q \vee p)] \rightarrow r$
- $S : [p \wedge (p \rightarrow r) \wedge (q \vee \neg r)] \rightarrow q$

Which of the above arguments are valid?

A.  $P$  and  $Q$  only

B.  $P$  and  $R$  only

C.  $P$  and  $S$  only

D.  $P, Q, R$  and  $S$

gateit-2004 mathematical-logic normal propositional-logic

Answer key 

## Answer Keys

3.1.1	N/A
3.1.6	D
3.1.11	D
3.1.16	D
3.1.21	D
3.1.26	B;C
3.1.31	B
3.2.2	C
3.3.4	A
3.3.9	B
3.3.14	C
3.3.19	A
3.3.24	D
3.3.29	D
3.3.34	D
3.3.39	B;C;D

3.1.2	N/A
3.1.7	B
3.1.12	B
3.1.17	X
3.1.22	B
3.1.27	B;D
3.1.32	A
3.2.3	A
3.3.5	B
3.3.10	True
3.3.15	A
3.3.20	N/A
3.3.25	B
3.3.30	C
3.3.35	A
3.3.40	C

3.1.3	A
3.1.8	D
3.1.13	B
3.1.18	D
3.1.23	A
3.1.28	A
3.1.33	C
3.3.1	N/A
3.3.6	B
3.3.11	N/A
3.3.16	N/A
3.3.21	B
3.3.26	B
3.3.31	11
3.3.36	B

3.1.4	D
3.1.9	D
3.1.14	A
3.1.19	D
3.1.24	C
3.1.29	C
3.1.34	D
3.3.2	N/A
3.3.7	N/A
3.3.12	D
3.3.17	A
3.3.22	A
3.3.27	B
3.3.32	4
3.3.37	B;D

3.1.5	D
3.1.10	X
3.1.15	C
3.1.20	C
3.1.25	C
3.1.30	B
3.2.1	B
3.3.3	A;B;C
3.3.8	N/A
3.3.13	D
3.3.18	A
3.3.23	B
3.3.28	B
3.3.33	D
3.3.38	A



**Syllabus:** Sets, Relations, Functions, Partial orders, Lattices, **Monoids**, Groups.

#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
<b>1 Mark Count</b>	1	0	1	1	0	1	0	1	0	0.63	1
<b>2 Marks Count</b>	1	1	1	1	2	0	2	1	0	1.13	2
<b>Total Marks</b>	3	2	3	3	4	1	4	3	1	<b>2.88</b>	4

#### 4.1

#### Binary Operation (8)



##### 4.1.1 Binary Operation: GATE CSE 1989 | Question: 1-v

The number of possible commutative binary operations that can be defined on a set of  $n$  elements (for a given  $n$ ) is \_\_\_\_\_.

gate1989 descriptive set-theory&algebra binary-operation

[Answer key](#)



##### 4.1.2 Binary Operation: GATE CSE 1994 | Question: 2.2



On the set  $N$  of non-negative integers, the binary operation \_\_\_\_\_ is associative and non-commutative.

gate1994 set-theory&algebra normal group-theory binary-operation fill-in-the-blanks

[Answer key](#)



##### 4.1.3 Binary Operation: GATE CSE 2003 | Question: 38



Consider the set  $\{a, b, c\}$  with binary operators  $+$  and  $*$  defined as follows:

+	a	b	c
a	b	a	c
b	a	b	c
c	a	c	b

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

For example,  $a + c = c, c + a = a, c * b = c$  and  $b * c = a$ .

Given the following set of equations:

- $(a * x) + (a * y) = c$
- $(b * x) + (c * y) = c$

The number of solution(s) (i.e., pair(s)  $(x, y)$ ) that satisfy the equations) is

- A. 0      B. 1      C. 2      D. 3

gatecse-2003 set-theory&algebra normal binary-operation

[Answer key](#)



##### 4.1.4 Binary Operation: GATE CSE 2006 | Question: 28



A logical binary relation  $\odot$ , is defined as follows:

A	B	$A \odot B$
True	True	True
True	False	True
False	True	False
False	False	True

Let  $\sim$  be the unary negation (NOT) operator, with higher precedence than  $\odot$ .

Which one of the following is equivalent to  $A \wedge B$ ?

- A.  $(\sim A \odot B)$   
 C.  $\sim (\sim A \odot \sim B)$

- B.  $\sim (A \odot \sim B)$   
 D.  $\sim (\sim A \odot B)$

gatecse-2006 set-theory&algebra binary-operation propositional-logic mathematical-logic

Answer key 

#### 4.1.5 Binary Operation: GATE CSE 2013 | Question: 1



A binary operation  $\oplus$  on a set of integers is defined as  $x \oplus y = x^2 + y^2$ . Which one of the following statements is **TRUE** about  $\oplus$ ?

- A. Commutative but not associative  
 C. Associative but not commutative
- B. Both commutative and associative  
 D. Neither commutative nor associative

gatecse-2013 set-theory&algebra easy binary-operation

Answer key 

#### 4.1.6 Binary Operation: GATE CSE 2015 Set 1 | Question: 28



The binary operator  $\neq$  is defined by the following truth table.

p	q	$p \neq q$
0	0	0
0	1	1
1	0	1
1	1	0

Which one of the following is true about the binary operator  $\neq$ ?

- A. Both commutative and associative  
 C. Not commutative but associative
- B. Commutative but not associative  
 D. Neither commutative nor associative

gatecse-2015-set1 set-theory&algebra easy binary-operation boolean-algebra

Answer key 

#### 4.1.7 Binary Operation: GATE CSE 2015 Set 3 | Question: 2



Let  $\#$  be the binary operator defined as

$X \# Y = X' + Y'$  where  $X$  and  $Y$  are Boolean variables.

Consider the following two statements.

- (S<sub>1</sub>)  $(P \# Q) \# R = P \# (Q \# R)$
- (S<sub>2</sub>)  $Q \# R = (R \# Q)$

Which are the following is/are true for the Boolean variables  $P, Q$  and  $R$ ?

- A. Only  $S_1$  is true  
 C. Both  $S_1$  and  $S_2$  are true
- B. Only  $S_2$  is true  
 D. Neither  $S_1$  nor  $S_2$  are true

gatecse-2015-set3 set-theory&algebra binary-operation normal

Answer key 

#### 4.1.8 Binary Operation: GATE IT 2006 | Question: 2



For the set  $N$  of natural numbers and a binary operation  $f : N \times N \rightarrow N$ , an element  $z \in N$  is called an identity for  $f$ , if  $f(a, z) = a = f(z, a)$ , for all  $a \in N$ . Which of the following binary operations have an identity?

- I.  $f(x, y) = x + y - 3$
  - II.  $f(x, y) = \max(x, y)$
  - III.  $f(x, y) = x^y$
- |                  |                    |                   |                  |
|------------------|--------------------|-------------------|------------------|
| A. I and II only | B. II and III only | C. I and III only | D. None of these |
|------------------|--------------------|-------------------|------------------|

gateit-2006 set-theory&algebra easy binary-operation

Answer key 

#### 4.2.1 Countable Uncountable Set: GATE CSE 1994 | Question: 3.9



Every subset of a countable set is countable.

State whether the above statement is true or false with reason.

gate1994 set-theory&algebra normal set-theory countable-uncountable-set true-false

Answer key

#### 4.2.2 Countable Uncountable Set: GATE CSE 2018 | Question: 27



Let  $N$  be the set of natural numbers. Consider the following sets,

- $P$  : Set of Rational numbers (positive and negative)
- $Q$  : Set of functions from  $\{0,1\}$  to  $N$
- $R$  : Set of functions from  $N$  to  $\{0,1\}$
- $S$  : Set of finite subsets of  $N$

Which of the above sets are countable?

- A.  $Q$  and  $S$  only      B.  $P$  and  $S$  only      C.  $P$  and  $R$  only      D.  $P, Q$  and  $S$  only

gatecse-2018 set-theory&algebra countable-uncountable-set normal two-marks

Answer key

### 4.3

#### Functions (29)



#### 4.3.1 Functions: GATE CSE 1987 | Question: 9b

How many one-to-one functions are there from a set  $A$  with  $n$  elements onto itself?

gate1987 set-theory&algebra functions descriptive

Answer key

#### 4.3.2 Functions: GATE CSE 1988 | Question: 13ii



If the set  $S$  has a finite number of elements, prove that if  $f$  maps  $S$  onto  $S$ , then  $f$  is one-to-one.

gate1988 descriptive set-theory&algebra functions

Answer key

#### 4.3.3 Functions: GATE CSE 1989 | Question: 13c



Find the number of single valued functions from set  $A$  to another set  $B$ , given that the cardinalities of the sets  $A$  and  $B$  are  $m$  and  $n$  respectively.

gate1989 descriptive functions set-theory&algebra

Answer key

#### 4.3.4 Functions: GATE CSE 1993 | Question: 8.6



Let  $A$  and  $B$  be sets with cardinalities  $m$  and  $n$  respectively. The number of one-one mappings from  $A$  to  $B$ , when  $m < n$ , is

- A.  $m^n$       B.  ${}^n P_m$       C.  ${}^m C_n$       D.  ${}^n C_m$   
E.  ${}^m P_n$

gate1993 set-theory&algebra functions easy

Answer key

#### 4.3.5 Functions: GATE CSE 1996 | Question: 1.3



Suppose  $X$  and  $Y$  are sets and  $|X|$  and  $|Y|$  are their respective cardinality. It is given that there are exactly 97 functions from  $X$  to  $Y$ . From this one can conclude that

- A.  $|X| = 1, |Y| = 97$       B.  $|X| = 97, |Y| = 1$   
C.  $|X| = 97, |Y| = 97$       D. None of the above

**Answer key****4.3.6 Functions: GATE CSE 1996 | Question: 2.1**

Let  $R$  denote the set of real numbers. Let  $f : R \times R \rightarrow R \times R$  be a bijective function defined by  $f(x,y) = (x+y, x-y)$ . The inverse function of  $f$  is given by

- A.  $f^{-1}(x,y) = \left(\frac{1}{x+y}, \frac{1}{x-y}\right)$
- B.  $f^{-1}(x,y) = (x-y, x+y)$
- C.  $f^{-1}(x,y) = \left(\frac{x+y}{2}, \frac{x-y}{2}\right)$
- D.  $f^{-1}(x,y) = [2(x-y), 2(x+y)]$

**Answer key****4.3.7 Functions: GATE CSE 1997 | Question: 13**

Let  $F$  be the set of one-to-one functions from the set  $\{1, 2, \dots, n\}$  to the set  $\{1, 2, \dots, m\}$  where  $m \geq n \geq 1$ .

- a. How many functions are members of  $F$ ?
- b. How many functions  $f$  in  $F$  satisfy the property  $f(i) = 1$  for some  $i, 1 \leq i \leq n$ ?
- c. How many functions  $f$  in  $F$  satisfy the property  $f(i) < f(j)$  for all  $i, j, 1 \leq i \leq j \leq n$ ?

**Answer key****4.3.8 Functions: GATE CSE 1998 | Question: 1.8**

The number of functions from an  $m$  element set to an  $n$  element set is

- A.  $m + n$
- B.  $m^n$
- C.  $n^m$
- D.  $m * n$

**Answer key****4.3.9 Functions: GATE CSE 2001 | Question: 2.3**

Let  $f : A \rightarrow B$  a function, and let  $E$  and  $F$  be subsets of  $A$ . Consider the following statements about images.

- $S_1 : f(E \cup F) = f(E) \cup f(F)$
- $S_2 : f(E \cap F) = f(E) \cap f(F)$

Which of the following is true about S1 and S2?

- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| A. Only $S_1$ is correct            | B. Only $S_2$ is correct              |
| C. Both $S_1$ and $S_2$ are correct | D. None of $S_1$ and $S_2$ is correct |

**Answer key****4.3.10 Functions: GATE CSE 2001 | Question: 4**

Consider the function  $h : N \times N \rightarrow N$  so that  $h(a,b) = (2a+1)2^b - 1$ , where  $N = \{0, 1, 2, 3, \dots\}$  is the set of natural numbers.

- a. Prove that the function  $h$  is an injection (one-one).
- b. Prove that it is also a Surjection (onto)

**Answer key**

#### 4.3.11 Functions: GATE CSE 2003 | Question: 37



Let  $f : A \rightarrow B$  be an injective (one-to-one) function. Define  $g : 2^A \rightarrow 2^B$  as:

$g(C) = \{f(x) \mid x \in C\}$ , for all subsets  $C$  of  $A$ .

Define  $h : 2^B \rightarrow 2^A$  as:  $h(D) = \{x \mid x \in A, f(x) \in D\}$ , for all subsets  $D$  of  $B$ . Which of the following statements is always true?

- A.  $g(h(D)) \subseteq D$   
B.  $g(h(D)) \supseteq D$   
C.  $g(h(D)) \cap D = \emptyset$   
D.  $g(h(D)) \cap (B - D) \neq \emptyset$

gatecse-2003 set-theory&algebra functions difficult

Answer key

#### 4.3.12 Functions: GATE CSE 2003 | Question: 39



Let  $\Sigma = \{a, b, c, d, e\}$  be an alphabet. We define an encoding scheme as follows:

$g(a) = 3, g(b) = 5, g(c) = 7, g(d) = 9, g(e) = 11$ .

Let  $p_i$  denote the  $i$ -th prime number ( $p_1 = 2$ ).

For a non-empty string  $s = a_1 \dots a_n$ , where each  $a_i \in \Sigma$ , define  $f(s) = \prod_{i=1}^n P_i^{g(a_i)}$ .

For a non-empty sequence  $\langle s_j, \dots, s_n \rangle$  of strings from  $\Sigma^+$ , define  $h(\langle s_1 \dots s_n \rangle) = \prod_{i=1}^n P_i^{f(s_i)}$

Which of the following numbers is the encoding,  $h$ , of a non-empty sequence of strings?

- A.  $2^7 3^7 5^7$   
B.  $2^8 3^8 5^8$   
C.  $2^9 3^9 5^9$   
D.  $2^{10} 3^{10} 5^{10}$

gatecse-2003 set-theory&algebra functions normal

Answer key

#### 4.3.13 Functions: GATE CSE 2005 | Question: 43



Let  $f : B \rightarrow C$  and  $g : A \rightarrow B$  be two functions and let  $h = fog$ . Given that  $h$  is an onto function which one of the following is TRUE?

- A.  $f$  and  $g$  should both be onto functions  
B.  $f$  should be onto but  $g$  need not be onto  
C.  $g$  should be onto but  $f$  need not be onto  
D. both  $f$  and  $g$  need not be onto

gatecse-2005 set-theory&algebra functions normal

Answer key

#### 4.3.14 Functions: GATE CSE 2006 | Question: 2



Let  $X, Y, Z$  be sets of sizes  $x, y$  and  $z$  respectively. Let  $W = X \times Y$  and  $E$  be the set of all subsets of  $W$ . The number of functions from  $Z$  to  $E$  is

- A.  $z^{2^y}$   
B.  $z \times 2^{xy}$   
C.  $z^{2^{x+y}}$   
D.  $2^{xyz}$

gatecse-2006 set-theory&algebra normal functions

Answer key

#### 4.3.15 Functions: GATE CSE 2006 | Question: 25



Let  $S = \{1, 2, 3, \dots, m\}, m > 3$ . Let  $X_1, \dots, X_n$  be subsets of  $S$  each of size 3. Define a function  $f$  from  $S$  to the set of natural numbers as,  $f(i)$  is the number of sets  $X_j$  that contain the element  $i$ . That is  $f(i) = |\{j \mid i \in X_j\}|$  then  $\sum_{i=1}^m f(i)$  is:

- A.  $3m$   
B.  $3n$   
C.  $2m+1$   
D.  $2n+1$

gatecse-2006 set-theory&algebra normal functions

Answer key

#### 4.3.16 Functions: GATE CSE 2007 | Question: 3



What is the maximum number of different Boolean functions involving  $n$  Boolean variables?

- A.  $n^2$   
B.  $2^n$   
C.  $2^{2^n}$   
D.  $2^{n^2}$

gatecse-2007 combinatory functions normal

Answer key 

#### 4.3.17 Functions: GATE CSE 2012 | Question: 37



How many onto (or surjective) functions are there from an  $n$ -element ( $n \geq 2$ ) set to a 2-element set?

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

gatecse-2012 set-theory&algebra functions normal

Answer key 

#### 4.3.18 Functions: GATE CSE 2014 Set 1 | Question: 50



Let  $S$  denote the set of all functions  $f : \{0,1\}^4 \rightarrow \{0,1\}$ . Denote by  $N$  the number of functions from  $S$  to the set  $\{0,1\}$ . The value of  $\log_2 \log_2 N$  is \_\_\_\_\_.

gatecse-2014-set1 set-theory&algebra functions combinatorics numerical-answers

Answer key 

#### 4.3.19 Functions: GATE CSE 2014 Set 3 | Question: 2



Let  $X$  and  $Y$  be finite sets and  $f : X \rightarrow Y$  be a function. Which one of the following statements is TRUE?

- A. For any subsets  $A$  and  $B$  of  $X$ ,  $|f(A \cup B)| = |f(A)| + |f(B)|$   
B. For any subsets  $A$  and  $B$  of  $X$ ,  $f(A \cap B) = f(A) \cap f(B)$   
C. For any subsets  $A$  and  $B$  of  $X$ ,  $|f(A \cap B)| = \min\{|f(A)|, |f(B)|\}$   
D. For any subsets  $S$  and  $T$  of  $Y$ ,  $f^{-1}(S \cap T) = f^{-1}(S) \cap f^{-1}(T)$

gatecse-2014-set3 set-theory&algebra functions normal

Answer key 

#### 4.3.20 Functions: GATE CSE 2014 Set 3 | Question: 49



Consider the set of all functions  $f : \{0,1,\dots,2014\} \rightarrow \{0,1,\dots,2014\}$  such that  $f(f(i)) = i$ , for all  $0 \leq i \leq 2014$ . Consider the following statements:

- P. For each such function it must be the case that for every  $i$ ,  $f(i) = i$ .  
Q. For each such function it must be the case that for some  $i$ ,  $f(i) = i$ .  
R. Each function must be onto.

Which one of the following is CORRECT?

- A.  $P, Q$  and  $R$  are true  
B. Only  $Q$  and  $R$  are true  
C. Only  $P$  and  $Q$  are true  
D. Only  $R$  is true

gatecse-2014-set3 set-theory&algebra functions normal

Answer key 

#### 4.3.21 Functions: GATE CSE 2015 Set 1 | Question: 5



If  $g(x) = 1 - x$  and  $h(x) = \frac{x}{x-1}$ , then  $\frac{g(h(x))}{h(g(x))}$  is:

- A.  $\frac{h(x)}{g(x)}$       B.  $\frac{-1}{x}$       C.  $\frac{g(x)}{h(x)}$       D.  $\frac{x}{(1-x)^2}$

gatecse-2015-set1 set-theory&algebra functions normal

Answer key 

#### 4.3.22 Functions: GATE CSE 2015 Set 2 | Question: 40



The number of onto functions (surjective functions) from set  $X = \{1, 2, 3, 4\}$  to set  $Y = \{a, b, c\}$  is \_\_\_\_\_.

gatecse-2015-set2 set-theory&algebra functions normal numerical-answers

Answer key 

### 4.3.23 Functions: GATE CSE 2015 Set 2 | Question: 54

Let  $X$  and  $Y$  denote the sets containing 2 and 20 distinct objects respectively and  $F$  denote the set of all possible functions defined from  $X$  to  $Y$ . Let  $f$  be randomly chosen from  $F$ . The probability of  $f$  being one-to-one is \_\_\_\_\_.



gatecse-2015-set2 set-theory&algebra functions normal numerical-answers

Answer key

### 4.3.24 Functions: GATE CSE 2016 Set 1 | Question: 28

A function  $f : \mathbb{N}^+ \rightarrow \mathbb{N}^+$ , defined on the set of positive integers  $\mathbb{N}^+$ , satisfies the following properties:

$$f(n) = f(n/2) \text{ if } n \text{ is even}$$

$$f(n) = f(n+5) \text{ if } n \text{ is odd}$$

Let  $R = \{i \mid \exists j : f(j) = i\}$  be the set of distinct values that  $f$  takes. The maximum possible size of  $R$  is \_\_\_\_\_.

gatecse-2016-set1 set-theory&algebra functions normal numerical-answers

Answer key

### 4.3.25 Functions: GATE CSE 2021 Set 2 | Question: 11

Consider the following sets, where  $n \geq 2$ :

- $S_1$ : Set of all  $n \times n$  matrices with entries from the set  $\{a, b, c\}$
- $S_2$ : Set of all functions from the set  $\{0, 1, 2, \dots, n^2 - 1\}$  to the set  $\{0, 1, 2\}$

Which of the following choice(s) is/are correct?

- There does not exist a bijection from  $S_1$  to  $S_2$
- There exists a surjection from  $S_1$  to  $S_2$
- There exists a bijection from  $S_1$  to  $S_2$
- There does not exist an injection from  $S_1$  to  $S_2$

gatecse-2021-set2 multiple-selects set-theory&algebra functions one-mark

Answer key

### 4.3.26 Functions: GATE CSE 2023 | Question: 39

Let  $f : A \rightarrow B$  be an onto (or surjective) function, where  $A$  and  $B$  are nonempty sets. Define an equivalence relation  $\sim$  on the set  $A$  as

$$a_1 \sim a_2 \text{ if } f(a_1) = f(a_2),$$

where  $a_1, a_2 \in A$ . Let  $\mathcal{E} = \{[x] : x \in A\}$  be the set of all the equivalence classes under  $\sim$ . Define a new mapping  $F : \mathcal{E} \rightarrow B$  as

$$F([x]) = f(x), \quad \text{for all the equivalence classes } [x] \text{ in } \mathcal{E}.$$

Which of the following statements is/are TRUE?

- $F$  is NOT well-defined.
- $F$  is an onto (or surjective) function.
- $F$  is a one-to-one (or injective) function.
- $F$  is a bijective function.

gatecse-2023 set-theory&algebra functions multiple-selects two-marks

Answer key

### 4.3.27 Functions: GATE CSE 2024 | Set 1 | Question: 22

Let  $A$  and  $B$  be non-empty finite sets such that there exist one-to-one and onto functions (i) from  $A$  to  $B$  and (ii) from  $A \times A$  to  $A \cup B$ . The number of possible values of  $|A|$  is \_\_\_\_\_.



**Answer key****4.3.28 Functions: GATE IT 2005 | Question: 31**

Let  $f$  be a function from a set  $A$  to a set  $B$ ,  $g$  a function from  $B$  to  $C$ , and  $h$  a function from  $A$  to  $C$ , such that  $h(a) = g(f(a))$  for all  $a \in A$ . Which of the following statements is always true for all such functions  $f$  and  $g$ ?

- A.  $g$  is onto  $\implies h$  is onto
- B.  $h$  is onto  $\implies f$  is onto
- C.  $h$  is onto  $\implies g$  is onto
- D.  $h$  is onto  $\implies f$  and  $g$  are onto

**Answer key****4.3.29 Functions: GATE IT 2006 | Question: 6**

Given a boolean function  $f(x_1, x_2, \dots, x_n)$ , which of the following equations is NOT true?

- A.  $f(x_1, x_2, \dots, x_n) = x'_1 f(x_1, x_2, \dots, x_n) + x_1 f(x_1, x_2, \dots, x_n)$
- B.  $f(x_1, x_2, \dots, x_n) = x_2 f(x_1, x_2, \dots, x_n) + x'_2 f(x_1, x_2, \dots, x_n)$
- C.  $f(x_1, x_2, \dots, x_n) = x'_n f(x_1, x_2, \dots, 0) + x_n f(x_1, x_2, \dots, 1)$
- D.  $f(x_1, x_2, \dots, x_n) = f(0, x_2, \dots, x_n) + f(1, x_2, \dots, x_n)$

**Answer key****4.4****Group Theory (33)****4.4.1 Group Theory: GATE CSE 1988 | Question: 2xviii**

Show that if  $G$  is a group such that  $(a * b)^2 = a^2 * b^2$  for all  $a, b$  belonging to  $G$ , then  $G$  is an abelian.

**Answer key****4.4.2 Group Theory: GATE CSE 1990 | Question: 2-x**

Match the pairs in the following questions:

(a)	Groups	(p)	Associativity
(b)	Semigroups	(q)	Identity
(c)	Monoids	(r)	Commutativity
(d)	Abelian groups	(s)	Left inverse

**Answer key****4.4.3 Group Theory: GATE CSE 1992 | Question: 14a**

If  $G$  is a group of even order, then show that there exists an element  $a \neq e$ , the identity in  $G$ , such that  $a^2 = e$ .

**Answer key****4.4.4 Group Theory: GATE CSE 1993 | Question: 28**

Let  $(\{p, q\}, *)$  be a semigroup where  $p * p = q$ . Show that:

- a.  $p * q = q * p$  and
- b.  $q * q = q$

**Answer key**

#### 4.4.5 Group Theory: GATE CSE 1994 | Question: 1.10



Some group  $(G, \circ)$  is known to be abelian. Then, which one of the following is true for  $G$ ?

- A.  $g = g^{-1}$  for every  $g \in G$
- B.  $g = g^2$  for every  $g \in G$
- C.  $(goh)^2 = g^2oh^2$  for every  $g, h \in G$
- D.  $G$  is of finite order

gate1994 set-theory&algebra group-theory normal

Answer key

#### 4.4.6 Group Theory: GATE CSE 1995 | Question: 2.17



Let  $A$  be the set of all non-singular matrices over real number and let  $*$  be the matrix multiplication operation. Then

- A.  $A$  is closed under  $*$  but  $\langle A, *\rangle$  is not a semigroup.
- B.  $\langle A, *\rangle$  is a semigroup but not a monoid.
- C.  $\langle A, *\rangle$  is a monoid but not a group.
- D.  $\langle A, *\rangle$  is a group but not an abelian group.

gate1995 set-theory&algebra group-theory

Answer key

#### 4.4.7 Group Theory: GATE CSE 1995 | Question: 21



Let  $G_1$  and  $G_2$  be subgroups of a group  $G$ .

- A. Show that  $G_1 \cap G_2$  is also a subgroup of  $G$ .
- B. Is  $G_1 \cup G_2$  always a subgroup of  $G$ ?

gate1995 set-theory&algebra group-theory normal descriptive proof

Answer key

#### 4.4.8 Group Theory: GATE CSE 1996 | Question: 1.4



Which of the following statements is FALSE?

- A. The set of rational numbers is an abelian group under addition
- B. The set of integers is an abelian group under addition
- C. The set of rational numbers form an abelian group under multiplication
- D. The set of real numbers excluding zero is an abelian group under multiplication

gate1996 set-theory&algebra group-theory normal

Answer key

#### 4.4.9 Group Theory: GATE CSE 1996 | Question: 2.4



Which one of the following is false?

- A. The set of all bijective functions on a finite set forms a group under function composition
- B. The set  $\{1, 2, \dots, p-1\}$  forms a group under multiplication mod  $p$ , where  $p$  is a prime number
- C. The set of all strings over a finite alphabet forms a group under concatenation
- D. A subset  $S \neq \emptyset$  of  $G$  is a subgroup of the group  $\langle G, *\rangle$  if and only if for any pair of elements  $a, b \in S, a * b^{-1} \in S$

gate1996 set-theory&algebra normal set-theory group-theory

Answer key

#### 4.4.10 Group Theory: GATE CSE 1997 | Question: 3.1



Let  $(Z, *)$  be an algebraic structure where  $Z$  is the set of integers and the operation  $*$  is defined by  $n * m = \max(n, m)$ . Which of the following statements is true for  $(Z, *)$ ?

- A.  $(Z, *)$  is a monoid
- B.  $(Z, *)$  is an Abelian group

C.  $(Z, *)$  is a group

D. None of the above

gate1997 set-theory&algebra group-theory normal

Answer key 

#### 4.4.11 Group Theory: GATE CSE 1998 | Question: 12



Let  $(A, *)$  be a semigroup. Furthermore, for every  $a$  and  $b$  in  $A$ , if  $a \neq b$ , then  $a * b \neq b * a$ .

- Show that for every  $a$  in  $A$ ,  $a * a = a$
- Show that for every  $a, b$  in  $A$ ,  $a * b * a = a$
- Show that for every  $a, b, c$  in  $A$ ,  $a * b * c = a * c$

gate1998 set-theory&algebra group-theory descriptive

Answer key 

#### 4.4.12 Group Theory: GATE CSE 1999 | Question: 4



Let  $G$  be a finite group and  $H$  be a subgroup of  $G$ . For  $a \in G$ , define  $aH = \{ah \mid h \in H\}$ .

- Show that  $|aH| = |bH|$ .
- Show that for every pair of elements  $a, b \in G$ , either  $aH = bH$  or  $aH$  and  $bH$  are disjoint.
- Use the above to argue that the order of  $H$  must divide the order of  $G$ .

gate1999 set-theory&algebra group-theory descriptive proof

Answer key 

#### 4.4.13 Group Theory: GATE CSE 2000 | Question: 4



Let  $S = \{0, 1, 2, 3, 4, 5, 6, 7\}$  and  $\otimes$  denote multiplication modulo 8, that is,  $x \otimes y = (xy) \bmod 8$

- Prove that  $(\{0, 1\}, \otimes)$  is not a group.
- Write three distinct groups  $(G, \otimes)$  where  $G \subset S$  and  $G$  has 2 elements.

gatecse-2000 set-theory&algebra descriptive group-theory

Answer key 

#### 4.4.14 Group Theory: GATE CSE 2002 | Question: 1.6



Which of the following is true?

- The set of all rational negative numbers forms a group under multiplication.
- The set of all non-singular matrices forms a group under multiplication.
- The set of all matrices forms a group under multiplication.
- Both B and C are true.

gatecse-2002 set-theory&algebra group-theory normal

Answer key 

#### 4.4.15 Group Theory: GATE CSE 2003 | Question: 7



Consider the set  $\Sigma^*$  of all strings over the alphabet  $\Sigma = \{0, 1\}$ .  $\Sigma^*$  with the concatenation operator for strings

- does not form a group
- forms a non-commutative group
- does not have a right identity element
- forms a group if the empty string is removed from  $\Sigma^*$

gatecse-2003 set-theory&algebra group-theory normal

Answer key 

#### 4.4.16 Group Theory: GATE CSE 2004 | Question: 72



The following is the incomplete operation table of a 4-element group.

*	e	a	b	c
e	e	a	b	c
a	a	b	c	e
b				
c				

The last row of the table is

- A.  $c a e b$   
B.  $c b a e$   
C.  $c b e a$   
D.  $c e a b$

gatecse-2004 set-theory&algebra group-theory normal

Answer key

#### 4.4.17 Group Theory: GATE CSE 2005 | Question: 13



The set  $\{1, 2, 4, 7, 8, 11, 13, 14\}$  is a group under multiplication modulo 15. The inverses of 4 and 7 are respectively:

- A. 3 and 13  
B. 2 and 11  
C. 4 and 13  
D. 8 and 14

gatecse-2005 set-theory&algebra normal group-theory

Answer key

#### 4.4.18 Group Theory: GATE CSE 2005 | Question: 46



Consider the set  $H$  of all  $3 \times 3$  matrices of the type

$$\begin{pmatrix} a & f & e \\ 0 & b & d \\ 0 & 0 & c \end{pmatrix}$$

where  $a, b, c, d, e$  and  $f$  are real numbers and  $abc \neq 0$ . Under the matrix multiplication operation, the set  $H$  is:

- A. a group  
B. a monoid but not a group  
C. a semi group but not a monoid  
D. neither a group nor a semi group

gatecse-2005 set-theory&algebra group-theory normal

Answer key

#### 4.4.19 Group Theory: GATE CSE 2006 | Question: 3



The set  $\{1, 2, 3, 5, 7, 8, 9\}$  under multiplication modulo 10 is not a group. Given below are four possible reasons. Which one of them is false?

- A. It is not closed  
B. 2 does not have an inverse  
C. 3 does not have an inverse  
D. 8 does not have an inverse

gatecse-2006 set-theory&algebra group-theory normal

Answer key

#### 4.4.20 Group Theory: GATE CSE 2007 | Question: 21



How many different non-isomorphic Abelian groups of order 4 are there?

- A. 2  
B. 3  
C. 4  
D. 5

gatecse-2007 group-theory normal

Answer key

#### 4.4.21 Group Theory: GATE CSE 2009 | Question: 1



Which one of the following is **NOT** necessarily a property of a Group?

- A. Commutativity  
C. Existence of inverse for every element

- B. Associativity  
D. Existence of identity

gatecse-2009 set-theory&algebra easy group-theory

[Answer key](#)



#### 4.4.22 Group Theory: GATE CSE 2009 | Question: 22

For the composition table of a cyclic group shown below:

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

Which one of the following choices is correct?

- A.  $a, b$  are generators  
C.  $c, d$  are generators
- B.  $b, c$  are generators  
D.  $d, a$  are generators

gatecse-2009 set-theory&algebra normal group-theory

[Answer key](#)



#### 4.4.23 Group Theory: GATE CSE 2010 | Question: 4

Consider the set  $S = \{1, \omega, \omega^2\}$ , where  $\omega$  and  $\omega^2$  are cube roots of unity. If  $*$  denotes the multiplication operation, the structure  $(S, *)$  forms

- A. A Group      B. A Ring      C. An integral domain      D. A field

gatecse-2010 set-theory&algebra normal group-theory

[Answer key](#)



#### 4.4.24 Group Theory: GATE CSE 2014 Set 3 | Question: 3

Let  $G$  be a group with 15 elements. Let  $L$  be a subgroup of  $G$ . It is known that  $L \neq G$  and that the size of  $L$  is at least 4. The size of  $L$  is \_\_\_\_\_.

gatecse-2014-set3 set-theory&algebra group-theory numerical-answers normal

[Answer key](#)



#### 4.4.25 Group Theory: GATE CSE 2014 Set 3 | Question: 50

There are two elements  $x, y$  in a group  $(G, *)$  such that every element in the group can be written as a product of some number of  $x$ 's and  $y$ 's in some order. It is known that

$$x * x = y * y = x * y * x * y = y * x * y * x = e$$

where  $e$  is the identity element. The maximum number of elements in such a group is \_\_\_\_\_.

gatecse-2014-set3 set-theory&algebra group-theory numerical-answers normal

[Answer key](#)



#### 4.4.26 Group Theory: GATE CSE 2018 | Question: 19

Let  $G$  be a finite group on 84 elements. The size of a largest possible proper subgroup of  $G$  is \_\_\_\_\_

gatecse-2018 group-theory numerical-answers set-theory&algebra one-mark

[Answer key](#)



#### 4.4.27 Group Theory: GATE CSE 2019 | Question: 10

Let  $G$  be an arbitrary group. Consider the following relations on  $G$ :



- $R_1 : \forall a, b \in G, aR_1b$  if and only if  $\exists g \in G$  such that  $a = g^{-1}bg$
- $R_2 : \forall a, b \in G, aR_2b$  if and only if  $a = b^{-1}$

Which of the above is/are equivalence relation/relations?

- A.  $R_1$  and  $R_2$       B.  $R_1$  only      C.  $R_2$  only      D. Neither  $R_1$  nor  $R_2$

gatecse-2019 engineering-mathematics discrete-mathematics set-theory&algebra group-theory one-mark

[Answer key](#)



#### 4.4.28 Group Theory: GATE CSE 2020 | Question: 18

Let  $G$  be a group of 35 elements. Then the largest possible size of a subgroup of  $G$  other than  $G$  itself is \_\_\_\_\_.

gatecse-2020 numerical-answers group-theory easy one-mark

[Answer key](#)



#### 4.4.29 Group Theory: GATE CSE 2021 Set 1 | Question: 34

Let  $G$  be a group of order 6, and  $H$  be a subgroup of  $G$  such that  $1 < |H| < 6$ . Which one of the following options is correct?

- A. Both  $G$  and  $H$  are always cyclic  
 C.  $G$  is always cyclic, but  $H$  may not be cyclic
- B.  $G$  may not be cyclic, but  $H$  is always cyclic  
 D. Both  $G$  and  $H$  may not be cyclic

gatecse-2021-set1 set-theory&algebra group-theory two-marks

[Answer key](#)



#### 4.4.30 Group Theory: GATE CSE 2022 | Question: 17

Which of the following statements is/are TRUE for a group  $G$ ?

- A. If for all  $x, y \in G$ ,  $(xy)^2 = x^2y^2$ , then  $G$  is commutative.  
 B. If for all  $x \in G$ ,  $x^2 = 1$ , then  $G$  is commutative. Here, 1 is the identity element of  $G$ .  
 C. If the order of  $G$  is 2, then  $G$  is commutative.  
 D. If  $G$  is commutative, then a subgroup of  $G$  need not be commutative.

gatecse-2022 set-theory&algebra group-theory multiple-selects one-mark

[Answer key](#)



#### 4.4.31 Group Theory: GATE CSE 2023 | Question: 41

Let  $X$  be a set and  $2^X$  denote the powerset of  $X$ .

Define a binary operation  $\Delta$  on  $2^X$  as follows:

$$A\Delta B = (A - B) \cup (B - A).$$

Let  $H = (2^X, \Delta)$ . Which of the following statements about  $H$  is/are correct?

- A.  $H$  is a group.  
 B. Every element in  $H$  has an inverse, but  $H$  is NOT a group.  
 C. For every  $A \in 2^X$ , the inverse of  $A$  is the complement of  $A$ .  
 D. For every  $A \in 2^X$ , the inverse of  $A$  is  $A$ .

gatecse-2023 set-theory&algebra group-theory multiple-selects two-marks

[Answer key](#)



#### 4.4.32 Group Theory: GATE CSE 2024 | Set 1 | Question: 42

Consider the operators  $\diamond$  and  $\square$  defined by  $a \diamond b = a + 2b$ ,  $a \square b = ab$ , for positive integers. Which of the following statements is/are TRUE?

- A. Operator  $\diamond$  obeys the associative law

- B. Operator  $\square$  obeys the associative law
- C. Operator  $\diamond$  over the operator  $\square$  obeys the distributive law
- D. Operator  $\square$  over the operator  $\diamond$  obeys the distributive law

gatecse2024-set1 multiple-selects set-theory&algebra group-theory two-marks

[Answer key](#)

#### 4.4.33 Group Theory: GATE CSE 2024 | Set 2 | Question: 53

Let  $Z_n$  be the group of integers  $\{0, 1, 2, \dots, n-1\}$  with addition modulo  $n$  as the group operation. The number of elements in the group  $Z_2 \times Z_3 \times Z_4$  that are their own inverses is \_\_\_\_\_.

gatecse2024-set2 numerical-answers set-theory&algebra group-theory two-marks

[Answer key](#)

4.5

#### Identify Function (1)

##### 4.5.1 Identify Function: GATE CSE 2025 | Set 1 | Question: 39

$A = \{0, 1, 2, 3, \dots\}$  is the set of non-negative integers. Let  $F$  be the set of functions from  $A$  to itself. For any two functions,  $f_1, f_2 \in F$ , we define

$$(f_1 \odot f_2)(n) = f_1(n) + f_2(n)$$

for every number  $n$  in  $A$ . Which of the following is/are CORRECT about the mathematical structure  $(F, \odot)$ ?

- A.  $(F, \odot)$  is an Abelian group.
- B.  $(F, \odot)$  is an Abelian monoid.
- C.  $(F, \odot)$  is a non-Abelian group.
- D.  $(F, \odot)$  is a non-Abelian monoid.

gatecse2025-set1 set-theory&algebra identify-function group-theory multiple-selects easy two-marks

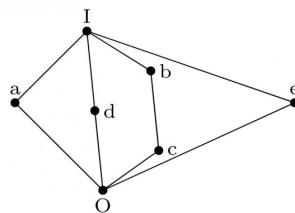
[Answer key](#)

4.6

#### Lattice (10)

##### 4.6.1 Lattice: GATE CSE 1988 | Question: 1vii

The complement(s) of the element ' $a'$  in the lattice shown in below figure is (are) \_\_\_\_\_



gate1988 descriptive lattice set-theory&algebra

[Answer key](#)

##### 4.6.2 Lattice: GATE CSE 1990 | Question: 17c

Show that the elements of the lattice  $(N, \leq)$ , where  $N$  is the set of positive integers and  $a \leq b$  if and only if  $a$  divides  $b$ , satisfy the distributive property.

gate1990 descriptive set-theory&algebra lattice

[Answer key](#)

##### 4.6.3 Lattice: GATE CSE 1992 | Question: 14b

Consider the set of integers  $\{1, 2, 3, 4, 6, 8, 12, 24\}$  together with the two binary operations LCM (lowest common multiple) and GCD (greatest common divisor). Which of the following algebraic structures does this represent?

A. group

B. ring

C. field

D. lattice

gate1992 set-theory&algebra partial-order lattice normal

Answer key 

#### 4.6.4 Lattice: GATE CSE 1994 | Question: 2.9

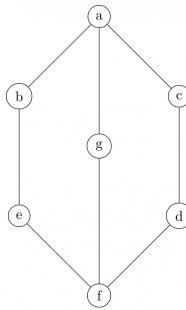
The Hasse diagrams of all the lattices with up to four elements are \_\_\_\_\_ (write all the relevant Hasse diagrams)

gate1994 set-theory&algebra lattice normal fill-in-the-blanks

Answer key 

#### 4.6.5 Lattice: GATE CSE 1997 | Question: 3.3

In the lattice defined by the Hasse diagram given in following figure, how many complements does the element 'e' have?



A. 2

B. 3

C. 0

D. 1

gate1997 set-theory&algebra lattice normal

Answer key 

#### 4.6.6 Lattice: GATE CSE 2002 | Question: 4

$S = \{(1, 2), (2, 1)\}$  is binary relation on set  $A = \{1, 2, 3\}$ . Is it irreflexive? Add the minimum number of ordered pairs to  $S$  to make it an equivalence relation. Give the modified  $S$ .

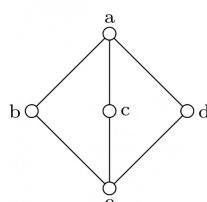
Let  $S = \{a, b\}$  and let  $\square(S)$  be the powerset of  $S$ . Consider the binary relation ' $\subseteq$ ' (set inclusion) on  $\square(S)$ . Draw the Hasse diagram corresponding to the lattice  $(\square(S), \subseteq)$

gatecse-2002 set-theory&algebra normal lattice descriptive

Answer key 

#### 4.6.7 Lattice: GATE CSE 2005 | Question: 9

The following is the Hasse diagram of the poset  $[\{a, b, c, d, e\}, \prec]$



The poset is :

A. not a lattice

C. a distributive lattice but not a Boolean algebra

B. a lattice but not a distributive lattice

D. a Boolean algebra

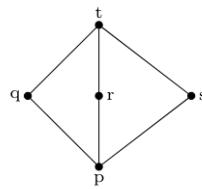
gatecse-2005 set-theory&algebra lattice normal

Answer key 

#### 4.6.8 Lattice: GATE CSE 2015 Set 1 | Question: 34



Suppose  $L = \{p, q, r, s, t\}$  is a lattice represented by the following Hasse diagram:



For any  $x, y \in L$ , not necessarily distinct,  $x \vee y$  and  $x \wedge y$  are join and meet of  $x, y$ , respectively. Let  $L^3 = \{(x, y, z) : x, y, z \in L\}$  be the set of all ordered triplets of the elements of  $L$ . Let  $p_r$  be the probability that an element  $(x, y, z) \in L^3$  chosen equiprobably satisfies  $x \vee (y \wedge z) = (x \vee y) \wedge (x \vee z)$ . Then

- A.  $p_r = 0$   
B.  $p_r = 1$   
C.  $0 < p_r \leq \frac{1}{5}$   
D.  $\frac{1}{5} < p_r < 1$

gatecse-2015-set1 set-theory&algebra normal lattice

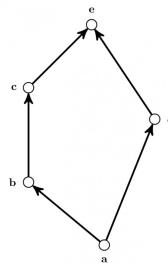
Answer key

#### 4.6.9 Lattice: GATE CSE 2017 Set 2 | Question: 21



Consider the set  $X = \{a, b, c, d, e\}$  under partial ordering  $R = \{(a, a), (a, b), (a, c), (a, d), (a, e), (b, b), (b, c), (b, e), (c, c), (c, e), (d, d), (d, e), (e, e)\}$

The Hasse diagram of the partial order  $(X, R)$  is shown below.



The minimum number of ordered pairs that need to be added to  $R$  to make  $(X, R)$  a lattice is \_\_\_\_\_

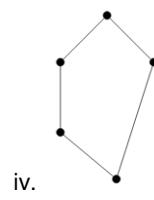
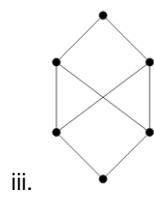
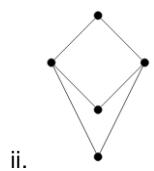
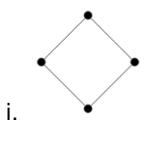
gatecse-2017-set2 set-theory&algebra lattice numerical-answers normal

Answer key

#### 4.6.10 Lattice: GATE IT 2008 | Question: 28



Consider the following Hasse diagrams.



Which all of the above represent a lattice?

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

gateit-2008 set-theory&algebra lattice normal

Answer key

#### 4.7.1 Mathematical Induction: GATE CSE 1995 | Question: 23



Prove using mathematical induction for  $n \geq 5, 2^n > n^2$

gate1995 set-theory&algebra proof mathematical-induction descriptive

[Answer key](#)

#### 4.7.2 Mathematical Induction: GATE CSE 2000 | Question: 3



Consider the following sequence:

$s_1 = s_2 = 1$  and  $s_i = 1 + \min(s_{i-1}, s_{i-2})$  for  $i > 2$ .

Prove by induction on  $n$  that  $s_n = \lceil \frac{n}{2} \rceil$ .

gatecse-2000 set-theory&algebra mathematical-induction descriptive

[Answer key](#)

### 4.8

#### Number Theory (7)

##### 4.8.1 Number Theory: GATE CSE 1995 | Question: 7(A)



Determine the number of divisors of 600.

gate1995 set-theory&algebra number-theory numerical-answers

[Answer key](#)

##### 4.8.2 Number Theory: GATE CSE 2014 Set 2 | Question: 49



The number of distinct positive integral factors of 2014 is \_\_\_\_\_

gatecse-2014-set2 set-theory&algebra easy numerical-answers number-theory

[Answer key](#)

##### 4.8.3 Number Theory: GATE CSE 2015 Set 2 | Question: 9



The number of divisors of 2100 is \_\_\_\_\_.

gatecse-2015-set2 set-theory&algebra number-theory easy numerical-answers

[Answer key](#)

##### 4.8.4 Number Theory: GATE IT 2005 | Question: 34



Let  $n = p^2q$ , where  $p$  and  $q$  are distinct prime numbers. How many numbers  $m$  satisfy  $1 \leq m \leq n$  and  $\gcd(m, n) = 1$ ? Note that  $\gcd(m, n)$  is the greatest common divisor of  $m$  and  $n$ .

- A.  $p(q - 1)$
- B.  $pq$
- C.  $(p^2 - 1)(q - 1)$
- D.  $p(p - 1)(q - 1)$

gateit-2005 set-theory&algebra normal number-theory

[Answer key](#)

##### 4.8.5 Number Theory: GATE IT 2007 | Question: 16



The minimum positive integer  $p$  such that  $3^p \pmod{17} = 1$  is

- A. 5
- B. 8
- C. 12
- D. 16

gateit-2007 set-theory&algebra normal number-theory

[Answer key](#)

##### 4.8.6 Number Theory: GATE IT 2008 | Question: 24



The exponent of 11 in the prime factorization of  $300!$  is

- A. 27
- B. 28
- C. 29
- D. 30

gateit-2008 set-theory&algebra normal number-theory

[Answer key](#)

#### 4.8.7 Number Theory: GATE1991-15,a



Show that the product of the least common multiple and the greatest common divisor of two positive integers  $a$  and  $b$  is  $a \times b$ .

gate1991 set-theory&algebra normal number-theory proof descriptive

[Answer key](#)

4.9

Onto (1)

#### 4.9.1 Onto: GATE CSE 2025 | Set 1 | Question: 7



If  $f(\cdot)$  and  $f(g(\cdot))$  are onto (surjective) functions, which ONE of the following is TRUE about the function  $g(\cdot)$ ?

- A.  $g(\cdot)$  must be an onto (surjective) function.
- B.  $g(\cdot)$  must be a one-to-one (injective) function.
- C.  $g(\cdot)$  must be a bijective function, that is, both one-to-one and onto.
- D.  $g(\cdot)$  is not required to be a one-to-one or onto function.

gatecse2025-set1 set-theory&algebra onto functions one-mark

[Answer key](#)

4.10

Partial Order (10)

#### 4.10.1 Partial Order: GATE CSE 1991 | Question: 01,xiv



If the longest chain in a partial order is of length  $n$ , then the partial order can be written as a \_\_\_\_\_ of  $n$  antichains.

gate1991 set-theory&algebra partial-order normal fill-in-the-blanks

[Answer key](#)

#### 4.10.2 Partial Order: GATE CSE 1993 | Question: 8.5



The less-than relation,  $<$ , on reals is

- A. a partial ordering since it is asymmetric and reflexive
- B. a partial ordering since it is antisymmetric and reflexive
- C. not a partial ordering because it is not asymmetric and not reflexive
- D. not a partial ordering because it is not antisymmetric and reflexive
- E. none of the above

gate1993 set-theory&algebra partial-order easy

[Answer key](#)

#### 4.10.3 Partial Order: GATE CSE 1996 | Question: 1.2



Let  $X = \{2, 3, 6, 12, 24\}$ . Let  $\leq$  be the partial order defined by  $X \leq Y$  if  $x$  divides  $y$ . Number of edges in the Hasse diagram of  $(X, \leq)$  is

- A. 3
- B. 4
- C. 9
- D. None of the above

gate1996 set-theory&algebra partial-order normal

[Answer key](#)

#### 4.10.4 Partial Order: GATE CSE 1997 | Question: 6.1



A partial order  $\leq$  is defined on the set  $S = \{x, a_1, a_2, \dots, a_n, y\}$  as  $x \leq_i a_i$  for all  $i$  and  $a_i \leq y$  for all  $i$ , where  $n \geq 1$ . The number of total orders on the set  $S$  which contain the partial order  $\leq$  is

- A.  $n!$
- B.  $n + 2$
- C.  $n$
- D. 1

gate1997 set-theory&algebra partial-order normal

[Answer key](#)

#### 4.10.5 Partial Order: GATE CSE 1998 | Question: 11



Suppose  $A = \{a, b, c, d\}$  and  $\Pi_1$  is the following partition of A

$$\Pi_1 = \{\{a, b, c\}, \{d\}\}$$

a. List the ordered pairs of the equivalence relations induced by  $\Pi_1$ .

b. Draw the graph of the above equivalence relation.

c. Let  $\Pi_2 = \{\{a\}, \{b\}, \{c\}, \{d\}\}$

$$\Pi_3 = \{\{a, b, c, d\}\}$$

$$\text{and } \Pi_4 = \{\{a, b\}, \{c, d\}\}$$

Draw a Poset diagram of the poset,  $\langle \{\Pi_1, \Pi_2, \Pi_3, \Pi_4\}, \text{refines} \rangle$ .

gate1998 set-theory&algebra normal partial-order descriptive

Answer key

#### 4.10.6 Partial Order: GATE CSE 2003 | Question: 31



Let  $(S, \leq)$  be a partial order with two minimal elements a and b, and a maximum element c. Let  $P: S \rightarrow \{\text{True}, \text{False}\}$  be a predicate defined on S. Suppose that  $P(a) = \text{True}$ ,  $P(b) = \text{False}$  and  $P(x) \implies P(y)$  for all  $x, y \in S$  satisfying  $x \leq y$ , where  $\implies$  stands for logical implication. Which of the following statements CANNOT be true?

- A.  $P(x) = \text{True}$  for all  $x \in S$  such that  $x \neq b$
- B.  $P(x) = \text{False}$  for all  $x \in S$  such that  $x \neq a$  and  $x \neq c$
- C.  $P(x) = \text{False}$  for all  $x \in S$  such that  $b \leq x$  and  $x \neq c$
- D.  $P(x) = \text{False}$  for all  $x \in S$  such that  $a \leq x$  and  $b \leq x$

gatecse-2003 set-theory&algebra partial-order normal propositional-logic

Answer key

#### 4.10.7 Partial Order: GATE CSE 2004 | Question: 73



The inclusion of which of the following sets into

$$S = \{\{1, 2\}, \{1, 2, 3\}, \{1, 3, 5\}, \{1, 2, 4\}, \{1, 2, 3, 4, 5\}\}$$

is necessary and sufficient to make  $S$  a complete lattice under the partial order defined by set containment?

- A.  $\{1\}$
- B.  $\{1\}, \{2, 3\}$
- C.  $\{1\}, \{1, 3\}$
- D.  $\{1\}, \{1, 3\}, \{1, 2, 3, 4\}, \{1, 2, 3, 5\}$

gatecse-2004 set-theory&algebra partial-order normal

Answer key

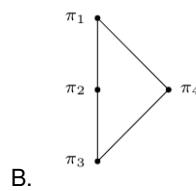
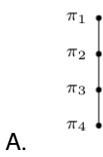
#### 4.10.8 Partial Order: GATE CSE 2007 | Question: 26

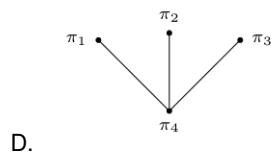
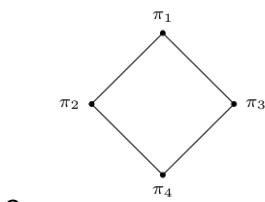


Consider the set  $S = \{a, b, c, d\}$ . Consider the following 4 partitions  $\pi_1, \pi_2, \pi_3, \pi_4$  on

$$S : \pi_1 = \{\overline{abcd}\}, \quad \pi_2 = \{\overline{ab}, \overline{cd}\}, \quad \pi_3 = \{\overline{abc}, \overline{d}\}, \quad \pi_4 = \{\overline{a}, \overline{b}, \overline{c}, \overline{d}\}.$$

Let  $\prec$  be the partial order on the set of partitions  $S' = \{\pi_1, \pi_2, \pi_3, \pi_4\}$  defined as follows:  $\pi_i \prec \pi_j$  if and only if  $\pi_i$  refines  $\pi_j$ . The poset diagram for  $(S', \prec)$  is:





gatecse-2007 set-theory&algebra normal partial-order descriptive

[Answer key](#)

#### 4.10.9 Partial Order: GATE CSE 2024 | Set 2 | Question: 24



Let  $P$  be the partial order defined on the set  $\{1, 2, 3, 4\}$  as follows

$$P = \{(x, x) \mid x \in \{1, 2, 3, 4\}\} \cup \{(1, 2), (3, 2), (3, 4)\}$$

The number of total orders on  $\{1, 2, 3, 4\}$  that contain  $P$  is \_\_\_\_\_.

gatecse2024-set2 numerical-answers set-theory&algebra partial-order one-mark

[Answer key](#)

#### 4.10.10 Partial Order: GATE IT 2007 | Question: 23



A partial order  $P$  is defined on the set of natural numbers as follows. Here  $\frac{x}{y}$  denotes integer division.

- i.  $(0, 0) \in P$ .
- ii.  $(a, b) \in P$  if and only if  $(a \% 10) \leq (b \% 10)$  and  $(\frac{a}{10}, \frac{b}{10}) \in P$ .

Consider the following ordered pairs:

- i.  $(101, 22)$
- ii.  $(22, 101)$
- iii.  $(145, 265)$
- iv.  $(0, 153)$

Which of these ordered pairs of natural numbers are contained in  $P$ ?

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

gateit-2007 set-theory&algebra partial-order normal

[Answer key](#)

### 4.11

### Polynomials (4)

#### 4.11.1 Polynomials: GATE CSE 1997 | Question: 4.4



A polynomial  $p(x)$  is such that  $p(0) = 5, p(1) = 4, p(2) = 9$  and  $p(3) = 20$ . The minimum degree it should have is

- A. 1
- B. 2
- C. 3
- D. 4

gate1997 set-theory&algebra normal polynomials

[Answer key](#)

#### 4.11.2 Polynomials: GATE CSE 2000 | Question: 2.4



A polynomial  $p(x)$  satisfies the following:

- $p(1) = p(3) = p(5) = 1$
- $p(2) = p(4) = -1$

The minimum degree of such a polynomial is

A. 1

B. 2

C. 3

D. 4

gatecse-2000 set-theory&algebra normal polynomials

Answer key 



#### 4.11.3 Polynomials: GATE CSE 2014 Set 2 | Question: 5

A non-zero polynomial  $f(x)$  of degree 3 has roots at  $x = 1, x = 2$  and  $x = 3$ . Which one of the following must be TRUE?

- A.  $f(0)f(4) < 0$
- C.  $f(0) + f(4) > 0$

- B.  $f(0)f(4) > 0$
- D.  $f(0) + f(4) < 0$

gatecse-2014-set2 set-theory&algebra polynomials normal

Answer key 



#### 4.11.4 Polynomials: GATE CSE 2017 Set 2 | Question: 24

Consider the quadratic equation  $x^2 - 13x + 36 = 0$  with coefficients in a base  $b$ . The solutions of this equation in the same base  $b$  are  $x = 5$  and  $x = 6$ . Then  $b = \underline{\hspace{2cm}}$

gatecse-2017-set2 polynomials numerical-answers set-theory&algebra

Answer key 

### Relations (37)

#### 4.12.1 Relations: GATE CSE 1987 | Question: 2d



State whether the following statements are TRUE or FALSE:

The union of two equivalence relations is also an equivalence relation.

gate1987 set-theory&algebra relations true-false

Answer key 



#### 4.12.2 Relations: GATE CSE 1987 | Question: 9a

How many binary relations are there on a set  $A$  with  $n$  elements?

gate1987 set-theory&algebra relations descriptive

Answer key 



#### 4.12.3 Relations: GATE CSE 1987 | Question: 9e

How many true inclusion relations are there of the form  $A \subseteq B$ , where  $A$  and  $B$  are subsets of a set  $S$  with  $n$  elements?

gate1987 set-theory&algebra relations descriptive

Answer key 



#### 4.12.4 Relations: GATE CSE 1989 | Question: 1-iv

The transitive closure of the relation  $\{(1,2), (2,3), (3,4), (5,4)\}$  on the set  $\{1,2,3,4,5\}$  is  $\underline{\hspace{2cm}}$ .

gate1989 set-theory&algebra relations descriptive

Answer key 



#### 4.12.5 Relations: GATE CSE 1992 | Question: 15.b

Let  $S$  be the set of all integers and let  $n > 1$  be a fixed integer. Define for  $a, b \in S$ ,  $aRb$  iff  $a - b$  is a multiple of  $n$ . Show that  $R$  is an equivalence relation and find its equivalence classes for  $n = 5$ .

gate1992 set-theory&algebra normal relations descriptive

Answer key 



#### 4.12.6 Relations: GATE CSE 1994 | Question: 2.3

Amongst the properties {reflexivity, symmetry, anti-symmetry, transitivity} the relation  $R = \{(x,y) \in N^2 | x \neq y\}$  satisfies \_\_\_\_\_

gate1994 set-theory&algebra relations normal fill-in-the-blanks

Answer key 



#### 4.12.7 Relations: GATE CSE 1995 | Question: 1.19

Let  $R$  be a symmetric and transitive relation on a set  $A$ . Then

- A.  $R$  is reflexive and hence an equivalence relation
- C.  $R$  is reflexive and hence not an equivalence relation
- B.  $R$  is reflexive and hence a partial order
- D. None of the above

gate1995 set-theory&algebra relations normal

Answer key 



#### 4.12.8 Relations: GATE CSE 1996 | Question: 2.2

Let  $R$  be a non-empty relation on a collection of sets defined by  $_A R_B$  if and only if  $A \cap B = \emptyset$ . Then, (pick the true statement)

- A.  $R$  is reflexive and transitive
- C.  $R$  is an equivalence relation
- B.  $R$  is symmetric and not transitive
- D.  $R$  is not reflexive and not symmetric

gate1996 set-theory&algebra relations normal

Answer key 



#### 4.12.9 Relations: GATE CSE 1996 | Question: 8

Let  $F$  be the collection of all functions  $f : \{1, 2, 3\} \rightarrow \{1, 2, 3\}$ . If  $f$  and  $g \in F$ , define an equivalence relation  $\sim$  by  $f \sim g$  if and only if  $f(3) = g(3)$ .

- Find the number of equivalence classes defined by  $\sim$ .
- Find the number of elements in each equivalence class.

gate1996 set-theory&algebra relations functions normal descriptive

Answer key 



#### 4.12.10 Relations: GATE CSE 1997 | Question: 14

Let  $R$  be a reflexive and transitive relation on a set  $A$ . Define a new relation  $E$  on  $A$  as

$$E = \{(a,b) \mid (a,b) \in R \text{ and } (b,a) \in R\}$$

Prove that  $E$  is an equivalence relation on  $A$ .

Define a relation  $\leq$  on the equivalence classes of  $E$  as  $E_1 \leq E_2$  if  $\exists a, b$  such that  $a \in E_1, b \in E_2$  and  $(a,b) \in R$ . Prove that  $\leq$  is a partial order.

gate1997 set-theory&algebra relations normal proof descriptive

Answer key 



#### 4.12.11 Relations: GATE CSE 1997 | Question: 6.3

The number of equivalence relations of the set  $\{1, 2, 3, 4\}$  is

- A. 15
- B. 16
- C. 24
- D. 4

gate1997 set-theory&algebra relations normal

Answer key 



#### 4.12.12 Relations: GATE CSE 1998 | Question: 1.6

Suppose  $A$  is a finite set with  $n$  elements. The number of elements in the largest equivalence relation of  $A$  is



A.  $n$

B.  $n^2$

C. 1

D.  $n+1$

gate1998 set-theory&algebra relations easy

Answer key 



#### 4.12.13 Relations: GATE CSE 1998 | Question: 1.7

Let  $R_1$  and  $R_2$  be two equivalence relations on a set. Consider the following assertions:

- i.  $R_1 \cup R_2$  is an equivalence relation
- ii.  $R_1 \cap R_2$  is an equivalence relation

Which of the following is correct?

- A. Both assertions are true
- B. Assertions (i) is true but assertions (ii) is not true
- C. Assertions (ii) is true but assertions (i) is not true
- D. Neither (i) nor (ii) is true

gate1998 set-theory&algebra relations normal

Answer key 



#### 4.12.14 Relations: GATE CSE 1998 | Question: 10a

Prove by induction that the expression for the number of diagonals in a polygon of  $n$  sides is  $\frac{n(n-3)}{2}$

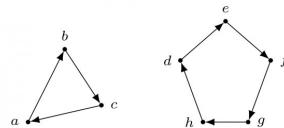
gate1998 set-theory&algebra descriptive relations

Answer key 



#### 4.12.15 Relations: GATE CSE 1998 | Question: 10b

Let  $R$  be a binary relation on  $A = \{a, b, c, d, e, f, g, h\}$  represented by the following two component digraph. Find the smallest integers  $m$  and  $n$  such that  $m < n$  and  $R^m = R^n$ .



gate1998 descriptive set-theory&algebra relations

Answer key 



#### 4.12.16 Relations: GATE CSE 1998 | Question: 2.3

The binary relation  $R = \{(1,1), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2), (3,3), (3,4)\}$  on the set  $A = \{1, 2, 3, 4\}$  is



- A. reflexive, symmetric and transitive
- B. neither reflexive, nor irreflexive but transitive
- C. irreflexive, symmetric and transitive
- D. irreflexive and antisymmetric

gate1998 set-theory&algebra easy relations

Answer key 



#### 4.12.17 Relations: GATE CSE 1999 | Question: 1.2

The number of binary relations on a set with  $n$  elements is:

A.  $n^2$

B.  $2^n$

C.  $2^{n^2}$

D. None of the above

gate1999 set-theory&algebra relations combinatorics easy

Answer key 



#### 4.12.18 Relations: GATE CSE 1999 | Question: 2.3

Let  $L$  be a set with a relation  $R$  which is transitive, anti-symmetric and reflexive and for any two elements  $a, b \in L$ , let the least upper bound  $lub(a, b)$  and the greatest lower bound  $glb(a, b)$  exist. Which of the following



is/are true?

- A.  $L$  is a poset  
B.  $L$  is a Boolean algebra  
C.  $L$  is a lattice  
D. None of the above

gate1999 set-theory&algebra normal relations multiple-selects

Answer key 

#### 4.12.19 Relations: GATE CSE 1999 | Question: 3



- a. Mr. X claims the following:

If a relation  $R$  is both symmetric and transitive, then  $R$  is reflexive. For this, Mr. X offers the following proof:

"From  $xRy$ , using symmetry we get  $yRx$ . Now because  $R$  is transitive  $xRy$  and  $yRx$  together imply  $xRx$ . Therefore,  $R$  is reflexive".

- b. Give an example of a relation  $R$  which is symmetric and transitive but not reflexive.

gate1999 set-theory&algebra relations normal descriptive

Answer key 

#### 4.12.20 Relations: GATE CSE 2000 | Question: 2.5



A relation  $R$  is defined on the set of integers as  $xRy$  iff  $(x + y)$  is even. Which of the following statements is true?

- A.  $R$  is not an equivalence relation  
B.  $R$  is an equivalence relation having 1 equivalence class  
C.  $R$  is an equivalence relation having 2 equivalence classes  
D.  $R$  is an equivalence relation having 3 equivalence classes

gatecse-2000 set-theory&algebra relations normal

Answer key 

#### 4.12.21 Relations: GATE CSE 2001 | Question: 1.2



Consider the following relations:

- $R_1(a, b)$  iff  $(a + b)$  is even over the set of integers
- $R_2(a, b)$  iff  $(a + b)$  is odd over the set of integers
- $R_3(a, b)$  iff  $a \cdot b > 0$  over the set of non-zero rational numbers
- $R_4(a, b)$  iff  $|a - b| \leq 2$  over the set of natural numbers

Which of the following statements is correct?

- A.  $R_1$  and  $R_2$  are equivalence relations,  $R_3$  and  $R_4$  are not  
B.  $R_1$  and  $R_3$  are equivalence relations,  $R_2$  and  $R_4$  are not  
C.  $R_1$  and  $R_4$  are equivalence relations,  $R_2$  and  $R_3$  are not  
D.  $R_1, R_2, R_3$  and  $R_4$  all are equivalence relations

gatecse-2001 set-theory&algebra normal relations

Answer key 

#### 4.12.22 Relations: GATE CSE 2002 | Question: 2.17



The binary relation  $S = \phi$  (empty set) on a set  $A = \{1, 2, 3\}$  is

- A. Neither reflexive nor symmetric  
B. Symmetric and reflexive  
C. Transitive and reflexive  
D. Transitive and symmetric

gatecse-2002 set-theory&algebra normal relations

Answer key 

#### 4.12.23 Relations: GATE CSE 2002 | Question: 3



Let  $A$  be a set of  $n(> 0)$  elements. Let  $N_r$  be the number of binary relations on  $A$  and let  $N_f$  be the number of

functions from  $A$  to  $A$

- A. Give the expression for  $N_r$ , in terms of  $n$ .
- B. Give the expression for  $N_f$ , terms of  $n$ .
- C. Which is larger for all possible  $n$ ,  $N_r$  or  $N_f$

gatecse-2002 set-theory&algebra normal descriptive relations

Answer key 

#### 4.12.24 Relations: GATE CSE 2004 | Question: 24



Consider the binary relation:

$$S = \{(x,y) \mid y = x + 1 \text{ and } x, y \in \{0, 1, 2\}\}$$

The reflexive transitive closure is  $S$  is

- A.  $\{(x,y) \mid y > x \text{ and } x, y \in \{0, 1, 2\}\}$
- B.  $\{(x,y) \mid y \geq x \text{ and } x, y \in \{0, 1, 2\}\}$
- C.  $\{(x,y) \mid y < x \text{ and } x, y \in \{0, 1, 2\}\}$
- D.  $\{(x,y) \mid y \leq x \text{ and } x, y \in \{0, 1, 2\}\}$

gatecse-2004 set-theory&algebra easy relations

Answer key 

#### 4.12.25 Relations: GATE CSE 2005 | Question: 42



Let  $R$  and  $S$  be any two equivalence relations on a non-empty set  $A$ . Which one of the following statements is TRUE?

- A.  $R \cup S$ ,  $R \cap S$  are both equivalence relations
- B.  $R \cup S$  is an equivalence relation
- C.  $R \cap S$  is an equivalence relation
- D. Neither  $R \cup S$  nor  $R \cap S$  are equivalence relations

gatecse-2005 set-theory&algebra normal relations

Answer key 

#### 4.12.26 Relations: GATE CSE 2005 | Question: 7



The time complexity of computing the transitive closure of a binary relation on a set of  $n$  elements is known to be:

- A.  $O(n)$
- B.  $O(n \log n)$
- C.  $O\left(n^{\frac{3}{2}}\right)$
- D.  $O(n^3)$

gatecse-2005 set-theory&algebra normal relations

Answer key 

#### 4.12.27 Relations: GATE CSE 2006 | Question: 4



A relation  $R$  is defined on ordered pairs of integers as follows:

$$(x,y)R(u,v) \text{ if } x < u \text{ and } y > v$$

Then  $R$  is:

- A. Neither a Partial Order nor an Equivalence Relation
- B. A Partial Order but not a Total Order
- C. A total Order
- D. An Equivalence Relation

gatecse-2006 set-theory&algebra normal relations

Answer key 

#### 4.12.28 Relations: GATE CSE 2007 | Question: 2

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

gatecse-2007 set-theory&algebra normal relations

Answer key 



#### 4.12.29 Relations: GATE CSE 2009 | Question: 4

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  
C.  $R$  is both symmetric and antisymmetric
- B.  $R$  is NOT symmetric but antisymmetric  
D.  $R$  is neither symmetric nor antisymmetric

gatecse-2009 set-theory&algebra easy relations

Answer key 



#### 4.12.30 Relations: GATE CSE 2010 | Question: 3

What is the possible number of reflexive relations on a set of 5 elements?

- A.  $2^{10}$       B.  $2^{15}$       C.  $2^{20}$       D.  $2^{25}$

gatecse-2010 set-theory&algebra easy relations

Answer key 



#### 4.12.31 Relations: GATE CSE 2015 Set 2 | Question: 16

Let  $R$  be the relation on the set of positive integers such that  $aRb$  if and only if  $a$  and  $b$  are distinct and have a common divisor other than 1. Which one of the following statements about  $R$  is true?

- A.  $R$  is symmetric and reflexive but not transitive  
B.  $R$  is reflexive but not symmetric not transitive  
C.  $R$  is transitive but not reflexive and not symmetric  
D.  $R$  is symmetric but not reflexive and not transitive

gatecse-2015-set2 set-theory&algebra relations normal

Answer key 



#### 4.12.32 Relations: GATE CSE 2015 Set 3 | Question: 41

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 if  $p - s = q - r$ . Which one of the following is true about  $R$ ?

- A. Both reflexive and symmetric  
C. Not reflexive but symmetric
- B. Reflexive but not symmetric  
D. Neither reflexive nor symmetric

gatecse-2015-set3 set-theory&algebra relations normal

Answer key 



#### 4.12.33 Relations: GATE CSE 2016 Set 2 | Question: 26

A binary relation  $R$  on  $\mathbb{N} \times \mathbb{N}$  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.
- $Q : R$  is transitive.

Which one of the following statements is TRUE?

- A. Both  $P$  and  $Q$  are true.  
C.  $P$  is false and  $Q$  is true.
- B.  $P$  is true and  $Q$  is false.  
D. Both  $P$  and  $Q$  are false.

gatecse-2016-set2 set-theory&algebra relations normal

Answer key 



#### 4.12.34 Relations: GATE CSE 2020 | Question: 17



Let  $\mathcal{R}$  be the set of all binary relations on the set  $\{1, 2, 3\}$ . Suppose a relation is chosen from  $\mathcal{R}$  at random. The probability that the chosen relation is reflexive (round off to 3 decimal places) is \_\_\_\_\_.

gatecse-2020 numerical-answers probability relations one-mark

Answer key

#### 4.12.35 Relations: GATE CSE 2021 Set 1 | Question: 43



A relation  $R$  is said to be circular if  $aRb$  and  $bRc$  together imply  $cRa$ .

Which of the following options is/are correct?

- A. If a relation  $S$  is reflexive and symmetric, then  $S$  is an equivalence relation.
- B. If a relation  $S$  is circular and symmetric, then  $S$  is an equivalence relation.
- C. If a relation  $S$  is reflexive and circular, then  $S$  is an equivalence relation.
- D. If a relation  $S$  is transitive and circular, then  $S$  is an equivalence relation.

gatecse-2021-set1 multiple-selects set-theory&algebra relations two-marks

Answer key

#### 4.12.36 Relations: GATE CSE 2025 | Set 2 | Question: 32



Let  $\mathcal{F}$  be the set of all functions from  $\{1, \dots, n\}$  to  $\{0, 1\}$ . Define the binary relation  $\leq$  on  $\mathcal{F}$  as follows:

$\forall f, g \in \mathcal{F}, f \leq g$  if and only if  $\forall x \in \{1, \dots, n\}, f(x) \leq g(x)$ , where  $0 \leq 1$ .

Which of the following statement(s) is/are TRUE?

- A.  $\leq$  is a symmetric relation
- B.  $(\mathcal{F}, \leq)$  is a partial order
- C.  $(\mathcal{F}, \leq)$  is a lattice
- D.  $\leq$  is an equivalence relation

gatecse2025-set2 set-theory&algebra functions relations multiple-selects two-marks

Answer key

#### 4.12.37 Relations: GATE IT 2004 | Question: 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  $R_1 R_2$  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.  $R_1 R_2 = \{(3, 2), (3, 4), (5, 1), (5, 3), (7, 1)\}$

gateit-2004 set-theory&algebra relations normal

Answer key

### 4.13 Set Theory (27)

#### 4.13.1 Set Theory: GATE CSE 1993 | Question: 17



Out of a group of 21 persons, 9 eat vegetables, 10 eat fish and 7 eat eggs. 5 persons eat all three. How many persons eat at least two out of the three dishes?

gate1993 set-theory&algebra easy set-theory descriptive

Answer key

#### 4.13.2 Set Theory: GATE CSE 1993 | Question: 8.3



Let  $S$  be an infinite set and  $S_1, \dots, S_n$  be sets such that  $S_1 \cup S_2 \cup \dots \cup S_n = S$ . Then

- A. at least one of the sets  $S_i$  is a finite set
- B. not more than one of the sets  $S_i$  can be finite
- C. at least one of the sets  $S_i$  is an infinite
- D. not more than one of the sets  $S_i$  can be infinite
- E. None of the above

gate1993 set-theory&algebra normal set-theory

[Answer key](#)

#### 4.13.3 Set Theory: GATE CSE 1993 | Question: 8.4



Let  $A$  be a finite set of size  $n$ . The number of elements in the power set of  $A \times A$  is:

- A.  $2^{2^n}$
- B.  $2^{n^2}$
- C.  $(2^n)^2$
- D.  $(2^2)^n$
- E. None of the above

gate1993 set-theory&algebra easy set-theory

[Answer key](#)

#### 4.13.4 Set Theory: GATE CSE 1994 | Question: 2.4



The number of subsets  $\{1, 2, \dots, n\}$  with odd cardinality is \_\_\_\_\_

gate1994 set-theory&algebra easy set-theory fill-in-the-blanks

[Answer key](#)

#### 4.13.5 Set Theory: GATE CSE 1995 | Question: 1.20



The number of elements in the power set  $P(S)$  of the set  $S = \{\{\emptyset\}, 1, \{2, 3\}\}$  is:

- A. 2
- B. 4
- C. 8
- D. None of the above

gate1995 set-theory&algebra normal set-theory

[Answer key](#)

#### 4.13.6 Set Theory: GATE CSE 1995 | Question: 25b



Determine the number of positive integers ( $\leq 720$ ) which are not divisible by any of 2, 3 or 5.

gate1995 set-theory&algebra set-theory numerical-answers

[Answer key](#)

#### 4.13.7 Set Theory: GATE CSE 1996 | Question: 1.1



Let  $A$  and  $B$  be sets and let  $A^c$  and  $B^c$  denote the complements of the sets  $A$  and  $B$ . The set  $(A - B) \cup (B - A) \cup (A \cap B)$  is equal to

- A.  $A \cup B$
- B.  $A^c \cup B^c$
- C.  $A \cap B$
- D.  $A^c \cap B^c$

gate1996 set-theory&algebra easy set-theory

[Answer key](#)

#### 4.13.8 Set Theory: GATE CSE 1998 | Question: 2.4



In a room containing 28 people, there are 18 people who speak English, 15 people who speak Hindi and 22 people who speak Kannada. 9 persons speak both English and Hindi, 11 persons speak both Hindi and Kannada whereas 13 persons speak both Kannada and English. How many speak all three languages?

- A. 9
- B. 8
- C. 7
- D. 6

gate1998 set-theory&algebra easy set-theory

[Answer key](#)

#### 4.13.9 Set Theory: GATE CSE 2000 | Question: 2.6



Let  $P(S)$  denotes the power set of set  $S$ . Which of the following is always true?

- A.  $P(P(S)) = P(S)$   
B.  $P(S) \cap P(P(S)) = \{\emptyset\}$   
C.  $P(S) \cap S = P(S)$   
D.  $S \notin P(S)$

gatecse-2000 set-theory&algebra easy set-theory

Answer key

#### 4.13.10 Set Theory: GATE CSE 2000 | Question: 6



Let  $S$  be a set of  $n$  elements  $\{1, 2, \dots, n\}$  and  $G$  a graph with  $2^n$  vertices, each vertex corresponding to a distinct subset of  $S$ . Two vertices are adjacent iff the symmetric difference of the corresponding sets has exactly 2 elements. Note: The symmetric difference of two sets  $R_1$  and  $R_2$  is defined as  $(R_1 \setminus R_2) \cup (R_2 \setminus R_1)$

Every vertex in  $G$  has the same degree. What is the degree of a vertex in  $G$ ?

How many connected components does  $G$  have?

gatecse-2000 set-theory&algebra normal descriptive set-theory

Answer key

#### 4.13.11 Set Theory: GATE CSE 2001 | Question: 2.2



Consider the following statements:

- $S_1$  : There exists infinite sets  $A, B, C$  such that  $A \cap (B \cup C)$  is finite.
- $S_2$  : There exists two irrational numbers  $x$  and  $y$  such that  $(x + y)$  is rational.

Which of the following is true about  $S_1$  and  $S_2$ ?

- A. Only  $S_1$  is correct  
B. Only  $S_2$  is correct  
C. Both  $S_1$  and  $S_2$  are correct  
D. None of  $S_1$  and  $S_2$  is correct

gatecse-2001 set-theory&algebra normal set-theory

Answer key

#### 4.13.12 Set Theory: GATE CSE 2001 | Question: 3



a. Prove that  $\text{powerset}(A \cap B) = \text{powerset}(A) \cap \text{powerset}(B)$

b. Let  $\text{sum}(n) = 0 + 1 + 2 + \dots + n$  for all natural numbers  $n$ . Give an induction proof to show that the following equation is true for all natural numbers  $m$  and  $n$ :

$$\text{sum}(m + n) = \text{sum}(m) + \text{sum}(n) + mn$$

gatecse-2001 set-theory&algebra normal set-theory descriptive

Answer key

#### 4.13.13 Set Theory: GATE CSE 2005 | Question: 8



Let  $A, B$  and  $C$  be non-empty sets and let  $X = (A - B) - C$  and  $Y = (A - C) - (B - C)$ . Which one of the following is TRUE?

- A.  $X = Y$   
B.  $X \subset Y$   
C.  $Y \subset X$   
D. None of these

gatecse-2005 set-theory&algebra easy set-theory

Answer key

#### 4.13.14 Set Theory: GATE CSE 2006 | Question: 22



Let  $E, F$  and  $G$  be finite sets. Let

- $X = (E \cap F) - (F \cap G)$  and
- $Y = (E - (E \cap G)) - (E - F)$ .

Which one of the following is true?

- A.  $X \subset Y$   
C.  $X = Y$

- B.  $X \supset Y$   
D.  $X - Y \neq \emptyset$  and  $Y - X \neq \emptyset$

gatecse-2006 set-theory&algebra normal set-theory

Answer key 

#### 4.13.15 Set Theory: GATE CSE 2006 | Question: 24

Given a set of elements  $N = 1, 2, \dots, n$  and two arbitrary subsets  $A \subseteq N$  and  $B \subseteq N$ , how many of the  $n!$  permutations  $\pi$  from  $N$  to  $N$  satisfy  $\min(\pi(A)) = \min(\pi(B))$ , where  $\min(S)$  is the smallest integer in the set of integers  $S$ , and  $\pi(S)$  is the set of integers obtained by applying permutation  $\pi$  to each element of  $S$ ?

- A.  $(n - |A \cup B|)|A||B|$   
C.  $n! \frac{|A \cap B|}{|A \cup B|}$   
B.  $(|A|^2 + |B|^2)n^2$   
D.  $\frac{|A \cap B|^2}{nC_{|A \cup B|}}$

gatecse-2006 set-theory&algebra normal set-theory

Answer key 

#### 4.13.16 Set Theory: GATE CSE 2008 | Question: 2

If  $P, Q, R$  are subsets of the universal set  $U$ , then

$$(P \cap Q \cap R) \cup (P^c \cap Q \cap R) \cup Q^c \cup R^c$$

is

- A.  $Q^c \cup R^c$   
C.  $P^c \cup Q^c \cup R^c$   
B.  $P \cup Q^c \cup R^c$   
D.  $U$

gatecse-2008 normal set-theory&algebra set-theory

Answer key 

#### 4.13.17 Set Theory: GATE CSE 2014 Set 2 | Question: 50

Consider the following relation on subsets of the set  $S$  of integers between 1 and 2014. For two distinct subsets  $U$  and  $V$  of  $S$  we say  $U < V$  if the minimum element in the symmetric difference of the two sets is in  $U$ .

Consider the following two statements:

- $S1$ : There is a subset of  $S$  that is larger than every other subset.
- $S2$ : There is a subset of  $S$  that is smaller than every other subset.

Which one of the following is CORRECT?

- A. Both  $S1$  and  $S2$  are true  
C.  $S2$  is true and  $S1$  is false  
B.  $S1$  is true and  $S2$  is false  
D. Neither  $S1$  nor  $S2$  is true

gatecse-2014-set2 set-theory&algebra normal set-theory

Answer key 

#### 4.13.18 Set Theory: GATE CSE 2015 Set 1 | Question: 16

For a set  $A$ , the power set of  $A$  is denoted by  $2^A$ . If  $A = \{5, \{6\}, \{7\}\}$ , which of the following options are TRUE?

- I.  $\emptyset \in 2^A$   
II.  $\emptyset \subseteq 2^A$   
III.  $\{5, \{6\}\} \in 2^A$   
IV.  $\{5, \{6\}\} \subseteq 2^A$

- A. I and III only      B. II and III only      C. I, II and III only      D. I, II and IV only

gatecse-2015-set1 set-theory&algebra set-theory normal

Answer key 

#### 4.13.19 Set Theory: GATE CSE 2015 Set 2 | Question: 18



The cardinality of the power set of  $\{0, 1, 2, \dots, 10\}$  is \_\_\_\_\_

gatecse-2015-set2 set-theory&algebra set-theory easy numerical-answers

[Answer key](#)

#### 4.13.20 Set Theory: GATE CSE 2015 Set 3 | Question: 23



Suppose  $U$  is the power set of the set  $S = \{1, 2, 3, 4, 5, 6\}$ . For any  $T \in U$ , let  $|T|$  denote the number of elements in  $T$  and  $T'$  denote the complement of  $T$ . For any  $T, R \in U$  let  $T \setminus R$  be the set of all elements in  $T$  which are not in  $R$ . Which one of the following is true?

- A.  $\forall X \in U, (|X| = |X'|)$
- B.  $\exists X \in U, \exists Y \in U, (|X| = 5, |Y| = 5 \text{ and } X \cap Y = \emptyset)$
- C.  $\forall X \in U, \forall Y \in U, (|X| = 2, |Y| = 3 \text{ and } X \setminus Y = \emptyset)$
- D.  $\forall X \in U, \forall Y \in U, (X \setminus Y = Y' \setminus X')$

gatecse-2015-set3 set-theory&algebra set-theory normal

[Answer key](#)

#### 4.13.21 Set Theory: GATE CSE 2016 Set 2 | Question: 28



Consider a set  $U$  of 23 different compounds in a chemistry lab. There is a subset  $S$  of  $U$  of 9 compounds, each of which reacts with exactly 3 compounds of  $U$ . Consider the following statements:

- I. Each compound in  $U \setminus S$  reacts with an odd number of compounds.
- II. At least one compound in  $U \setminus S$  reacts with an odd number of compounds.
- III. Each compound in  $U \setminus S$  reacts with an even number of compounds.

Which one of the above statements is **ALWAYS TRUE**?

- A. Only I
- B. Only II
- C. Only III
- D. None.

gatecse-2016-set2 set-theory&algebra difficult set-theory

[Answer key](#)

#### 4.13.22 Set Theory: GATE CSE 2017 Set 1 | Question: 47



The number of integers between 1 and 500 (both inclusive) that are divisible by 3 or 5 or 7 is \_\_\_\_\_.

gatecse-2017-set1 set-theory&algebra normal numerical-answers set-theory

[Answer key](#)

#### 4.13.23 Set Theory: GATE CSE 2021 Set 2 | Question: 37



For two  $n$ -dimensional real vectors  $P$  and  $Q$ , the operation  $s(P, Q)$  is defined as follows:

$$s(P, Q) = \sum_{i=1}^n (P[i] \cdot Q[i])$$

Let  $\mathcal{L}$  be a set of 10-dimensional non-zero real vectors such that for every pair of distinct vectors  $P, Q \in \mathcal{L}$ ,  $s(P, Q) = 0$ . What is the maximum cardinality possible for the set  $\mathcal{L}$ ?

- A. 9
- B. 10
- C. 11
- D. 100

gatecse-2021-set2 set-theory&algebra set-theory two-marks

[Answer key](#)

#### 4.13.24 Set Theory: GATE IT 2004 | Question: 2



In a class of 200 students, 125 students have taken Programming Language course, 85 students have taken Data Structures course, 65 students have taken Computer Organization course; 50 students have taken both Programming Language and Data Structures, 35 students have taken both Programming Language and Computer Organization; 30 students have taken both Data Structures and Computer Organization, 15 students have taken all the three courses.

How many students have not taken any of the three courses?

A. 15

B. 20

C. 25

D. 30

gateit-2004 set-theory&algebra easy set-theory

[Answer key](#)



#### 4.13.25 Set Theory: GATE IT 2005 | Question: 33

Let  $A$  be a set with  $n$  elements. Let  $C$  be a collection of distinct subsets of  $A$  such that for any two subsets  $S_1$  and  $S_2$  in  $C$ , either  $S_1 \subset S_2$  or  $S_2 \subset S_1$ . What is the maximum cardinality of  $C$ ?

A.  $n$

B.  $n + 1$

C.  $2^{n-1} + 1$

D.  $n!$

gateit-2005 set-theory&algebra normal set-theory

[Answer key](#)



#### 4.13.26 Set Theory: GATE IT 2006 | Question: 23

Let  $P$ ,  $Q$  and  $R$  be sets let  $\Delta$  denote the symmetric difference operator defined as  $P\Delta Q = (P \cup Q) - (P \cap Q)$ . Using Venn diagrams, determine which of the following is/are TRUE?

- I.  $P\Delta(Q \cap R) = (P\Delta Q) \cap (P\Delta R)$
- II.  $P \cap (Q \cap R) = (P \cap Q)\Delta(P \cap R)$

A. I only

B. II only

C. Neither I nor II

D. Both I and II

gateit-2006 set-theory&algebra normal set-theory

[Answer key](#)



#### 4.13.27 Set Theory: GATE IT 2006 | Question: 24

What is the cardinality of the set of integers  $X$  defined below?

$$X = \{n \mid 1 \leq n \leq 123, n \text{ is not divisible by either } 2, 3 \text{ or } 5\}$$

A. 28

B. 33

C. 37

D. 44

gateit-2006 set-theory&algebra normal set-theory

[Answer key](#)



## Answer Keys

4.1.1	N/A	4.1.2	N/A	4.1.3	C	4.1.4	D	4.1.5	A
4.1.6	A	4.1.7	B	4.1.8	A	4.2.1	True	4.2.2	D
4.3.1	N/A	4.3.2	N/A	4.3.3	N/A	4.3.4	B	4.3.5	A
4.3.6	C	4.3.7	N/A	4.3.8	C	4.3.9	A	4.3.10	N/A
4.3.11	A	4.3.12	B	4.3.13	B	4.3.14	D	4.3.15	B
4.3.16	C	4.3.17	C	4.3.18	16	4.3.19	D	4.3.20	B
4.3.21	A	4.3.22	36	4.3.23	0.95	4.3.24	2	4.3.25	B;C
4.3.26	B;C;D	4.3.27	2	4.3.28	C	4.3.29	D	4.4.1	N/A
4.4.2	N/A	4.4.3	N/A	4.4.4	N/A	4.4.5	C	4.4.6	D
4.4.7	N/A	4.4.8	C	4.4.9	C	4.4.10	D	4.4.11	N/A
4.4.12	N/A	4.4.13	N/A	4.4.14	B	4.4.15	A	4.4.16	D
4.4.17	C	4.4.18	A	4.4.19	C	4.4.20	A	4.4.21	A
4.4.22	C	4.4.23	A	4.4.24	5	4.4.25	4	4.4.26	42
4.4.27	B	4.4.28	7	4.4.29	B	4.4.30	A;B;C	4.4.31	A;D
4.4.32	B;D	4.4.33	4	4.5.1	B	4.6.1	N/A	4.6.2	N/A





**Syllabus:** Limits, Continuity, and Differentiability, Maxima and minima, Mean value theorem, Integration.

#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
<b>1 Mark Count</b>	1	1	1	1	2	1	1	1	1	1.13	2
<b>2 Marks Count</b>	0	0	0	0	0	0	0	0	0	0	0
<b>Total Marks</b>	1	1	1	1	2	1	1	1	1	1.13	2

### 5.1

### Continuity (9)



#### 5.1.1 Continuity: GATE CSE 1996 | Question: 3

Let  $f$  be a function defined by

$$f(x) = \begin{cases} x^2 & \text{for } x \leq 1 \\ ax^2 + bx + c & \text{for } 1 < x \leq 2 \\ x + d & \text{for } x > 2 \end{cases}$$

Find the values for the constants  $a$ ,  $b$ ,  $c$  and  $d$  so that  $f$  is continuous and differentiable everywhere on the real line.

gate1996 calculus continuity differentiation normal descriptive

**Answer key**



#### 5.1.2 Continuity: GATE CSE 1998 | Question: 1.4

Consider the function  $y = |x|$  in the interval  $[-1, 1]$ . In this interval, the function is

- |  |  |
|--|--|
| A. continuous and differentiable<br>C. differentiable but not continuous | B. continuous but not differentiable<br>D. neither continuous nor differentiable |
|--|--|

gate1998 calculus continuity differentiation easy

**Answer key**



#### 5.1.3 Continuity: GATE CSE 2007 | Question: 1

Consider the following two statements about the function  $f(x) = |x|$ :

- P.  $f(x)$  is continuous for all real values of  $x$ .
- Q.  $f(x)$  is differentiable for all real values of  $x$ .

Which of the following is **TRUE**?

- |   |  |
|---|--|
| A. $P$ is true and $Q$ is false.<br>C. Both $P$ and $Q$ are true. | B. $P$ is false and $Q$ is true.<br>D. Both $P$ and $Q$ are false. |
|---|--|

gatecse-2007 calculus continuity differentiation easy

**Answer key**



#### 5.1.4 Continuity: GATE CSE 2013 | Question: 22

Which one of the following functions is continuous at  $x = 3$ ?

- A.  $f(x) = \begin{cases} 2, & \text{if } x = 3 \\ x - 1 & \text{if } x > 3 \\ \frac{x+3}{3} & \text{if } x < 3 \end{cases}$
- B.  $f(x) = \begin{cases} 4, & \text{if } x = 3 \\ 8 - x & \text{if } x \neq 3 \end{cases}$
- C.  $f(x) = \begin{cases} x + 3, & \text{if } x \leq 3 \\ x - 4 & \text{if } x > 3 \end{cases}$
- D.  $f(x) = \begin{cases} \frac{1}{x^3 - 27} & \text{if } x \neq 3 \end{cases}$

gatecse-2013 calculus continuity normal

[Answer key](#)

### 5.1.5 Continuity: GATE CSE 2014 Set 1 | Question: 47



A function  $f(x)$  is continuous in the interval  $[0, 2]$ . It is known that  $f(0) = f(2) = -1$  and  $f(1) = 1$ . Which one of the following statements must be true?

- A. There exists a  $y$  in the interval  $(0, 1)$  such that  $f(y) = f(y + 1)$
- B. For every  $y$  in the interval  $(0, 1)$ ,  $f(y) = f(2 - y)$
- C. The maximum value of the function in the interval  $(0, 2)$  is 1
- D. There exists a  $y$  in the interval  $(0, 1)$  such that  $f(y) = -f(2 - y)$

gatecse-2014-set1 calculus continuity normal

[Answer key](#)

### 5.1.6 Continuity: GATE CSE 2015 Set 2 | Question: 26



Let  $f(x) = x^{-(\frac{1}{3})}$  and  $A$  denote the area of region bounded by  $f(x)$  and the X-axis, when  $x$  varies from  $-1$  to  $1$ . Which of the following statements is/are TRUE?

- I.  $f$  is continuous in  $[-1, 1]$
- II.  $f$  is not bounded in  $[-1, 1]$
- III.  $A$  is nonzero and finite

A. II only      B. III only      C. II and III only      D. I, II and III

gatecse-2015-set2 calculus continuity functions normal

[Answer key](#)

### 5.1.7 Continuity: GATE CSE 2021 Set 2 | Question: 25



Suppose that  $f : \mathbb{R} \rightarrow \mathbb{R}$  is a continuous function on the interval  $[-3, 3]$  and a differentiable function in the interval  $(-3, 3)$  such that for every  $x$  in the interval,  $f'(x) \leq 2$ . If  $f(-3) = 7$ , then  $f(3)$  is at most \_\_\_\_\_

gatecse-2021-set2 numerical-answers calculus continuity one-mark

[Answer key](#)

### 5.1.8 Continuity: GATE DS&AI 2024 | Question: 27



Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a function. Note:  $\mathbb{R}$  denotes the set of real numbers.

$$f(x) = \begin{cases} -x, & \text{if } x < -2 \\ ax^2 + bx + c, & \text{if } x \in [-2, 2] \\ x, & \text{if } x > 2 \end{cases}$$

Which ONE of the following choices gives the values of  $a, b, c$  that make the function  $f$  continuous and differentiable?

- |                                    |                                    |
|------------------------------------|------------------------------------|
| A. $a = \frac{1}{4}, b = 0, c = 1$ | B. $a = \frac{1}{2}, b = 0, c = 0$ |
| C. $a = 0, b = 0, c = 0$           | D. $a = 1, b = 1, c = -4$          |

gate-ds-ai-2024 calculus continuity differentiation two-marks

[Answer key](#)

### 5.1.9 Continuity: GATE2010 ME



The function  $y = |2 - 3x|$

- A. **is continuous**  $\forall x \in R$  and differentiable  $\forall x \in R$
- B. **is continuous**  $\forall x \in R$  and differentiable  $\forall x \in R$  except at  $x = \frac{3}{2}$
- C. **is continuous**  $\forall x \in R$  and differentiable  $\forall x \in R$  except at  $x = \frac{2}{3}$

D. **is continuous**  $\forall x \in R$  except  $x = 3$  and differentiable  $\forall x \in R$

calculus gate2010me engineering-mathematics continuity

Answer key 

5.2

Definite Integral (3)

#### 5.2.1 Definite Integral: GATE CSE 2023 | Question: 21



The value of the definite integral

$$\int_{-3}^3 \int_{-2}^2 \int_{-1}^1 (4x^2y - z^3) dz dy dx$$

is \_\_\_\_\_. (Rounded off to the nearest integer)

gatecse-2023 calculus definite-integral numerical-answers one-mark

Answer key 

#### 5.2.2 Definite Integral: GATE CSE 2024 | Set 2 | Question: 6



Let  $f(x)$  be a continuous function from  $\mathbb{R}$  to  $\mathbb{R}$  such that

$$f(x) = 1 - f(2-x)$$

Which one of the following options is the CORRECT value of  $\int_0^2 f(x)dx$  ?

- A. 0      B. 1      C. 2      D. -1

gatecse2024-set2 calculus definite-integral one-mark

Answer key 

#### 5.2.3 Definite Integral: GATE CSE 2025 | Set 2 | Question: 2



The value of  $x$  such that  $x > 1$ , satisfying the equation  $\int_1^x t \ln t dt = \frac{1}{4}$  is

- A.  $\sqrt{e}$       B.  $e$       C.  $e^2$       D.  $e - 1$

gatecse2025-set2 calculus definite-integral one-mark

Answer key 

5.3

Differentiation (10)

#### 5.3.1 Differentiation: GATE CSE 1996 | Question: 1.6



The formula used to compute an approximation for the second derivative of a function  $f$  at a point  $x_0$  is

- A.  $\frac{f(x_0 + h) + f(x_0 - h)}{2}$   
B.  $\frac{f(x_0 + h) - f(x_0 - h)}{2h}$   
C.  $\frac{f(x_0 + h) + 2f(x_0) + f(x_0 - h)}{h^2}$   
D.  $\frac{f(x_0 + h) - 2f(x_0) + f(x_0 - h)}{h^2}$

gate1996 calculus differentiation normal

Answer key 

#### 5.3.2 Differentiation: GATE CSE 2014 Set 1 | Question: 46



The function  $f(x) = x \sin x$  satisfies the following equation:

$$f''(x) + f(x) + t \cos x = 0$$

The value of  $t$  is \_\_\_\_\_.

gatecse-2014-set1 calculus easy numerical-answers differentiation

[Answer key](#)

### 5.3.3 Differentiation: GATE CSE 2014 Set 1 | Question: 6



Let the function

$$f(\theta) = \begin{vmatrix} \sin \theta & \cos \theta & \tan \theta \\ \sin\left(\frac{\pi}{6}\right) & \cos\left(\frac{\pi}{6}\right) & \tan\left(\frac{\pi}{6}\right) \\ \sin\left(\frac{\pi}{3}\right) & \cos\left(\frac{\pi}{3}\right) & \tan\left(\frac{\pi}{3}\right) \end{vmatrix}$$

where

$\theta \in \left[\frac{\pi}{6}, \frac{\pi}{3}\right]$  and  $f'(\theta)$  denote the derivative of  $f$  with respect to  $\theta$ . Which of the following statements is/are **TRUE**?

- I. There exists  $\theta \in (\frac{\pi}{6}, \frac{\pi}{3})$  such that  $f'(\theta) = 0$   
 II. There exists  $\theta \in (\frac{\pi}{6}, \frac{\pi}{3})$  such that  $f'(\theta) \neq 0$

- A. I only      B. II only      C. Both I and II      D. Neither I nor II

gatecse-2014-set1 calculus differentiation normal

[Answer key](#)

### 5.3.4 Differentiation: GATE CSE 2016 Set 2 | Question: 02



Let  $f(x)$  be a polynomial and  $g(x) = f'(x)$  be its derivative. If the degree of  $(f(x) + f(-x))$  is 10, then the degree of  $(g(x) - g(-x))$  is \_\_\_\_\_.

gatecse-2016-set2 calculus normal numerical-answers differentiation

[Answer key](#)

### 5.3.5 Differentiation: GATE CSE 2017 Set 2 | Question: 10



If  $f(x) = R \sin(\frac{\pi x}{2}) + S$ ,  $f'\left(\frac{1}{2}\right) = \sqrt{2}$  and  $\int_0^1 f(x) dx = \frac{2R}{\pi}$ , then the constants  $R$  and  $S$  are

- A.  $\frac{2}{\pi}$  and  $\frac{16}{\pi}$       B.  $\frac{2}{\pi}$  and 0      C.  $\frac{4}{\pi}$  and 0      D.  $\frac{4}{\pi}$  and  $\frac{16}{\pi}$

gatecse-2017-set2 engineering-mathematics calculus differentiation

[Answer key](#)

### 5.3.6 Differentiation: GATE CSE 2024 | Set 1 | Question: 1



Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a function such that  $f(x) = \max\{x, x^3\}$ ,  $x \in \mathbb{R}$ , where  $\mathbb{R}$  is the set of all real numbers. The set of all points where  $f(x)$  is NOT differentiable is

- A.  $\{-1, 1, 2\}$       B.  $\{-2, -1, 1\}$       C.  $\{0, 1\}$       D.  $\{-1, 0, 1\}$

gatecse2024-set1 calculus differentiation one-mark

[Answer key](#)

### 5.3.7 Differentiation: GATE CSE 2025 | Set 1 | Question: 21



Consider the given function  $f(x)$ .

$$f(x) = \begin{cases} ax + b & \text{for } x < 1 \\ x^3 + x^2 + 1 & \text{for } x \geq 1 \end{cases}$$

If the function is differentiable everywhere, the value of  $b$  must be \_\_\_\_\_. (rounded off to one decimal place)

gatecse2025-set1 calculus differentiation numerical-answers one-mark

[Answer key](#)

### 5.3.8 Differentiation: GATE DA 2025 | Question: 14

Consider two functions  $f : \mathbb{R} \rightarrow \mathbb{R}$  and  $g : \mathbb{R} \rightarrow (1, \infty)$ . Both functions are differentiable at a point  $c$ . Which of the following functions is/are ALWAYS differentiable at  $c$ ? The symbol  $\cdot$  denotes product and the symbol  $\circ$  denotes composition of functions.

- A.  $f \pm g$       B.  $f \cdot g$       C.  $\frac{f}{g}$       D.  $f \circ g + g \circ f$

gateda-2025 calculus differentiation limits multiple-selects one-mark

Answer key 

### 5.3.9 Differentiation: GATE DA 2025 | Question: 4

Let  $f(x) = \frac{e^x - e^{-x}}{2}, x \in \mathbb{R}$ . Let  $f^{(k)}(a)$  denote the  $k^{th}$  derivative of  $f$  evaluated at  $a$ . What is the value of  $f^{(10)}(0)$ ? (Note: ! denotes factorial)

- A. 0      B. 1      C.  $\frac{1}{10!}$       D.  $\frac{2}{10!}$

gateda-2025 calculus differentiation one-mark

Answer key 

### 5.3.10 Differentiation: GATE DA 2025 | Question: 41

Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a twice-differentiable function and suppose its second derivative satisfies  $f''(x) > 0$  for all  $x \in \mathbb{R}$ . Which of the following statements is/are ALWAYS correct?

- A.  $f$  has a local minima  
B. There does not exist  $x$  and  $y, x \neq y$ , such that  $f'(x) = f'(y) = 0$   
C.  $f$  has at most one global minimum  
D.  $f$  has at most one local minimum

gateda-2025 calculus maxima-minima differentiation multiple-selects two-marks

Answer key 

## 5.4

### Integration (11)

#### 5.4.1 Integration: GATE CSE 1993 | Question: 02.6

The value of the double integral  $\int_0^1 \int_0^x \frac{x}{1+y^2} dx dy$  is \_\_\_\_\_.

gate1993 calculus integration normal fill-in-the-blanks

Answer key 

#### 5.4.2 Integration: GATE CSE 1998 | Question: 8

- a. Find the points of local maxima and minima, if any, of the following function defined in  $0 \leq x \leq 6$ .

$$x^3 - 6x^2 + 9x + 15$$

- b. Integrate

$$\int_{-\pi}^{\pi} x \cos x dx$$

gate1998 calculus maxima-minima integration normal descriptive

Answer key 

#### 5.4.3 Integration: GATE CSE 2000 | Question: 2.3

Let  $S = \sum_{i=3}^{100} i \log_2 i$ , and  $T = \int_2^{100} x \log_2 x dx$ .

Which of the following statements is true?

- A.  $S > T$   
C.  $S < T$  and  $2S > T$

gatecse-2000 calculus integration normal

Answer key 

- B.  $S = T$   
D.  $2S \leq T$



#### 5.4.4 Integration: GATE CSE 2009 | Question: 25

$$\int_0^{\pi/4} (1 - \tan x) / (1 + \tan x) dx$$



- A. 0  
B. 1  
C.  $\ln 2$   
D.  $1/2 \ln 2$

gatecse-2009 calculus integration normal

Answer key 

#### 5.4.5 Integration: GATE CSE 2011 | Question: 31

Given  $i = \sqrt{-1}$ , what will be the evaluation of the definite integral  $\int_0^{\pi/2} \frac{\cos x + i \sin x}{\cos x - i \sin x} dx$  ?



- A. 0  
B. 2  
C.  $-i$   
D.  $i$

gatecse-2011 calculus integration normal

Answer key 

#### 5.4.6 Integration: GATE CSE 2014 Set 3 | Question: 47



The value of the integral given below is

$$\int_0^{\pi} x^2 \cos x dx$$

- A.  $-2\pi$   
B.  $\pi$   
C.  $-\pi$   
D.  $2\pi$

gatecse-2014-set3 calculus limits integration normal

Answer key 

#### 5.4.7 Integration: GATE CSE 2014 Set 3 | Question: 6



If  $\int_0^{2\pi} |x \sin x| dx = k\pi$ , then the value of  $k$  is equal to \_\_\_\_\_.

gatecse-2014-set3 calculus integration limits numerical-answers easy

Answer key 

#### 5.4.8 Integration: GATE CSE 2015 Set 1 | Question: 44



Compute the value of:

$$\int_{\frac{1}{\pi}}^{\frac{2}{\pi}} \frac{\cos(1/x)}{x^2} dx$$

gatecse-2015-set1 calculus integration normal numerical-answers

Answer key 

#### 5.4.9 Integration: GATE CSE 2015 Set 3 | Question: 45



If for non-zero  $x$ ,  $af(x) + bf(\frac{1}{x}) = \frac{1}{x} - 25$  where  $a \neq b$  then  $\int_1^2 f(x) dx$  is

- A.  $\frac{1}{a^2-b^2} \left[ a(\ln 2 - 25) + \frac{47b}{2} \right]$   
 C.  $\frac{1}{a^2-b^2} \left[ a(2\ln 2 - 25) + \frac{47b}{2} \right]$

gatecse-2015-set3 calculus integration normal

- B.  $\frac{1}{a^2-b^2} \left[ a(2\ln 2 - 25) - \frac{47b}{2} \right]$   
 D.  $\frac{1}{a^2-b^2} \left[ a(\ln 2 - 25) - \frac{47b}{2} \right]$

[Answer key](#)



#### 5.4.10 Integration: GATE CSE 2018 | Question: 16

The value of  $\int_0^{\pi/4} x \cos(x^2) dx$  correct to three decimal places (assuming that  $\pi = 3.14$ ) is \_\_\_\_\_

gatecse-2018 calculus integration normal numerical-answers one-mark

[Answer key](#)



#### 5.4.11 Integration: GATE IT 2005 | Question: 35

What is the value of  $\int_0^{2\pi} (x - \pi)^2 (\sin x) dx$

- A.  $-1$       B.  $0$       C.  $1$       D.  $\pi$

gateit-2005 calculus integration normal

[Answer key](#)

### 5.5

### Limits (15)



#### 5.5.1 Limits: GATE CSE 1993 | Question: 02.1

$$\lim_{x \rightarrow 0} \frac{x(e^x - 1) + 2(\cos x - 1)}{x(1 - \cos x)} \text{ is } _____$$

gate1993 limits calculus normal fill-in-the-blanks

[Answer key](#)



#### 5.5.2 Limits: GATE CSE 1995 | Question: 7(B)

Compute without using power series expansion  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ .

gate1995 calculus limits numerical-answers

[Answer key](#)



#### 5.5.3 Limits: GATE CSE 2008 | Question: 1

$$\lim_{x \rightarrow \infty} \frac{x - \sin x}{x + \cos x} \text{ equals}$$



- A.  $1$       B.  $-1$       C.  $\infty$       D.  $-\infty$

gatecse-2008 calculus limits easy

[Answer key](#)



#### 5.5.4 Limits: GATE CSE 2010 | Question: 5

What is the value of  $\lim_{n \rightarrow \infty} \left(1 - \frac{1}{n}\right)^{2n}$  ?



- A.  $0$       B.  $e^{-2}$       C.  $e^{-1/2}$       D.  $1$

gatecse-2010 calculus limits normal

[Answer key](#)



#### 5.5.5 Limits: GATE CSE 2015 Set 1 | Question: 4

$\lim_{x \rightarrow \infty} x^{\frac{1}{x}}$  is



- A.  $\infty$       B.  $0$       C.  $1$       D. Not defined

**Answer key****5.5.6 Limits: GATE CSE 2015 Set 3 | Question: 9**The value of  $\lim_{x \rightarrow \infty} (1 + x^2)^{e^{-x}}$  is

- A. 0      B.  $\frac{1}{2}$       C. 1      D.  $\infty$

**Answer key****5.5.7 Limits: GATE CSE 2016 Set 1 | Question: 3**

$$\lim_{x \rightarrow 4} \frac{\sin(x - 4)}{x - 4} = \underline{\hspace{2cm}}$$

**Answer key****5.5.8 Limits: GATE CSE 2017 Set 1 | Question: 28**The value of  $\lim_{x \rightarrow 1} \frac{x^7 - 2x^5 + 1}{x^3 - 3x^2 + 2}$ 

- A. is 0      B. is  $-1$       C. is 1      D. does not exist

**Answer key****5.5.9 Limits: GATE CSE 2019 | Question: 13**Compute  $\lim_{x \rightarrow 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$ 

- A. 1      B.  $53/12$   
C.  $108/7$       D. Limit does not exist

**Answer key****5.5.10 Limits: GATE CSE 2021 Set 1 | Question: 20**

Consider the following expression.

$$\lim_{x \rightarrow -3} \frac{\sqrt{2x + 22} - 4}{x + 3}$$

The value of the above expression (rounded to 2 decimal places) is \_\_\_\_\_.

**Answer key****5.5.11 Limits: GATE CSE 2022 | Question: 24**

The value of the following limit is \_\_\_\_\_.

$$\lim_{x \rightarrow 0^+} \frac{\sqrt{x}}{1 - e^{2\sqrt{x}}}$$

**Answer key**

### 5.5.12 Limits: GATE DA 2025 | Question: 22



$$\lim_{t \rightarrow +\infty} \sqrt{t^2 + t} - t =$$

(Round off to one decimal place)

gateda-2025 calculus limits numerical-answers one-mark

[Answer key](#)

### 5.5.13 Limits: GATE DA 2025 | Question: 49



Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be such that  $|f(x) - f(y)| \leq (x - y)^2$  for all  $x, y \in \mathbb{R}$ . Then  $f(1) - f(0) = \underline{\hspace{2cm}}$  (Answer in integer)

gateda-2025 calculus limits numerical-answers two-marks

[Answer key](#)

### 5.5.14 Limits: GATE DS&AI 2024 | Question: 50



Evaluate the following limit:

$$\lim_{x \rightarrow 0} \frac{\ln((x^2 + 1) \cos x)}{x^2} =$$

gate-ds-ai-2024 calculus numerical-answers limits engineering-mathematics two-marks

[Answer key](#)

### 5.5.15 Limits: GATE Data Science and Artificial Intelligence 2024 | Sample Paper | Question: 5



$$\lim_{x \rightarrow 2} \frac{\sqrt{x} - \sqrt{2}}{x - 2}$$

A. 0

B.  $\sqrt{2}$

C.  $\frac{1}{2\sqrt{2}}$

D.  $\frac{1}{\sqrt{2}}$

gateda-sample-paper-2024 calculus limits

[Answer key](#)

## 5.6

### Maxima Minima (13)

#### 5.6.1 Maxima Minima: GATE CSE 1987 | Question: 1-xxvi



If  $f(x_i) \cdot f(x_{i+1}) < 0$  then

- A. There must be a root of  $f(x)$  between  $x_i$  and  $x_{i+1}$
- B. There need not be a root of  $f(x)$  between  $x_i$  and  $x_{i+1}$
- C. There fourth derivative of  $f(x)$  with respect to  $x$  vanishes at  $x_i$
- D. The fourth derivative of  $f(x)$  with respect to  $x$  vanishes at  $x_{i+1}$

gate1987 calculus maxima-minima

[Answer key](#)

#### 5.6.2 Maxima Minima: GATE CSE 1995 | Question: 1.21



In the interval  $[0, \pi]$  the equation  $x = \cos x$  has

- A. No solution
- B. Exactly one solution
- C. Exactly two solutions
- D. An infinite number of solutions

gate1995 calculus normal maxima-minima

[Answer key](#)

### 5.6.3 Maxima Minima: GATE CSE 1995 | Question: 25a



Find the minimum value of  $3 - 4x + 2x^2$ .

gate1995 calculus maxima-minima easy descriptive

[Answer key](#)



### 5.6.4 Maxima Minima: GATE CSE 1997 | Question: 4.1

What is the maximum value of the function  $f(x) = 2x^2 - 2x + 6$  in the interval  $[0, 2]$ ?



- A. 6      B. 10      C. 12      D. 5.5

gate1997 calculus maxima-minima normal

[Answer key](#)



### 5.6.5 Maxima Minima: GATE CSE 2008 | Question: 25

A point on a curve is said to be an extremum if it is a local minimum or a local maximum. The number of distinct extrema for the curve  $3x^4 - 16x^3 + 24x^2 + 37$  is

- A. 0      B. 1      C. 2      D. 3

gatecse-2008 calculus maxima-minima easy

[Answer key](#)



### 5.6.6 Maxima Minima: GATE CSE 2012 | Question: 9

Consider the function  $f(x) = \sin(x)$  in the interval  $x = [\frac{\pi}{4}, \frac{7\pi}{4}]$ . The number and location(s) of the local minima of this function are

- A. One, at  $\frac{\pi}{2}$   
 B. One, at  $\frac{3\pi}{2}$   
 C. Two, at  $\frac{\pi}{2}$  and  $\frac{3\pi}{2}$   
 D. Two, at  $\frac{\pi}{4}$  and  $\frac{3\pi}{2}$

gatecse-2012 calculus maxima-minima normal

[Answer key](#)



### 5.6.7 Maxima Minima: GATE CSE 2015 Set 2 | Question: GA-3

Consider a function  $f(x) = 1 - |x|$  on  $-1 \leq x \leq 1$ . The value of  $x$  at which the function attains a maximum, and the maximum value of the function are:

- A. 0, -1      B. -1, 0      C. 0, 1      D. -1, 2

gatecse-2015-set2 set-theory&algebra functions normal maxima-minima

[Answer key](#)



### 5.6.8 Maxima Minima: GATE CSE 2020 | Question: 1

Consider the functions

- I.  $e^{-x}$   
 II.  $x^2 - \sin x$   
 III.  $\sqrt{x^3 + 1}$

Which of the above functions is/are increasing everywhere in  $[0, 1]$ ?

- A. III only  
 B. II only  
 C. II and III only  
 D. I and III only

gatecse-2020 engineering-mathematics calculus maxima-minima one-mark

[Answer key](#)

### 5.6.9 Maxima Minima: GATE CSE 2023 | Question: 18



Let

$$f(x) = x^3 + 15x^2 - 33x - 36$$

be a real-valued function.

Which of the following statements is/are TRUE?

- A.  $f(x)$  does not have a local maximum.
- B.  $f(x)$  has a local maximum.
- C.  $f(x)$  does not have a local minimum.
- D.  $f(x)$  has a local minimum.

gatecse-2023 calculus maxima-minima multiple-selects one-mark

Answer key

### 5.6.10 Maxima Minima: GATE DA 2025 | Question: 39



Consider the function  $f(x) = \frac{x^3}{3} + \frac{7}{2}x^2 + 10x + \frac{133}{2}$ ,  $x \in [-8, 0]$ . Which of the following statements is/are correct?

- A. The maximum value of  $f$  is attained at  $x = -5$
- B. The minimum value of  $f$  is attained at  $x = -2$
- C. The maximum value of  $f$  is  $\frac{133}{2}$
- D. The minimum value of the derivative of  $f$  is attained at  $x = -\frac{7}{2}$

gateda-2025 calculus maxima-minima multiple-selects two-marks

### 5.6.11 Maxima Minima: GATE DS&AI 2024 | Question: 40



Consider the function  $f : \mathbb{R} \rightarrow \mathbb{R}$  where  $\mathbb{R}$  is the set of all real numbers.

$$f(x) = \frac{x^4}{4} - \frac{2x^3}{3} - \frac{3x^2}{2} + 1$$

Which of the following statements is/are TRUE?

- A.  $x = 0$  is a local maximum of  $f$
- B.  $x = 3$  is a local minimum of  $f$
- C.  $x = -1$  is a local maximum of  $f$
- D.  $x = 0$  is a local minimum of  $f$

gate-ds-ai-2024 calculus maxima-minima multiple-selects two-marks

Answer key

### 5.6.12 Maxima Minima: GATE DS&AI 2024 | Question: 5



For any twice differentiable function  $f : \mathbb{R} \rightarrow \mathbb{R}$ , if at some  $x^* \in \mathbb{R}$ ,  $f'(x^*) = 0$  and  $f''(x^*) > 0$ , then the function  $f$  necessarily has a \_\_\_\_\_ at  $x = x^*$ .

Note:  $\mathbb{R}$  denotes the set of real numbers.

- A. local minimum
- B. global minimum
- C. local maximum
- D. global maximum

gate-ds-ai-2024 calculus maxima-minima one-mark

Answer key

### 5.6.13 Maxima Minima: GATE IT 2008 | Question: 31



If  $f(x)$  is defined as follows, what is the minimum value of  $f(x)$  for  $x \in (0, 2]$  ?

$$f(x) = \begin{cases} \frac{25}{8x} & \text{when } x \leq \frac{3}{2} \\ x + \frac{1}{x} & \text{otherwise} \end{cases}$$

A. 2

B.  $2\frac{1}{12}$

C.  $2\frac{1}{6}$

D.  $2\frac{1}{2}$

gateit-2008 calculus maxima-minima normal

[Answer key](#)

5.7

## Polynomials (2)



### 5.7.1 Polynomials: GATE CSE 1987 | Question: 1-xxii

The equation  $7x^7 + 14x^6 + 12x^5 + 3x^4 + 12x^3 + 10x^2 + 5x + 7 = 0$  has



- A. All complex roots
- C. Four pairs of imaginary roots

- B. At least one real root
- D. None of the above

gate1987 calculus polynomials

[Answer key](#)

### 5.7.2 Polynomials: GATE CSE 1995 | Question: 2.8



If the cube roots of unity are  $1, \omega$  and  $\omega^2$ , then the roots of the following equation are

$$(x - 1)^3 + 8 = 0$$

- A.  $-1, 1 + 2\omega, 1 + 2\omega^2$
- C.  $-1, 1 - 2\omega, 1 - 2\omega^2$

- B.  $1, 1 - 2\omega, 1 - 2\omega^2$
- D.  $-1, 1 + 2\omega, -1 + 2\omega^2$

gate1995 calculus normal polynomials

[Answer key](#)

## Answer Keys

5.1.1	N/A	5.1.2	B	5.1.3	A	5.1.4	A	5.1.5	A
5.1.6	C	5.1.7	19 : 19	5.1.8	A	5.1.9	C	5.2.1	0
5.2.2	B	5.2.3	A	5.3.1	D	5.3.2	-2	5.3.3	C
5.3.4	9	5.3.5	C	5.3.6	D	5.3.7	-2.1:-1.9	5.3.8	A;B;C
5.3.9	A	5.3.10	B;C;D	5.4.1	N/A	5.4.2	N/A	5.4.3	A
5.4.4	D	5.4.5	D	5.4.6	A	5.4.7	4	5.4.8	-1
5.4.9	A	5.4.10	0.288 : 0.289	5.4.11	B	5.5.1	1	5.5.2	1
5.5.3	A	5.5.4	B	5.5.5	C	5.5.6	C	5.5.7	1
5.5.8	C	5.5.9	C	5.5.10	0.25 : 0.25	5.5.11	-0.5	5.5.12	0.5:0.5
5.5.13	0:0	5.5.14	0.5	5.5.15	C	5.6.1	A	5.6.2	B
5.6.3	1	5.6.4	B	5.6.5	B	5.6.6	D	5.6.7	C
5.6.8	A	5.6.9	B;D	5.6.10	C;D	5.6.11	A;B	5.6.12	A
5.6.13	B	5.7.1	B	5.7.2	C				



**Syllabus:** Matrices, determinants, System of linear equations, Eigenvalues and eigenvectors, LU decomposition.

### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
1 Mark Count	1	2	1	0	2	1	0	1	0	1	2
2 Marks Count	1	1	1	1	0	2	1	1	0	1	2
Total Marks	3	4	3	2	2	5	2	3	2	3	5

## 6.1

## Cartesian Coordinates (1)



## 6.1.1 Cartesian Coordinates: GATE IT 2007 | Question: 80

Let  $P_1, P_2, \dots, P_n$  be  $n$  points in the  $xy$ -plane such that no three of them are collinear. For every pair of points  $P_i$  and  $P_j$ , let  $L_{ij}$  be the line passing through them. Let  $L_{ab}$  be the line with the steepest gradient amongst all  $\frac{n(n-1)}{2}$  lines.

Which one of the following properties should necessarily be satisfied ?

- A.  $P_a$  and  $P_b$  are adjacent to each other with respect to their  $x$ -coordinate
- B. Either  $P_a$  or  $P_b$  has the largest or the smallest  $y$ -coordinate among all the points
- C. The difference between  $x$ -coordinates  $P_a$  and  $P_b$  is minimum
- D. None of the above

gateit-2007 linear-algebra cartesian-coordinates

Answer key

## 6.2

## Determinant (11)



## 6.2.1 Determinant: GATE CSE 1997 | Question: 1.3

The determinant of the matrix

$$\begin{bmatrix} 6 & -8 & 1 & 1 \\ 0 & 2 & 4 & 6 \\ 0 & 0 & 4 & 8 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

- A. 11
- B. -48
- C. 0
- D. -24

gate1997 linear-algebra normal determinant

Answer key

## 6.2.2 Determinant: GATE CSE 2000 | Question: 1.3



The determinant of the matrix

$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 8 & 1 & 7 & 2 \\ 2 & 0 & 2 & 0 \\ 9 & 0 & 6 & 1 \end{bmatrix}$$

- A. 4
- B. 0
- C. 15
- D. 20

gatecse-2000 linear-algebra easy determinant

Answer key

## 6.2.3 Determinant: GATE CSE 2013 | Question: 3



Which one of the following does NOT equal

$$\begin{array}{ll} \left| \begin{array}{ccc} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{array} \right| ? & \left| \begin{array}{ccc} 1 & x+1 & x^2+1 \\ 1 & y+1 & y^2+1 \\ 1 & z+1 & z^2+1 \end{array} \right| \\ \text{A. } \left| \begin{array}{ccc} 1 & x(x+1) & x+1 \\ 1 & y(y+1) & y+1 \\ 1 & z(z+1) & z+1 \\ 0 & x-y & x^2-y^2 \end{array} \right| & \text{B. } \left| \begin{array}{ccc} 1 & x+y & x^2+y^2 \\ 2 & y+z & y^2+z^2 \\ 1 & z & z^2 \end{array} \right| \\ \text{C. } \left| \begin{array}{ccc} 0 & y-z & y^2-z^2 \\ 1 & z & z^2 \end{array} \right| & \text{D. } \left| \begin{array}{ccc} 2 & -4 & 7 \\ 1 & 9 & 5 \end{array} \right| \end{array}$$

gatecse-2013 linear-algebra normal determinant

[Answer key](#)



#### 6.2.4 Determinant: GATE CSE 2014 Set 2 | Question: 4

If the matrix  $A$  is such that

$$A = \begin{bmatrix} 2 \\ -4 \\ 7 \end{bmatrix} [1 \ 9 \ 5]$$

then the determinant of  $A$  is equal to \_\_\_\_\_.

gatecse-2014-set2 linear-algebra numerical-answers easy determinant

[Answer key](#)



#### 6.2.5 Determinant: GATE CSE 2019 | Question: 9

Let  $X$  be a square matrix. Consider the following two statements on  $X$ .

- I.  $X$  is invertible
- II. Determinant of  $X$  is non-zero

Which one of the following is TRUE?

- |   |                                       |
|---|---------------------------------------|
| A. I implies II; II does not imply I        | B. II implies I; I does not imply II  |
| C. I does not imply II; II does not imply I | D. I and II are equivalent statements |

gatecse-2019 engineering-mathematics linear-algebra determinant one-mark

[Answer key](#)



#### 6.2.6 Determinant: GATE CSE 2023 | Question: 8

Let

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 4 & 1 & 2 & 3 \\ 3 & 4 & 1 & 2 \\ 2 & 3 & 4 & 1 \end{bmatrix}$$

and

$$B = \begin{bmatrix} 3 & 4 & 1 & 2 \\ 4 & 1 & 2 & 3 \\ 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{bmatrix}$$

Let  $\det(A)$  and  $\det(B)$  denote the determinants of the matrices  $A$  and  $B$ , respectively.

Which one of the options given below is TRUE?

- A.  $\det(A) = \det(B)$   
 B.  $\det(B) = -\det(A)$   
 C.  $\det(A) = 0$   
 D.  $\det(AB) = \det(A) + \det(B)$

gatecse-2023 linear-algebra determinant one-mark easy

[Answer key](#) 

#### 6.2.7 Determinant: GATE CSE 2024 | Set 2 | Question: 37



Let  $A$  be an  $n \times n$  matrix over the set of all real numbers  $\mathbb{R}$ . Let  $B$  be a matrix obtained from  $A$  by swapping two rows. Which of the following statements is/are TRUE?

- A. The determinant of  $B$  is the negative of the determinant of  $A$   
 B. If  $A$  is invertible, then  $B$  is also invertible  
 C. If  $A$  is symmetric, then  $B$  is also symmetric  
 D. If the trace of  $A$  is zero, then the trace of  $B$  is also zero

gatecse2024-set2 linear-algebra multiple-selects matrix determinant two-marks

[Answer key](#) 

#### 6.2.8 Determinant: GATE CSE 2025 | Set 2 | Question: 4



Let  $L$ ,  $M$ , and  $N$  be non-singular matrices of order 3 satisfying the equations  $L^2 = L^{-1}$ ,  $M = L^8$  and  $N = L^2$ . Which ONE of the following is the value of the determinant of  $(M - N)$ ?

- A. 0      B. 1      C. 2      D. 3

gatecse2025-set2 linear-algebra determinant easy one-mark

[Answer key](#) 

#### 6.2.9 Determinant: GATE DS&AI 2024 | Question: 25



Consider the  $3 \times 3$  matrix  $M = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & 3 \\ 4 & 3 & 6 \end{bmatrix}$ .

The determinant of  $(M^2 + 12M)$  is \_\_\_\_\_.

gate-ds-ai-2024 numerical-answers matrix determinant linear-algebra easy one-mark

[Answer key](#) 

#### 6.2.10 Determinant: GATE IT 2004 | Question: 32



Let  $A$  be an  $n \times n$  matrix of the following form.

$$A = \begin{bmatrix} 3 & 1 & 0 & 0 & 0 & \dots & 0 & 0 & 0 \\ 1 & 3 & 1 & 0 & 0 & \dots & 0 & 0 & 0 \\ 0 & 1 & 3 & 1 & 0 & \dots & 0 & 0 & 0 \\ 0 & 0 & 1 & 3 & 1 & \dots & 0 & 0 & 0 \\ \dots & & & & & & & & \\ \dots & & & & & & & & \\ 0 & 0 & 0 & 0 & 0 & \dots & 1 & 3 & 1 \\ 0 & 0 & 0 & 0 & 0 & \dots & 0 & 1 & 3 \end{bmatrix}_{n \times n}$$

What is the value of the determinant of  $A$ ?

- A.  $\left(\frac{5+\sqrt{3}}{2}\right)^{n-1} \left(\frac{5\sqrt{3}+7}{2\sqrt{3}}\right) + \left(\frac{5-\sqrt{3}}{2}\right)^{n-1} \left(\frac{5\sqrt{3}-7}{2\sqrt{3}}\right)$

- B.  $\left(\frac{7+\sqrt{5}}{2}\right)^{n-1} \left(\frac{7\sqrt{5}+3}{2\sqrt{5}}\right) + \left(\frac{7-\sqrt{5}}{2}\right)^{n-1} \left(\frac{7\sqrt{5}-3}{2\sqrt{5}}\right)$   
 C.  $\left(\frac{3+\sqrt{7}}{2}\right)^{n-1} \left(\frac{3\sqrt{7}+5}{2\sqrt{7}}\right) + \left(\frac{3-\sqrt{7}}{2}\right)^{n-1} \left(\frac{3\sqrt{7}-5}{2\sqrt{7}}\right)$   
 D.  $\left(\frac{3+\sqrt{5}}{2}\right)^{n-1} \left(\frac{3\sqrt{5}+7}{2\sqrt{5}}\right) + \left(\frac{3-\sqrt{5}}{2}\right)^{n-1} \left(\frac{3\sqrt{5}-7}{2\sqrt{5}}\right)$

gateit-2004 linear-algebra matrix normal determinant

[Answer key](#)

### 6.2.11 Determinant: GATE IT 2005 | Question: 3



The determinant of the matrix given below is

$$\begin{bmatrix} 0 & 1 & 0 & 2 \\ -1 & 1 & 1 & 3 \\ 0 & 0 & 0 & 1 \\ 1 & -2 & 0 & 1 \end{bmatrix}$$

- A. -1      B. 0      C. 1      D. 2

gateit-2005 linear-algebra normal determinant

[Answer key](#)

## 6.3

### Eigen Value (33)

#### 6.3.1 Eigen Value: GATE CSE 1993 | Question: 01.1



The eigen vector ( $s$ ) of the matrix

$$\begin{bmatrix} 0 & 0 & \alpha \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, \alpha \neq 0$$

is (are)

- A.  $(0, 0, \alpha)$       B.  $(\alpha, 0, 0)$       C.  $(0, 0, 1)$       D.  $(0, \alpha, 0)$

gate1993 eigen-value linear-algebra easy multiple-selects

[Answer key](#)

#### 6.3.2 Eigen Value: GATE CSE 2002 | Question: 5a



Obtain the eigen values of the matrix

$$A = \begin{bmatrix} 1 & 2 & 34 & 49 \\ 0 & 2 & 43 & 94 \\ 0 & 0 & -2 & 104 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

gatecse-2002 linear-algebra eigen-value normal descriptive

[Answer key](#)

#### 6.3.3 Eigen Value: GATE CSE 2005 | Question: 49



What are the eigenvalues of the following  $2 \times 2$  matrix?

$$\begin{pmatrix} 2 & -1 \\ -4 & 5 \end{pmatrix}$$

- A. -1 and 1      B. 1 and 6      C. 2 and 5      D. 4 and -1

**Answer key****6.3.4 Eigen Value: GATE CSE 2007 | Question: 25**

Let  $A$  be a  $4 \times 4$  matrix with eigen values  $-5, -2, 1, 4$ . Which of the following is an eigen value of the matrix  $\begin{bmatrix} A & I \\ I & A \end{bmatrix}$ , where  $I$  is the  $4 \times 4$  identity matrix?

- A.  $-5$       B.  $-7$       C.  $2$       D.  $1$

**Answer key****6.3.5 Eigen Value: GATE CSE 2008 | Question: 28**

How many of the following matrices have an eigenvalue 1?

$$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \text{ and } \begin{bmatrix} -1 & 0 \\ 1 & -1 \end{bmatrix}$$

- A. one      B. two      C. three      D. four

**Answer key****6.3.6 Eigen Value: GATE CSE 2010 | Question: 29**

Consider the following matrix

$$A = \begin{bmatrix} 2 & 3 \\ x & y \end{bmatrix}$$

If the eigenvalues of  $A$  are 4 and 8, then

- A.  $x = 4, y = 10$       B.  $x = 5, y = 8$       C.  $x = 3, y = 9$       D.  $x = -4, y = 10$

**Answer key****6.3.7 Eigen Value: GATE CSE 2011 | Question: 40**

Consider the matrix as given below.

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 7 \\ 0 & 0 & 3 \end{bmatrix}$$

Which one of the following options provides the **CORRECT** values of the eigenvalues of the matrix?

- A.  $1, 4, 3$       B.  $3, 7, 3$       C.  $7, 3, 2$       D.  $1, 2, 3$

**Answer key****6.3.8 Eigen Value: GATE CSE 2012 | Question: 11**

Let  $A$  be the  $2 \times 2$  matrix with elements  $a_{11} = a_{12} = a_{21} = +1$  and  $a_{22} = -1$ . Then the eigenvalues of the matrix  $A^{19}$  are

- A.  $1024$  and  $-1024$   
 C.  $4\sqrt{2}$  and  $-4\sqrt{2}$
- B.  $1024\sqrt{2}$  and  $-1024\sqrt{2}$   
 D.  $512\sqrt{2}$  and  $-512\sqrt{2}$

**Answer key**

### 6.3.9 Eigen Value: GATE CSE 2014 Set 1 | Question: 5

The value of the dot product of the eigenvectors corresponding to any pair of different eigenvalues of a  $4 - \text{by} - 4$  symmetric positive definite matrix is \_\_\_\_\_

gatecse-2014-set1 linear-algebra eigen-value numerical-answers normal

Answer key 

### 6.3.10 Eigen Value: GATE CSE 2014 Set 2 | Question: 47

The product of the non-zero eigenvalues of the matrix is \_\_\_\_\_

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

gatecse-2014-set2 linear-algebra eigen-value normal numerical-answers

Answer key 

### 6.3.11 Eigen Value: GATE CSE 2014 Set 3 | Question: 4

Which one of the following statements is TRUE about every  $n \times n$  matrix with only real eigenvalues?

- A. If the trace of the matrix is positive and the determinant of the matrix is negative, at least one of its eigenvalues is negative.
- B. If the trace of the matrix is positive, all its eigenvalues are positive.
- C. If the determinant of the matrix is positive, all its eigenvalues are positive.
- D. If the product of the trace and determinant of the matrix is positive, all its eigenvalues are positive.

gatecse-2014-set3 linear-algebra eigen-value normal

Answer key 

### 6.3.12 Eigen Value: GATE CSE 2015 Set 1 | Question: 36

Consider the following  $2 \times 2$  matrix  $A$  where two elements are unknown and are marked by  $a$  and  $b$ . The eigenvalues of this matrix are  $-1$  and  $7$ . What are the values of  $a$  and  $b$ ?

$$A = \begin{pmatrix} 1 & 4 \\ b & a \end{pmatrix}$$

- A.  $a = 6, b = 4$
- B.  $a = 4, b = 6$
- C.  $a = 3, b = 5$
- D.  $a = 5, b = 3$

gatecse-2015-set1 linear-algebra eigen-value easy

Answer key 

### 6.3.13 Eigen Value: GATE CSE 2015 Set 2 | Question: 5

The larger of the two eigenvalues of the matrix  $\begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$  is \_\_\_\_\_.

gatecse-2015-set2 linear-algebra eigen-value easy numerical-answers

Answer key 

### 6.3.14 Eigen Value: GATE CSE 2015 Set 3 | Question: 15

In the given matrix  $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 1 & 0 \\ 1 & 2 & 1 \end{bmatrix}$ , one of the eigenvalues is 1. The eigenvectors corresponding to the eigenvalue 1 are

- A.  $\{a(4, 2, 1) \mid a \neq 0, a \in \mathbb{R}\}$

- B.  $\{a(-4, 2, 1) \mid a \neq 0, a \in \mathbb{R}\}$   
C.  $\{a(\sqrt{2}, 0, 1) \mid a \neq 0, a \in \mathbb{R}\}$   
D.  $\{a(-\sqrt{2}, 0, 1) \mid a \neq 0, a \in \mathbb{R}\}$

gatecse-2015-set3 linear-algebra eigen-value normal

Answer key 

### 6.3.15 Eigen Value: GATE CSE 2016 Set 1 | Question: 05



Two eigenvalues of a  $3 \times 3$  real matrix  $P$  are  $(2 + \sqrt{-1})$  and 3. The determinant of  $P$  is \_\_\_\_\_.

gatecse-2016-set1 linear-algebra eigen-value numerical-answers normal

Answer key 

### 6.3.16 Eigen Value: GATE CSE 2016 Set 2 | Question: 06



Suppose that the eigenvalues of matrix  $A$  are 1, 2, 4. The determinant of  $(A^{-1})^T$  is \_\_\_\_\_.

gatecse-2016-set2 linear-algebra eigen-value normal numerical-answers

Answer key 

### 6.3.17 Eigen Value: GATE CSE 2017 Set 1 | Question: 31



Let  $A$  be  $n \times n$  real valued square symmetric matrix of rank 2 with  $\sum_{i=1}^n \sum_{j=1}^n A_{ij}^2 = 50$ . Consider the following statements.

- I. One eigenvalue must be in  $[-5, 5]$   
II. The eigenvalue with the largest magnitude must be strictly greater than 5

Which of the above statements about eigenvalues of  $A$  is/are necessarily CORRECT?

- A. Both I and II      B. I only      C. II only      D. Neither I nor II

gatecse-2017-set1 linear-algebra eigen-value normal

Answer key 

### 6.3.18 Eigen Value: GATE CSE 2017 Set 2 | Question: 22



Let  $P = \begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$  and  $Q = \begin{bmatrix} -1 & -2 & -1 \\ 6 & 12 & 6 \\ 5 & 10 & 5 \end{bmatrix}$  be two matrices.

Then the rank of  $P + Q$  is \_\_\_\_\_.

gatecse-2017-set2 linear-algebra eigen-value numerical-answers

Answer key 

### 6.3.19 Eigen Value: GATE CSE 2017 Set 2 | Question: 52



If the characteristic polynomial of a  $3 \times 3$  matrix  $M$  over  $\mathbb{R}$  (the set of real numbers) is  $\lambda^3 - 4\lambda^2 + a\lambda + 30$ ,  $a \in \mathbb{R}$ , and one eigenvalue of  $M$  is 2, then the largest among the absolute values of the eigenvalues of  $M$  is \_\_\_\_\_.

gatecse-2017-set2 engineering-mathematics linear-algebra numerical-answers eigen-value

Answer key 

### 6.3.20 Eigen Value: GATE CSE 2018 | Question: 17



Consider a matrix  $A = uv^T$  where  $u = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ ,  $v = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ . Note that  $v^T$  denotes the transpose of  $v$ . The largest eigenvalue of  $A$  is \_\_\_\_\_.

gatecse-2018 linear-algebra eigen-value normal numerical-answers one-mark

[Answer key](#)

### 6.3.21 Eigen Value: GATE CSE 2018 | Question: 26



Consider a matrix P whose only eigenvectors are the multiples of  $\begin{bmatrix} 1 \\ 4 \end{bmatrix}$ .

Consider the following statements.

- I. P does not have an inverse
- II. P has a repeated eigenvalue
- III. P cannot be diagonalized

Which one of the following options is correct?

- |  |   |
|--|---|
| A. Only I and III are necessarily true | B. Only II is necessarily true          |
| C. Only I and II are necessarily true  | D. Only II and III are necessarily true |

gatecse-2018 linear-algebra matrix eigen-value normal two-marks

[Answer key](#)

### 6.3.22 Eigen Value: GATE CSE 2019 | Question: 44



Consider the following matrix:

$$R = \begin{bmatrix} 1 & 2 & 4 & 8 \\ 1 & 3 & 9 & 27 \\ 1 & 4 & 16 & 64 \\ 1 & 5 & 25 & 125 \end{bmatrix}$$

The absolute value of the product of Eigen values of R is \_\_\_\_\_

gatecse-2019 numerical-answers engineering-mathematics linear-algebra eigen-value two-marks

[Answer key](#)

### 6.3.23 Eigen Value: GATE CSE 2021 Set 1 | Question: 52



Consider the following matrix.

$$\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$$

The largest eigenvalue of the above matrix is \_\_\_\_\_.

gatecse-2021-set1 linear-algebra matrix eigen-value numerical-answers two-marks

[Answer key](#)

### 6.3.24 Eigen Value: GATE CSE 2022 | Question: 43



Which of the following is/are the eigenvector(s) for the matrix given below?

$$\begin{pmatrix} -9 & -6 & -2 & -4 \\ -8 & -6 & -3 & -1 \\ 20 & 15 & 8 & 5 \\ 32 & 21 & 7 & 12 \end{pmatrix}$$

A.  $\begin{pmatrix} -1 \\ 1 \\ 0 \\ 1 \end{pmatrix}$

B.  $\begin{pmatrix} 1 \\ 0 \\ -1 \\ 0 \end{pmatrix}$

C.  $\begin{pmatrix} -1 \\ 0 \\ 2 \\ 2 \end{pmatrix}$

D.  $\begin{pmatrix} 0 \\ 1 \\ -3 \\ 0 \end{pmatrix}$

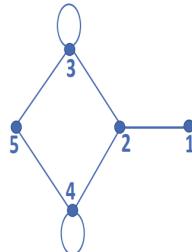
gatecse-2022 linear-algebra eigen-value multiple-selects two-marks

[Answer key](#)



### 6.3.25 Eigen Value: GATE CSE 2023 | Question: 20

Let  $A$  be the adjacency matrix of the graph with vertices  $\{1, 2, 3, 4, 5\}$ .



Let  $\lambda_1, \lambda_2, \lambda_3, \lambda_4$ , and  $\lambda_5$  be the five eigenvalues of  $A$ . Note that these eigenvalues need not be distinct.

The value of  $\lambda_1 + \lambda_2 + \lambda_3 + \lambda_4 + \lambda_5 = \underline{\hspace{2cm}}$

gatecse-2023 linear-algebra eigen-value numerical-answers one-mark

[Answer key](#)



### 6.3.26 Eigen Value: GATE CSE 2024 | Set 1 | Question: 2

The product of all eigenvalues of the matrix  $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$  is

A.  $-1$

B.  $0$

C.  $1$

D.  $2$

gatecse2024-set1 linear-algebra eigen-value one-mark

[Answer key](#)



### 6.3.27 Eigen Value: GATE CSE 2025 | Set 1 | Question: 31

Let  $A$  be a  $2 \times 2$  matrix as given.

$$A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

What are the eigenvalues of the matrix  $A^{13}$ ?

A.  $1, -1$

C.  $4\sqrt{2}, -4\sqrt{2}$

B.  $2\sqrt{2}, -2\sqrt{2}$

D.  $64\sqrt{2}, -64\sqrt{2}$

gatecse2025-set1 linear-algebra matrix eigen-value easy two-marks

[Answer key](#)



### 6.3.28 Eigen Value: GATE DA 2025 | Question: 18

Let  $A = I_n + xx^\top$ , where  $I_n$  is the  $n \times n$  identity matrix and  $x \in \mathbb{R}^n, x^\top x = 1$ . Which of the following options is/are correct?

A. Rank of  $A$  is  $n$

C.  $0$  is an eigenvalue of  $A$

B.  $A$  is invertible

D.  $A^{-1}$  has a negative eigenvalue

gateda-2025 linear-algebra matrix eigen-value multiple-selects one-mark

[Answer key](#)

### 6.3.29 Eigen Value: GATE DS&AI 2024 | Question: 3



Consider the matrix  $M = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$ .

Which ONE of the following statements is TRUE?

- A. The eigenvalues of  $M$  are non-negative and real.
- B. The eigenvalues of  $M$  are complex conjugate pairs.
- C. One eigenvalue of  $M$  is positive and real, and another eigenvalue of  $M$  is zero.
- D. One eigenvalue of  $M$  is non-negative and real, and another eigenvalue of  $M$  is negative and real.

gate-ds-ai-2024 eigen-value linear-algebra one-mark

Answer key

### 6.3.30 Eigen Value: GATE Data Science and Artificial Intelligence 2024 | Sample Paper | Question: 17



For matrix  $H = \begin{bmatrix} 9 & -2 \\ -2 & 6 \end{bmatrix}$ , one of the eigenvalues is 5. Then, the other eigenvalue is

- A. 12
- B. 10
- C. 8
- D. 6

gateda-sample-paper-2024 linear-algebra eigen-value easy

Answer key

### 6.3.31 Eigen Value: GATE IT 2006 | Question: 26



What are the eigenvalues of the matrix  $P$  given below

$$P = \begin{pmatrix} a & 1 & 0 \\ 1 & a & 1 \\ 0 & 1 & a \end{pmatrix}$$

- A.  $a, a - \sqrt{2}, a + \sqrt{2}$
- B.  $a, a, a$
- C.  $0, a, 2a$
- D.  $-a, 2a, 2a$

gateit-2006 linear-algebra eigen-value normal

Answer key

### 6.3.32 Eigen Value: GATE IT 2007 | Question: 2



Let  $A$  be the matrix  $\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$ . What is the maximum value of  $x^T A x$  where the maximum is taken over all  $x$  that are the unit eigenvectors of  $A$ ?

- A. 5
- B.  $\frac{(5+\sqrt{5})}{2}$
- C. 3
- D.  $\frac{(5-\sqrt{5})}{2}$

gateit-2007 linear-algebra eigen-value normal

Answer key

### 6.3.33 Eigen Value: GATE-2014 EC



Which one of the following statements is NOT true for a square matrix  $A$ ?

- a. If  $A$  is real symmetric, the eigen values of  $A$  are the diagonal elements of it.
- b. If all the principal minors of  $A$  are positive, all the eigen values of  $A$  are also positive.

My question is what is "principal minors of  $A$ " ?

linear-algebra gate2014-ec-1 eigen-value

Answer key

**6.4****Gaussian Elimination (1)****6.4.1 Gaussian Elimination: GATE DA 2025 | Question: 2**

The number of additions and multiplications involved in performing Gaussian elimination on any  $n \times n$  upper triangular matrix is of the order

- A.  $O(n)$       B.  $O(n^2)$       C.  $O(n^3)$       D.  $O(n^4)$

gateda-2025 linear-algebra matrix gaussian-elimination one-mark

**Answer key**

**6.5****Lu Decomposition (1)****6.5.1 Lu Decomposition: GATE CSE 2025 | Set 2 | Question: 34**

Consider a system of linear equations  $PX = Q$  where  $P \in \mathbb{R}^{3 \times 3}$  and  $Q \in \mathbb{R}^{3 \times 1}$ . Suppose  $P$  has an LU decomposition,  $P = LU$ , where

$$L = \begin{bmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{bmatrix} \text{ and } U = \begin{bmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{bmatrix}.$$

Which of the following statement(s) is/are TRUE?

- A. The system  $PX = Q$  can be solved by first solving  $LY = Q$  and then  $UX = Y$ .  
 B. If  $P$  is invertible, then both  $L$  and  $U$  are invertible.  
 C. If  $P$  is singular, then at least one of the diagonal elements of  $U$  is zero.  
 D. If  $P$  is symmetric, then both  $L$  and  $U$  are symmetric.

gatecse2025-set2 linear-algebra system-of-equations matrix lu-decomposition multiple-selects two-marks

**Answer key**

**6.6****Matrix (22)****6.6.1 Matrix: GATE CSE 1987 | Question: 1-xxiii**

A square matrix is singular whenever

- A. The rows are linearly independent  
 C. The row are linearly dependent  
 B. The columns are linearly independent  
 D. None of the above

gate1987 linear-algebra matrix

**Answer key**

**6.6.2 Matrix: GATE CSE 1988 | Question: 16i**

Assume that the matrix  $A$  given below, has factorization of the form  $LU = PA$ , where  $L$  is lower-triangular with all diagonal elements equal to 1,  $U$  is upper-triangular, and  $P$  is a permutation matrix. For

$$A = \begin{bmatrix} 2 & 5 & 9 \\ 4 & 6 & 5 \\ 8 & 2 & 3 \end{bmatrix}$$

Compute  $L$ ,  $U$ , and  $P$  using Gaussian elimination with partial pivoting.

gate1988 normal descriptive linear-algebra matrix

**Answer key**

### 6.6.3 Matrix: GATE CSE 1993 | Question: 02.7



If  $A = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & -1 & 0 & -1 \\ 0 & 0 & i & i \\ 0 & 0 & 0 & -i \end{pmatrix}$  the matrix  $A^4$ , calculated by the use of Cayley-Hamilton theorem or otherwise, is

gate1993 linear-algebra normal matrix fill-in-the-blanks

[Answer key](#)

### 6.6.4 Matrix: GATE CSE 1994 | Question: 1.2



Let  $A$  and  $B$  be real symmetric matrices of size  $n \times n$ . Then which one of the following is true?

- A.  $AA' = I$       B.  $A = A^{-1}$       C.  $AB = BA$       D.  $(AB)' = BA$

gate1994 linear-algebra normal matrix

[Answer key](#)

### 6.6.5 Matrix: GATE CSE 1994 | Question: 3.12



Find the inverse of the matrix  $\begin{bmatrix} 1 & 0 & 1 \\ -1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

gate1994 linear-algebra matrix easy descriptive

[Answer key](#)

### 6.6.6 Matrix: GATE CSE 1996 | Question: 10



Let  $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$  and  $B = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}$  be two matrices such that  $AB = I$ . Let  $C = A \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$  and  $CD = I$ . Express the elements of  $D$  in terms of the elements of  $B$ .

gate1996 linear-algebra matrix normal descriptive

[Answer key](#)

### 6.6.7 Matrix: GATE CSE 1996 | Question: 2.6



The matrices  $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$  and  $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$  commute under multiplication

- A. if  $a = b$  or  $\theta = n\pi, n$  an integer      B. always  
C. never      D. if  $a \cos\theta = b \sin\theta$

gate1996 linear-algebra normal matrix

[Answer key](#)

### 6.6.8 Matrix: GATE CSE 1997 | Question: 4.2



Let  $A = (a_{ij})$  be an  $n$ -rowed square matrix and  $I_{12}$  be the matrix obtained by interchanging the first and second rows of the  $n$ -rowed Identity matrix. Then  $AI_{12}$  is such that its first

- A. Row is the same as its second row      B. Row is the same as the second row of  $A$   
C. Column is the same as the second column of  $A$       D. Row is all zero

gate1997 linear-algebra easy matrix

[Answer key](#)

### 6.6.9 Matrix: GATE CSE 1998 | Question: 2.2



Consider the following determinant  $\Delta = \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix}$

Which of the following is a factor of  $\Delta$ ?

- A.  $a + b$       B.  $a - b$       C.  $a + b + c$       D.  $abc$

gate1998 linear-algebra matrix normal

Answer key 



#### 6.6.10 Matrix: GATE CSE 2001 | Question: 1.1

Consider the following statements:

- S1: The sum of two singular  $n \times n$  matrices may be non-singular
- S2: The sum of two  $n \times n$  non-singular matrices may be singular

Which one of the following statements is correct?

- A. S1 and S2 both are true  
C. S1 is false, S2 is true  
B. S1 is true, S2 is false  
D. S1 and S2 both are false

gatecse-2001 linear-algebra normal matrix

Answer key 



#### 6.6.11 Matrix: GATE CSE 2004 | Question: 26

The number of different  $n \times n$  symmetric matrices with each element being either 0 or 1 is: (Note: power(2, X) is same as  $2^X$ )

- A. power(2, n)  
C. power(2,  $\frac{(n^2+n)}{2}$ )  
B. power(2,  $n^2$ )  
D. power(2,  $\frac{(n^2-n)}{2}$ )

gatecse-2004 linear-algebra normal matrix

Answer key 



#### 6.6.12 Matrix: GATE CSE 2004 | Question: 27

Let  $A, B, C, D$  be  $n \times n$  matrices, each with non-zero determinant. If  $ABCD = I$ , then  $B^{-1}$  is

- A.  $D^{-1}C^{-1}A^{-1}$   
C.  $ADC$   
B.  $CDA$   
D. Does not necessarily exist

gatecse-2004 linear-algebra normal matrix

Answer key 



#### 6.6.13 Matrix: GATE CSE 2004 | Question: 76

In an  $M \times N$  matrix all non-zero entries are covered in  $a$  rows and  $b$  columns. Then the maximum number of non-zero entries, such that no two are on the same row or column, is

- A.  $\leq a + b$   
C.  $\leq \min(M - a, N - b)$   
B.  $\leq \max(a, b)$   
D.  $\leq \min(a, b)$

gatecse-2004 linear-algebra normal matrix

Answer key 



#### 6.6.14 Matrix: GATE CSE 2006 | Question: 23

$F$  is an  $n \times n$  real matrix.  $b$  is an  $n \times 1$  real vector. Suppose there are two  $n \times 1$  vectors,  $u$  and  $v$  such that,  $u \neq v$  and  $Fu = b, Fv = b$ . Which one of the following statements is false?

- A. Determinant of  $F$  is zero.  
B. There are an infinite number of solutions to  $Fx = b$   
C. There is an  $x \neq 0$  such that  $Fx = 0$   
D.  $F'$  must have two identical rows

gatecse-2006 linear-algebra normal matrix

Answer key 

### 6.6.15 Matrix: GATE CSE 2015 Set 1 | Question: 18

In the LU decomposition of the matrix  $\begin{bmatrix} 2 & 2 \\ 4 & 9 \end{bmatrix}$ , if the diagonal elements of  $U$  are both 1, then the lower diagonal entry  $l_{22}$  of  $L$  is \_\_\_\_\_.

gatecse-2015-set1 linear-algebra matrix numerical-answers

Answer key 



### 6.6.16 Matrix: GATE CSE 2015 Set 2 | Question: 27

Perform the following operations on the matrix  $\begin{bmatrix} 3 & 4 & 45 \\ 7 & 9 & 105 \\ 13 & 2 & 195 \end{bmatrix}$



- Add the third row to the second row
- Subtract the third column from the first column.

The determinant of the resultant matrix is \_\_\_\_\_.

gatecse-2015-set2 linear-algebra matrix easy numerical-answers

Answer key 



### 6.6.17 Matrix: GATE CSE 2022 | Question: 10

Consider the following two statements with respect to the matrices  $A_{m \times n}, B_{n \times m}, C_{n \times n}$  and  $D_{n \times n}$ .

Statement 1 :  $tr(AB) = tr(BA)$

Statement 2 :  $tr(CD) = tr(DC)$

where  $tr()$  represents the trace of a matrix. Which one of the following holds?

- Statement 1 is correct and Statement 2 is wrong.
- Statement 1 is wrong and Statement 2 is correct.
- Both Statement 1 and Statement 2 are correct.
- Both Statement 1 and Statement 2 are wrong.

gatecse-2022 linear-algebra matrix one-mark

Answer key 



### 6.6.18 Matrix: GATE CSE 2025 | Set 2 | Question: 1

If  $A = \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$ , then which ONE of the following is  $A^8$  ?

A.  $\begin{pmatrix} 25 & 0 \\ 0 & 25 \end{pmatrix}$   
C.  $\begin{pmatrix} 625 & 0 \\ 0 & 625 \end{pmatrix}$

B.  $\begin{pmatrix} 125 & 0 \\ 0 & 125 \end{pmatrix}$   
D.  $\begin{pmatrix} 3125 & 0 \\ 0 & 3125 \end{pmatrix}$

gatecse2025-set2 linear-algebra matrix easy one-mark

Answer key 



### 6.6.19 Matrix: GATE DA 2025 | Question: 27

Let  $A \in \mathbb{R}^{n \times n}$  be such that  $A^3 = A$ . Which one of the following statements is ALWAYS correct?

- A.  $A$  is invertible  
C. The sum of the diagonal elements of  $A$  is 1
- B. Determinant of  $A$  is 0  
D.  $A$  and  $A^2$  have the same rank

gateda-2025 linear-algebra matrix two-marks

Answer key 



### 6.6.20 Matrix: GATE DA 2025 | Question: 42

An  $n \times n$  matrix  $A$  with real entries satisfies the property:  $\|Ax\|^2 = \|x\|^2$ , for all  $x \in \mathbb{R}^n$ , where  $\|\cdot\|$  denotes the



Euclidean norm. Which of the following statements is/are ALWAYS correct?

- A.  $A$  must be orthogonal
- C. The eigenvalues of  $A$  are either  $+1$  or  $-1$

gateda-2025 linear-algebra matrix multiple-selects two-marks

Answer key 

- B.  $A = I$ , where  $I$  denotes the identity matrix, is the only solution
- D.  $A$  has full rank



#### 6.6.21 Matrix: GATE IT 2004 | Question: 36

If matrix  $X = \begin{bmatrix} a & 1 \\ -a^2 + a - 1 & 1-a \end{bmatrix}$  and  $X^2 - X + I = O$  ( $I$  is the identity matrix and  $O$  is the zero matrix), then the inverse of  $X$  is

- A.  $\begin{bmatrix} 1-a & -1 \\ a^2 & a \end{bmatrix}$
- C.  $\begin{bmatrix} -a & 1 \\ -a^2 + a - 1 & 1-a \end{bmatrix}$
- B.  $\begin{bmatrix} 1-a & -1 \\ a^2 - a + 1 & a \end{bmatrix}$
- D.  $\begin{bmatrix} a^2 - a + 1 & a \\ 1 & 1-a \end{bmatrix}$

gateit-2004 linear-algebra matrix normal

Answer key 



#### 6.6.22 Matrix: GATE IT 2008 | Question: 29

If  $M$  is a square matrix with a zero determinant, which of the following assertion (s) is (are) correct?

- S1: Each row of  $M$  can be represented as a linear combination of the other rows
- S2: Each column of  $M$  can be represented as a linear combination of the other columns
- S3:  $MX = 0$  has a nontrivial solution
- S4:  $M$  has an inverse

- A. S3 and S2
- B. S1 and S4
- C. S1 and S3
- D. S1, S2 and S3

gateit-2008 linear-algebra normal matrix

Answer key 

### 6.7

#### Orthonormality (2)



#### 6.7.1 Orthonormality: GATE DA 2025 | Question: 15

Which of the following statements is/are correct?

- A.  $\mathbb{R}^n$  has a unique set of orthonormal basis vectors
- B.  $\mathbb{R}^n$  does not have a unique set of orthonormal basis vectors
- C. Linearly independent vectors in  $\mathbb{R}^n$  are orthonormal
- D. Orthonormal vectors  $\mathbb{R}^n$  are linearly independent

gateda-2025 linear-algebra vector-space orthonormality multiple-selects one-mark

Answer key 

#### 6.7.2 Orthonormality: GATE DA 2025 | Question: 40

Let  $x_1, x_2, x_3, x_4, x_5$  be a system of orthonormal vectors in  $\mathbb{R}^{10}$ . Consider the matrix  $A = x_1x_1^\top + \dots + x_5x_5^\top$ . Which of the following statements is/are correct?

- A. Singular values of  $A$  are also its eigenvalues
- C. Determinant of  $A$  is 1
- B. Singular values of  $A$  are either 0 or 1
- D.  $A$  is invertible

gateda-2025 linear-algebra orthonormality vector-space matrix multiple-selects two-marks

Answer key 

### 6.8

#### Rank of Matrix (6)



#### 6.8.1 Rank of Matrix: GATE CSE 1994 | Question: 1.9

The rank of matrix  $\begin{bmatrix} 0 & 0 & -3 \\ 9 & 3 & 5 \\ 3 & 1 & 1 \end{bmatrix}$  is:

- A. 0      B. 1      C. 2      D. 3

gate1994 linear-algebra matrix rank-of-matrix easy

[Answer key](#)



#### 6.8.2 Rank of Matrix: GATE CSE 1995 | Question: 1.24

The rank of the following  $(n+1) \times (n+1)$  matrix, where  $a$  is a real number is

$$\begin{bmatrix} 1 & a & a^2 & \dots & a^n \\ 1 & a & a^2 & \dots & a^n \\ \vdots & \vdots & \vdots & & \vdots \\ \vdots & \vdots & \vdots & & \vdots \\ 1 & a & a^2 & \dots & a^n \end{bmatrix}$$

- A. 1      B. 2  
C.  $n$       D. Depends on the value of  $a$

gate1995 linear-algebra matrix normal rank-of-matrix

[Answer key](#)



#### 6.8.3 Rank of Matrix: GATE CSE 1998 | Question: 2.1

The rank of the matrix given below is:

$$\begin{bmatrix} 1 & 4 & 8 & 7 \\ 0 & 0 & 3 & 0 \\ 4 & 2 & 3 & 1 \\ 3 & 12 & 24 & 21 \end{bmatrix}$$

- A. 3      B. 1      C. 2      D. 4

gate1998 linear-algebra matrix normal rank-of-matrix

[Answer key](#)



#### 6.8.4 Rank of Matrix: GATE CSE 2002 | Question: 1.1

The rank of the matrix  $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$  is

- A. 4      B. 2      C. 1      D. 0

gatecse-2002 linear-algebra easy rank-of-matrix

[Answer key](#)



#### 6.8.5 Rank of Matrix: GATE CSE 2020 | Question: 27

Let  $A$  and  $B$  be two  $n \times n$  matrices over real numbers. Let  $\text{rank}(M)$  and  $\det(M)$  denote the rank and determinant of a matrix  $M$ , respectively. Consider the following statements.

- I.  $\text{rank}(AB) = \text{rank}(A)\text{rank}(B)$
- II.  $\det(AB) = \det(A)\det(B)$
- III.  $\text{rank}(A+B) \leq \text{rank}(A) + \text{rank}(B)$
- IV.  $\det(A+B) \leq \det(A) + \det(B)$

Which of the above statements are TRUE?

- A. I and II only      B. I and IV only      C. II and III only      D. III and IV only

**Answer key****6.8.6 Rank of Matrix: GATE CSE 2021 Set 2 | Question: 24**

Suppose that  $P$  is a  $4 \times 5$  matrix such that every solution of the equation  $Px=0$  is a scalar multiple of  $[2 \ 5 \ 4 \ 3 \ 1]^T$ . The rank of  $P$  is \_\_\_\_\_

**Answer key****6.9****Singular Value Decomposition (1)****6.9.1 Singular Value Decomposition: GATE DS&AI 2024 | Question: 51**

Let  $u = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix}$ , and let  $\sigma_1, \sigma_2, \sigma_3, \sigma_4, \sigma_5$  be the singular values of the matrix  $M = uu^T$  (where  $u^T$  is the transpose of  $u$ ). The value of  $\sum_{i=1}^5 \sigma_i$  is \_\_\_\_\_

**Answer key****6.10****Subspace (1)****6.10.1 Subspace: GATE DS&AI 2024 | Question: 37**

Select all choices that are subspaces of  $\mathbb{R}^3$ .

Note:  $\mathbb{R}$  denotes the set of real numbers.

- A.  $\left\{ \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \in \mathbb{R}^3 : \mathbf{x} = \alpha \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} + \beta \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \alpha, \beta \in \mathbb{R} \right\}$
- B.  $\left\{ \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \in \mathbb{R}^3 : \mathbf{x} = \alpha^2 \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix} + \beta^2 \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \alpha, \beta \in \mathbb{R} \right\}$
- C.  $\left\{ \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \in \mathbb{R}^3 : 5x_1 + 2x_3 = 0, 4x_1 - 2x_2 + 3x_3 = 0 \right\}$
- D.  $\left\{ \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \in \mathbb{R}^3 : 5x_1 + 2x_3 + 4 = 0 \right\}$

**Answer key****6.11****System of Equations (17)****6.11.1 System of Equations: GATE CSE 1996 | Question: 1.7**

Let  $Ax = b$  be a system of linear equations where  $A$  is an  $m \times n$  matrix and  $b$  is a  $m \times 1$  column vector and  $X$  is an  $n \times 1$  column vector of unknowns. Which of the following is false?

- A. The system has a solution if and only if, both  $A$  and the augmented matrix  $[Ab]$  have the same rank.
- B. If  $m < n$  and  $b$  is the zero vector, then the system has infinitely many solutions.
- C. If  $m = n$  and  $b$  is a non-zero vector, then the system has a unique solution.
- D. The system will have only a trivial solution when  $m = n$ ,  $b$  is the zero vector and  $\text{rank}(A) = n$ .

gate1996 linear-algebra system-of-equations normal

[Answer key](#)



### 6.11.2 System of Equations: GATE CSE 1998 | Question: 1.2

Consider the following set of equations

- $x + 2y = 5$
- $4x + 8y = 12$
- $3x + 6y + 3z = 15$

This set

- |                                   |                                     |
|-----------------------------------|-------------------------------------|
| A. has unique solution            | B. has no solution                  |
| C. has finite number of solutions | D. has infinite number of solutions |

gate1998 linear-algebra system-of-equations easy

[Answer key](#)



### 6.11.3 System of Equations: GATE CSE 1998 | Question: 9

Derive the expressions for the number of operations required to solve a system of linear equations in  $n$  unknowns using the Gaussian Elimination Method. Assume that one operation refers to a multiplication followed by an addition.

gate1998 linear-algebra system-of-equations descriptive

[Answer key](#)



### 6.11.4 System of Equations: GATE CSE 2003 | Question: 41

Consider the following system of linear equations

$$\begin{pmatrix} 2 & 1 & -4 \\ 4 & 3 & -12 \\ 1 & 2 & -8 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} \alpha \\ 5 \\ 7 \end{pmatrix}$$

Notice that the second and the third columns of the coefficient matrix are linearly dependent. For how many values of  $\alpha$ , does this system of equations have infinitely many solutions?

- A. 0      B. 1      C. 2      D. 3

gatecse-2003 linear-algebra system-of-equations normal

[Answer key](#)



### 6.11.5 System of Equations: GATE CSE 2004 | Question: 71

How many solutions does the following system of linear equations have?

- $-x + 5y = -1$
- $x - y = 2$
- $x + 3y = 3$

- |                    |                           |
|--------------------|---------------------------|
| A. infinitely many | B. two distinct solutions |
| C. unique          | D. none                   |

gatecse-2004 linear-algebra system-of-equations normal

[Answer key](#)



### 6.11.6 System of Equations: GATE CSE 2005 | Question: 48

Consider the following system of linear equations :

$$2x_1 - x_2 + 3x_3 = 1$$

$$3x_1 + 2x_2 + 5x_3 = 2$$

$$-x_1 + 4x_2 + x_3 = 3$$

The system of equations has

- A. no solution  
B. a unique solution  
C. more than one but a finite number of solutions  
D. an infinite number of solutions

gatecse-2005 linear-algebra system-of-equations normal

Answer key 



#### 6.11.7 System of Equations: GATE CSE 2008 | Question: 3

The following system of equations

- $x_1 + x_2 + 2x_3 = 1$
- $x_1 + 2x_2 + 3x_3 = 2$
- $x_1 + 4x_2 + \alpha x_3 = 4$

has a unique solution. The only possible value(s) for  $\alpha$  is/are

- A. 0      B. either 0 or 1      C. one of 0, 1, or -1      D. any real number

gatecse-2008 easy linear-algebra system-of-equations

Answer key 



#### 6.11.8 System of Equations: GATE CSE 2014 Set 1 | Question: 4

Consider the following system of equations:

- $3x + 2y = 1$
- $4x + 7z = 1$
- $x + y + z = 3$
- $x - 2y + 7z = 0$

The number of solutions for this system is \_\_\_\_\_

gatecse-2014-set1 linear-algebra system-of-equations numerical-answers normal

Answer key 



#### 6.11.9 System of Equations: GATE CSE 2015 Set 3 | Question: 33

If the following system has non-trivial solution,

- $px + qy + rz = 0$
- $qx + ry + pz = 0$
- $rx + py + qz = 0$ ,

then which one of the following options is TRUE?

- A.  $p - q + r = 0$  or  $p = q = -r$   
B.  $p + q - r = 0$  or  $p = -q = r$   
C.  $p + q + r = 0$  or  $p = q = r$   
D.  $p - q + r = 0$  or  $p = -q = -r$

gatecse-2015-set3 linear-algebra system-of-equations normal

Answer key 



#### 6.11.10 System of Equations: GATE CSE 2016 Set 2 | Question: 04

Consider the systems, each consisting of  $m$  linear equations in  $n$  variables.

- I. If  $m < n$ , then all such systems have a solution.
- II. If  $m > n$ , then none of these systems has a solution.
- III. If  $m = n$ , then there exists a system which has a solution.

Which one of the following is **CORRECT**?

- A. I, II and III are true.  
B. Only II and III are true.



C. Only III is true.

D. None of them is true.

gatecse-2016-set2 linear-algebra system-of-equations normal

Answer key 



#### 6.11.11 System of Equations: GATE CSE 2017 Set 1 | Question: 3

Let  $c_1, \dots, c_n$  be scalars, not all zero, such that  $\sum_{i=1}^n c_i a_i = 0$  where  $a_i$  are column vectors in  $R^n$ .

Consider the set of linear equations

$$Ax = b$$

where  $A = [a_1, \dots, a_n]$  and  $b = \sum_{i=1}^n c_i a_i$ . The set of equations has

- A. a unique solution at  $x = J_n$  where  $J_n$  denotes a  $n$ -dimensional vector of all 1.
- B. no solution
- C. infinitely many solutions
- D. finitely many solutions

gatecse-2017-set1 linear-algebra system-of-equations normal

Answer key 



#### 6.11.12 System of Equations: GATE CSE 2022 | Question: 35

Consider solving the following system of simultaneous equations using LU decomposition.

$$x_1 + x_2 - 2x_3 = 4$$

$$x_1 + 3x_2 - x_3 = 7$$

$$2x_1 + x_2 - 5x_3 = 7$$

where  $L$  and  $U$  are denoted as

$$L = \begin{pmatrix} L_{11} & 0 & 0 \\ L_{21} & L_{22} & 0 \\ L_{31} & L_{32} & L_{33} \end{pmatrix}, U = \begin{pmatrix} U_{11} & U_{12} & U_{13} \\ 0 & U_{22} & U_{23} \\ 0 & 0 & U_{33} \end{pmatrix}$$

Which one of the following is the correct combination of values for  $L_{32}$ ,  $U_{33}$ , and  $x_1$ ?

- A.  $L_{32} = 2, U_{33} = -\frac{1}{2}, x_1 = -1$
- B.  $L_{32} = 2, U_{33} = 2, x_1 = -1$
- C.  $L_{32} = -\frac{1}{2}, U_{33} = 2, x_1 = 0$
- D.  $L_{32} = -\frac{1}{2}, U_{33} = -\frac{1}{2}, x_1 = 0$

gatecse-2022 linear-algebra matrix system-of-equations two-marks

Answer key 



#### 6.11.13 System of Equations: GATE CSE 2024 | Set 1 | Question: 39

Let  $A$  be any  $n \times m$  matrix, where  $m > n$ . Which of the following statements is/are TRUE about the system of linear equations  $Ax = 0$ ?

- A. There exist at least  $m - n$  linearly independent solutions to this system
- B. There exist  $m - n$  linearly independent vectors such that every solution is a linear combination of these vectors
- C. There exists a non-zero solution in which at least  $m - n$  variables are 0
- D. There exists a solution in which at least  $n$  variables are non-zero

gatecse2024-set1 multiple-selects linear-algebra system-of-equations two-marks

Answer key 



#### 6.11.14 System of Equations: GATE CSE 2025 | Set 1 | Question: 13

Consider the given system of linear equations for variables  $x$  and  $y$ , where  $k$  is a real-valued constant. Which of the following option(s) is/are CORRECT?

$$x + ky = 1$$

$$kx + y = -1$$

- A. There is exactly one value of  $k$  for which the above system of equations has no solution.  
 B. There exist an infinite number of values of  $k$  for which the system of equations has no solution.  
 C. There exists exactly one value of  $k$  for which the system of equations has exactly one solution.  
 D. There exists exactly one value of  $k$  for which the system of equations has an infinite number of solutions.

gatecse2025-set1 linear-algebra system-of-equations multiple-selects one-mark

[Answer key](#)

### 6.11.15 System of Equations: GATE DA 2025 | Question: 3



The sum of the elements in each row of  $A \in \mathbb{R}^{n \times n}$  is 1. If  $B = A^3 - 2A^2 + A$ , which one of the following statements is correct (for  $x \in \mathbb{R}^n$ )?

- A. The equation  $Bx = 0$  has no solution  
 B. The equation  $Bx = 0$  has exactly two solutions  
 C. The equation  $Bx = 0$  has infinitely many solutions  
 D. The equation  $Bx = 0$  has a unique solution

gateda-2025 linear-algebra system-of-equations one-mark

[Answer key](#)

### 6.11.16 System of Equations: GATE DS&AI 2024 | Question: 38



Which of the following statements is/are TRUE?

Note:  $\mathbb{R}$  denotes the set of real numbers.

- A. There exist  $M \in \mathbb{R}^{3 \times 3}$ ,  $p \in \mathbb{R}^3$ , and  $q \in \mathbb{R}^3$  such that  $Mx = p$  has a unique solution and  $Mx = q$  has infinite solutions.  
 B. There exist  $M \in \mathbb{R}^{3 \times 3}$ ,  $p \in \mathbb{R}^3$ , and  $q \in \mathbb{R}^3$  such that  $Mx = p$  has no solutions and  $Mx = q$  has infinite solutions.  
 C. There exist  $M \in \mathbb{R}^{2 \times 3}$ ,  $p \in \mathbb{R}^2$ , and  $q \in \mathbb{R}^2$  such that  $Mx = p$  has a unique solution and  $Mx = q$  has infinite solutions.  
 D. There exist  $M \in \mathbb{R}^{3 \times 2}$ ,  $p \in \mathbb{R}^3$ , and  $q \in \mathbb{R}^3$  such that  $Mx = p$  has a unique solution and  $Mx = q$  has no solutions.

linear-algebra system-of-equations gate-ds-ai-2024 multiple-selects two-marks

[Answer key](#)

### 6.11.17 System of Equations: GATE IT 2004 | Question: 6



What values of  $x$ ,  $y$  and  $z$  satisfy the following system of linear equations?

$$\begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 2 & 2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 8 \\ 12 \end{bmatrix}$$

- A.  $x = 6, y = 3, z = 2$   
 B.  $x = 12, y = 3, z = -4$   
 C.  $x = 6, y = 6, z = -4$   
 D.  $x = 12, y = -3, z = 0$

gateit-2004 linear-algebra system-of-equations easy

[Answer key](#)

## 6.12

### Vector Space (6)

#### 6.12.1 Vector Space: GATE CSE 1995 | Question: 2.13



A unit vector perpendicular to both the vectors  $a = 2i - 3j + k$  and  $b = i + j - 2k$  is:

- A.  $\frac{1}{\sqrt{3}}(i + j + k)$       B.  $\frac{1}{3}(i + j - k)$       C.  $\frac{1}{3}(i - j - k)$       D.  $\frac{1}{\sqrt{3}}(i + j - k)$

gate1995 linear-algebra normal vector-space

[Answer key](#)

### 6.12.2 Vector Space: GATE CSE 2007 | Question: 27



Consider the set of (column) vectors defined by

$$X = \left\{ x \in \mathbb{R}^3 \mid x_1 + x_2 + x_3 = 0, \text{ where } x^T = [x_1, x_2, x_3]^T \right\}$$

.Which of the following is TRUE?

- A.  $\left\{ [1, -1, 0]^T, [1, 0, -1]^T \right\}$  is a basis for the subspace  $X$ .
- B.  $\left\{ [1, -1, 0]^T, [1, 0, -1]^T \right\}$  is a linearly independent set, but it does not span  $X$  and therefore is not a basis of  $X$ .
- C.  $X$  is not a subspace of  $\mathbb{R}^3$ .
- D. None of the above

gatecse-2007 linear-algebra normal vector-space

[Answer key](#)

### 6.12.3 Vector Space: GATE CSE 2014 Set 3 | Question: 5



If  $V_1$  and  $V_2$  are 4-dimensional subspaces of a 6-dimensional vector space  $V$ , then the smallest possible dimension of  $V_1 \cap V_2$  is \_\_\_\_\_.

gatecse-2014-set3 linear-algebra vector-space normal numerical-answers

[Answer key](#)

### 6.12.4 Vector Space: GATE CSE 2017 Set 1 | Question: 30



Let  $u$  and  $v$  be two vectors in  $\mathbb{R}^2$  whose Euclidean norms satisfy  $\|u\| = 2\|v\|$ . What is the value of  $\alpha$  such that  $w = u + \alpha v$  bisects the angle between  $u$  and  $v$ ?

- A. 2
- B.  $\frac{1}{2}$
- C. 1
- D.  $-\frac{1}{2}$

gatecse-2017-set1 linear-algebra normal vector-space

[Answer key](#)

### 6.12.5 Vector Space: GATE DA 2025 | Question: 28



Let  $\{x_1, x_2, \dots, x_n\}$  be a set of linearly independent vectors in  $\mathbb{R}^n$ . Let the  $(i, j)$ -th element of matrix  $A \in \mathbb{R}^{n \times n}$  be given by  $A_{ij} = x_i^T x_j, 1 \leq i, j \leq n$ . Which one of the following statements is correct?

- A.  $A$  is invertible
- B. 0 is a singular value of  $A$
- C. Determinant of  $A$  is 0
- D.  $z^T A z = 0$  for some non-zero  $z \in \mathbb{R}^n$

gateda-2025 linear-algebra vector-space matrix two-marks

[Answer key](#)

### 6.12.6 Vector Space: GATE DS&AI 2024 | Question: 39



Let  $\mathbb{R}$  be the set of real numbers,  $U$  be a subspace of  $\mathbb{R}^3$  and  $M \in \mathbb{R}^{3 \times 3}$  be the matrix corresponding to the projection on to the subspace  $U$ .

Which of the following statements is/are TRUE?

- A. If  $U$  is a 1-dimensional subspace of  $\mathbb{R}^3$ , then the null space of  $M$  is a 1-dimensional subspace.
- B. If  $U$  is a 2-dimensional subspace of  $\mathbb{R}^3$ , then the null space of  $M$  is a 1-dimensional subspace.
- C.  $M^2 = M$
- D.  $M^3 = M$

gate-ds-ai-2024 linear-algebra vector-space multiple-selects two-marks

[Answer key](#)

## Answer Keys

6.1.1	A	6.2.1	B	6.2.2	A	6.2.3	A	6.2.4	0
6.2.5	D	6.2.6	B	6.2.7	A;B	6.2.8	A	6.2.9	0
6.2.10	D	6.2.11	A	6.3.1	B;D	6.3.2	N/A	6.3.3	B
6.3.4	C	6.3.5	A	6.3.6	D	6.3.7	A	6.3.8	D
6.3.9	0	6.3.10	6	6.3.11	A	6.3.12	D	6.3.13	6
6.3.14	B	6.3.15	15	6.3.16	0.125	6.3.17	B	6.3.18	2
6.3.19	5	6.3.20	3	6.3.21	D	6.3.22	12	6.3.23	3 : 3
6.3.24	A;C;D	6.3.25	2	6.3.26	B	6.3.27	D	6.3.28	A;B
6.3.29	B	6.3.30	B	6.3.31	A	6.3.32	B	6.3.33	Q-Q
6.4.1	B	6.5.1	A;B;C	6.6.1	C	6.6.2	N/A	6.6.3	N/A
6.6.4	D	6.6.5	N/A	6.6.6	N/A	6.6.7	A	6.6.8	C
6.6.9	B	6.6.10	A	6.6.11	C	6.6.12	B	6.6.13	D
6.6.14	D	6.6.15	5	6.6.16	0	6.6.17	C	6.6.18	C
6.6.19	D	6.6.20	A;D	6.6.21	B	6.6.22	D	6.7.1	B;D
6.7.2	A;B	6.8.1	C	6.8.2	A	6.8.3	A	6.8.4	C
6.8.5	C	6.8.6	4 : 4	6.9.1	55	6.10.1	A;C	6.11.1	C
6.11.2	B	6.11.3	N/A	6.11.4	B	6.11.5	C	6.11.6	B
6.11.7	X	6.11.8	1	6.11.9	C	6.11.10	C	6.11.11	C
6.11.12	D	6.11.13	A	6.11.14	A;D	6.11.15	C	6.11.16	B;D
6.11.17	C	6.12.1	A	6.12.2	A	6.12.3	2	6.12.4	A
6.12.5	A	6.12.6	B;C;D						



**Syllabus:** Random variables, Uniform, Normal, Exponential, Poisson and Binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem

### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
<b>1 Mark Count</b>	1	0	2	1	0	0	1	1	0	0.75	2
<b>2 Marks Count</b>	1	2	1	1	1	0	2	2	0	1.25	2
<b>Total Marks</b>	3	4	4	3	2	0	5	5	0	3.25	5

## 7.1

## Bayes Theorem (1)



## 7.1.1 Bayes Theorem: GATE DA 2025 | Question: 21

There are three boxes containing white balls and black balls.

Box -1 contains 2 black and 1 white balls.

Box- 2 contains 1 black and 2 white balls.

Box -3 contains 3 black and 3 white balls.

In a random experiment, one of these boxes is selected, where the probability of choosing Box- 1 is  $\frac{1}{2}$ , Box-2 is  $\frac{1}{6}$ , and Box- 3 is  $\frac{1}{3}$ . A ball is drawn at random from the selected box. Given that the ball drawn is white, the probability that it is drawn from Box-2 is \_\_\_\_\_ (Round off to two decimal places)

gateda-2025 probability bayes-theorem numerical-answers one-mark

Answer key

## 7.2

## Bayesian Network (2)



## 7.2.1 Bayesian Network: GATE DS&amp;AI 2024 | Question: 14

Consider five random variables  $U, V, W, X$ , and  $Y$  whose joint distribution satisfies:

$$P(U, V, W, X, Y) = P(U)P(V)P(W | U, V)P(X | W)P(Y | W)$$

Which ONE of the following statements is FALSE?

- A.  $Y$  is conditionally independent of  $V$  given  $W$
- B.  $X$  is conditionally independent of  $U$  given  $W$
- C.  $U$  and  $V$  are conditionally independent given  $W$
- D.  $Y$  and  $X$  are conditionally independent given  $W$

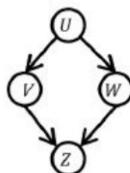
gate-ds-ai-2024 probability random-variable bayesian-network one-mark

Answer key

## 7.2.2 Bayesian Network: GATE DS&amp;AI 2024 | Question: 54



Given the following Bayesian Network consisting of four Bernoulli random variables and the associated conditional probability tables:



	$P(\cdot)$
$U = 0$	0.5
$U = 1$	0.5

	$P(V = 0   \cdot)$	$P(V = 1   \cdot)$
$U = 0$	0.5	0.5
$U = 1$	0.5	0.5

	$P(W = 0   \cdot)$	$P(W = 1   \cdot)$
$U = 0$	1	0
$U = 1$	0	1

		$P(Z = 0   \cdot)$	$P(Z = 1   \cdot)$
$V = 0$	$W = 0$	0.5	0.5
$V = 0$	$W = 1$	1	0
$V = 1$	$W = 0$	1	0
$V = 1$	$W = 1$	0.5	0.5

The value of  $P(U = 1, V = 1, W = 1, Z = 1) = \underline{\hspace{2cm}}$  (rounded off to three decimal places).

gate-ds-ai-2024 probability bayesian-network numerical-answers two-marks

Answer key 

## 7.3

### Bernoulli Distribution (1)

#### 7.3.1 Bernoulli Distribution: GATE DA 2025 | Question: 30



A random variable  $X$  is said to be distributed as Bernoulli( $\theta$ ), denoted by  $X \sim \text{Bernoulli}(\theta)$ , if

$$P(X = 1) = \theta, \quad P(X = 0) = 1 - \theta$$

for  $0 < \theta < 1$ . Let  $Y = \sum_{i=1}^{300} X_i$ , where  $X_i \sim \text{Bernoulli}(\theta), i = 1, 2, \dots, 300$  be independent and identically distributed random variables with  $\theta = 0.25$ . The value of  $P(60 \leq Y \leq 90)$ , after approximation through Central Limit Theorem, is given by (Recall that  $\phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-\frac{t^2}{2}} dt$ )

- A.  $\phi(2) - \phi(-2)$
- B.  $\phi(1) - \phi(-1)$
- C.  $\phi(3) - \phi(-3)$
- D.  $\phi(90) - \phi(60)$

gateda-2025 probability random-variable bernoulli-distribution two-marks

Answer key 

## 7.4

### Binomial Distribution (6)

#### 7.4.1 Binomial Distribution: GATE CSE 2002 | Question: 2.16



Four fair coins are tossed simultaneously. The probability that at least one head and one tail turn up is

- A.  $\frac{1}{16}$
- B.  $\frac{1}{8}$
- C.  $\frac{7}{8}$
- D.  $\frac{15}{16}$

**Answer key****7.4.2 Binomial Distribution: GATE CSE 2005 | Question: 52**

A random bit string of length  $n$  is constructed by tossing a fair coin  $n$  times and setting a bit to 0 or 1 depending on outcomes head and tail, respectively. The probability that two such randomly generated strings are not identical is:

- A.  $\frac{1}{2^n}$       B.  $1 - \frac{1}{n!}$       C.  $\frac{1}{n!}$       D.  $1 - \frac{1}{2^n}$

**Answer key****7.4.3 Binomial Distribution: GATE CSE 2006 | Question: 21**

For each element in a set of size  $2n$ , an unbiased coin is tossed. The  $2n$  coin tosses are independent. An element is chosen if the corresponding coin toss was a head. The probability that exactly  $n$  elements are chosen is

- A.  $\frac{2^n C_n}{4^n}$       B.  $\frac{2^n C_n}{2^n}$       C.  $\frac{1}{2^n C_n}$       D.  $\frac{1}{2}$

**Answer key****7.4.4 Binomial Distribution: GATE IT 2005 | Question: 32**

An unbiased coin is tossed repeatedly until the outcome of two successive tosses is the same. Assuming that the trials are independent, the expected number of tosses is

- A. 3      B. 4      C. 5      D. 6

**Answer key****7.4.5 Binomial Distribution: GATE IT 2006 | Question: 22**

When a coin is tossed, the probability of getting a Head is  $p, 0 < p < 1$ . Let  $N$  be the random variable denoting the number of tosses till the first Head appears, including the toss where the Head appears. Assuming that successive tosses are independent, the expected value of  $N$  is

- A.  $\frac{1}{p}$       B.  $\frac{1}{(1-p)}$       C.  $\frac{1}{p^2}$       D.  $\frac{1}{(1-p^2)}$

**Answer key****7.4.6 Binomial Distribution: GATE IT 2007 | Question: 1**

Suppose there are two coins. The first coin gives heads with probability  $\frac{5}{8}$  when tossed, while the second coin gives heads with probability  $\frac{1}{4}$ . One of the two coins is picked up at random with equal probability and tossed. What is the probability of obtaining heads ?

- A.  $\left(\frac{7}{8}\right)$       B.  $\left(\frac{1}{2}\right)$       C.  $\left(\frac{7}{16}\right)$       D.  $\left(\frac{5}{32}\right)$

**Answer key****7.5****Conditional Probability (14)****7.5.1 Conditional Probability: GATE CSE 1994 | Question: 1.4, ISRO2017-2**

Let  $A$  and  $B$  be any two arbitrary events, then, which one of the following is TRUE?

- A.  $P(A \cap B) = P(A)P(B)$   
 C.  $P(A | B) = P(A \cap B)P(B)$       B.  $P(A \cup B) = P(A) + P(B)$   
 D.  $P(A \cup B) \leq P(A) + P(B)$

[Answer key](#)

### 7.5.2 Conditional Probability: GATE CSE 1994 | Question: 2.6



The probability of an event  $B$  is  $P_1$ . The probability that events  $A$  and  $B$  occur together is  $P_2$  while the probability that  $A$  and  $B$  occur together is  $P_3$ . The probability of the event  $A$  in terms of  $P_1, P_2$  and  $P_3$  is \_\_\_\_\_

gate1994 probability normal conditional-probability fill-in-the-blanks

[Answer key](#)

### 7.5.3 Conditional Probability: GATE CSE 2003 | Question: 3



Let  $P(E)$  denote the probability of the event  $E$ . Given  $P(A) = 1$ ,  $P(B) = \frac{1}{2}$ , the values of  $P(A | B)$  and  $P(B | A)$  respectively are

- A.  $\left(\frac{1}{4}\right), \left(\frac{1}{2}\right)$       B.  $\left(\frac{1}{2}\right), \left(\frac{1}{4}\right)$       C.  $\left(\frac{1}{2}\right), 1$       D.  $1, \left(\frac{1}{2}\right)$

gatecse-2003 probability easy conditional-probability

[Answer key](#)

### 7.5.4 Conditional Probability: GATE CSE 2005 | Question: 51



Box  $P$  has 2 red balls and 3 blue balls and box  $Q$  has 3 red balls and 1 blue ball. A ball is selected as follows: (i) select a box (ii) choose a ball from the selected box such that each ball in the box is equally likely to be chosen.

The probabilities of selecting boxes  $P$  and  $Q$  are  $\frac{1}{3}$  and  $\frac{2}{3}$  respectively. Given that a ball selected in the above process is a red ball, the probability that it came from the box  $P$  is:

- A.  $\frac{4}{19}$       B.  $\frac{5}{19}$       C.  $\frac{2}{9}$       D.  $\frac{19}{30}$

gatecse-2005 probability conditional-probability normal

[Answer key](#)

### 7.5.5 Conditional Probability: GATE CSE 2008 | Question: 27



Aishwarya studies either computer science or mathematics everyday. If she studies computer science on a day, then the probability that she studies mathematics the next day is 0.6. If she studies mathematics on a day, then the probability that she studies computer science the next day is 0.4. Given that Aishwarya studies computer science on Monday, what is the probability that she studies computer science on Wednesday?

- A. 0.24      B. 0.36      C. 0.4      D. 0.6

gatecse-2008 probability normal conditional-probability

[Answer key](#)

### 7.5.6 Conditional Probability: GATE CSE 2009 | Question: 21



An unbalanced dice (with 6 faces, numbered from 1 to 6) is thrown. The probability that the face value is odd is 90% of the probability that the face value is even. The probability of getting any even numbered face is the same. If the probability that the face is even given that it is greater than 3 is 0.75, which one of the following options is closest to the probability that the face value exceeds 3?

- A. 0.453      B. 0.468      C. 0.485      D. 0.492

gatecse-2009 probability normal conditional-probability

[Answer key](#)

### 7.5.7 Conditional Probability: GATE CSE 2011 | Question: 3



If two fair coins are flipped and at least one of the outcomes is known to be a head, what is the probability that both outcomes are heads?

- A.  $\left(\frac{1}{3}\right)$       B.  $\left(\frac{1}{4}\right)$       C.  $\left(\frac{1}{2}\right)$       D.  $\left(\frac{2}{3}\right)$

gatecse-2011 probability easy conditional-probability

Answer key 

### 7.5.8 Conditional Probability: GATE CSE 2012 | Question: 33

Suppose a fair six-sided die is rolled once. If the value on the die is 1, 2, or 3, the die is rolled a second time. What is the probability that the sum total of values that turn up is at least 6?

A.  $\frac{10}{21}$

B.  $\frac{5}{12}$

C.  $\frac{2}{3}$

D.  $\frac{1}{6}$

gatecse-2012 probability conditional-probability normal

Answer key 

### 7.5.9 Conditional Probability: GATE CSE 2016 Set 2 | Question: 05

Suppose that a shop has an equal number of LED bulbs of two different types. The probability of an LED bulb lasting more than 100 hours given that it is of Type 1 is 0.7, and given that it is of Type 2 is 0.4. The probability that an LED bulb chosen uniformly at random lasts more than 100 hours is \_\_\_\_\_.

gatecse-2016-set2 probability conditional-probability normal numerical-answers

Answer key 

### 7.5.10 Conditional Probability: GATE CSE 2017 Set 2 | Question: 26

$P$  and  $Q$  are considering to apply for a job. The probability that  $P$  applies for the job is  $\frac{1}{4}$ , the probability that  $P$  applies for the job given that  $Q$  applies for the job is  $\frac{1}{2}$ , and the probability that  $Q$  applies for the job given that  $P$  applies for the job is  $\frac{1}{3}$ . Then the probability that  $P$  does not apply for the job given that  $Q$  does not apply for this job is

A.  $\left(\frac{4}{5}\right)$

B.  $\left(\frac{5}{6}\right)$

C.  $\left(\frac{7}{8}\right)$

D.  $\left(\frac{11}{12}\right)$

gatecse-2017-set2 probability conditional-probability

Answer key 

### 7.5.11 Conditional Probability: GATE CSE 2018 | Question: 44

Consider Guwahati, ( $G$ ) and Delhi ( $D$ ) whose temperatures can be classified as high ( $H$ ), medium ( $M$ ) and low ( $L$ ). Let  $P(H_G)$  denote the probability that Guwahati has high temperature. Similarly,  $P(M_G)$  and  $P(L_G)$  denotes the probability of Guwahati having medium and low temperatures respectively. Similarly, we use  $P(H_D)$ ,  $P(M_D)$  and  $P(L_D)$  for Delhi.

The following table gives the conditional probabilities for Delhi's temperature given Guwahati's temperature.

	$H_D$	$M_D$	$L_D$
$H_G$	0.40	0.48	0.12
$M_G$	0.10	0.65	0.25
$L_G$	0.01	0.50	0.49

Consider the first row in the table above. The first entry denotes that if Guwahati has high temperature ( $H_G$ ) then the probability of Delhi also having a high temperature ( $H_D$ ) is 0.40; i.e.,  $P(H_D | H_G) = 0.40$ . Similarly, the next two entries are  $P(M_D | H_G) = 0.48$  and  $P(L_D | H_G) = 0.12$ . Similarly for the other rows.

If it is known that  $P(H_G) = 0.2$ ,  $P(M_G) = 0.5$ , and  $P(L_G) = 0.3$ , then the probability (correct to two decimal places) that Guwahati has high temperature given that Delhi has high temperature is \_\_\_\_\_.

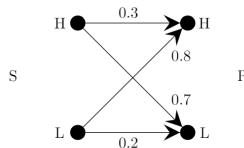
gatecse-2018 probability conditional-probability numerical-answers two-marks

Answer key 

### 7.5.12 Conditional Probability: GATE CSE 2021 Set 1 | Question: 54

A sender ( $S$ ) transmits a signal, which can be one of the two kinds:  $H$  and  $L$  with probabilities 0.1 and 0.9 respectively, to a receiver ( $R$ ).

In the graph below, the weight of edge  $(u,v)$  is the probability of receiving  $v$  when  $u$  is transmitted, where  $u,v \in \{H,L\}$ . For example, the probability that the received signal is  $L$  given the transmitted signal was  $H$ , is 0.7.



If the received signal is  $H$ , the probability that the transmitted signal was  $H$  (rounded to 2 decimal places) is \_\_\_\_\_.

gatecse-2021-set1 probability conditional-probability numerical-answers two-marks

[Answer key](#)

#### 7.5.13 Conditional Probability: GATE CSE 2024 | Set 1 | Question: 53

A bag contains 10 red balls and 15 blue balls. Two balls are drawn randomly without replacement. Given that the first ball drawn is red, the probability (rounded off to 3 decimal places) that both balls drawn are red is \_\_\_\_\_.

gatecse2024-set1 numerical-answers probability conditional-probability two-marks

[Answer key](#)

#### 7.5.14 Conditional Probability: GATE IT 2006 | Question: 1

In a certain town, the probability that it will rain in the afternoon is known to be 0.6. Moreover, meteorological data indicates that if the temperature at noon is less than or equal to  $25^{\circ}C$ , the probability that it will rain in the afternoon is 0.4. The temperature at noon is equally likely to be above  $25^{\circ}C$ , or at/below  $25^{\circ}C$ . What is the probability that it will rain in the afternoon on a day when the temperature at noon is above  $25^{\circ}C$ ?

- A. 0.4
- B. 0.6
- C. 0.8
- D. 0.9

gateit-2006 probability normal conditional-probability

[Answer key](#)

### 7.6

#### Continuous Distribution (1)

##### 7.6.1 Continuous Distribution: GATE CSE 2016 Set 1 | Question: 04

A probability density function on the interval  $[a, 1]$  is given by  $1/x^2$  and outside this interval the value of the function is zero. The value of  $a$  is \_\_\_\_\_.

gatecse-2016-set1 probability normal numerical-answers continuous-distribution

[Answer key](#)

### 7.7

#### Expectation (13)

##### 7.7.1 Expectation: GATE CSE 1999 | Question: 1.1

Suppose that the expectation of a random variable  $X$  is 5. Which of the following statements is true?

- A. There is a sample point at which  $X$  has the value 5.
- B. There is a sample point at which  $X$  has value greater than 5.
- C. There is a sample point at which  $X$  has a value greater than or equal to 5.
- D. None of the above.

gate1999 probability expectation easy

[Answer key](#)

##### 7.7.2 Expectation: GATE CSE 2004 | Question: 74

An examination paper has 150 multiple choice questions of one mark each, with each question having four choices. Each incorrect answer fetches  $-0.25$  marks. Suppose 1000 students choose all their answers randomly with uniform probability. The sum total of the expected marks obtained by all these students is

A. 0

B. 2550

C. 7525

D. 9375

gatecse-2004 probability expectation normal

Answer key 



### 7.7.3 Expectation: GATE CSE 2006 | Question: 18

We are given a set  $X = \{X_1, \dots, X_n\}$  where  $X_i = 2^i$ . A sample  $S \subseteq X$  is drawn by selecting each  $X_i$  independently with probability  $P_i = \frac{1}{2}$ . The expected value of the smallest number in sample  $S$  is:

A.  $(\frac{1}{n})$

B. 2

C.  $\sqrt{n}$

D.  $n$

gatecse-2006 probability expectation normal

Answer key 



### 7.7.4 Expectation: GATE CSE 2011 | Question: 18

If the difference between the expectation of the square of a random variable ( $E[X^2]$ ) and the square of the expectation of the random variable ( $E[X]$ )<sup>2</sup> is denoted by  $R$ , then

A.  $R = 0$

B.  $R < 0$

C.  $R \geq 0$

D.  $R > 0$

gatecse-2011 probability random-variable expectation normal

Answer key 



### 7.7.5 Expectation: GATE CSE 2013 | Question: 24

Consider an undirected random graph of eight vertices. The probability that there is an edge between a pair of vertices is  $\frac{1}{2}$ . What is the expected number of unordered cycles of length three?

A.  $\frac{1}{8}$

B. 1

C. 7

D. 8

gatecse-2013 probability expectation normal

Answer key 



### 7.7.6 Expectation: GATE CSE 2014 Set 2 | Question: 2

Each of the nine words in the sentence "The quick brown fox jumps over the lazy dog" is written on a separate piece of paper. These nine pieces of paper are kept in a box. One of the pieces is drawn at random from the box. The expected length of the word drawn is \_\_\_\_\_. (The answer should be rounded to one decimal place.)

gatecse-2014-set2 probability expectation numerical-answers easy

Answer key 



### 7.7.7 Expectation: GATE CSE 2017 Set 2 | Question: 31

For any discrete random variable  $X$ , with probability mass function  $P(X = j) = p_j, p_j \geq 0, j \in \{0, \dots, N\}$ , and  $\sum_{j=0}^N p_j = 1$ , define the polynomial function  $g_x(z) = \sum_{j=0}^N p_j z^j$ . For a certain discrete random variable  $Y$ , there exists a scalar  $\beta \in [0, 1]$  such that  $g_y(z) = (1 - \beta + \beta z)^N$ . The expectation of  $Y$  is

A.  $N\beta(1 - \beta)$   
C.  $N(1 - \beta)$

B.  $N\beta$   
D. Not expressible in terms of  $N$  and  $\beta$  alone

gatecse-2017-set2 probability random-variable difficult expectation

Answer key 



### 7.7.8 Expectation: GATE CSE 2021 Set 1 | Question: 35

Consider the two statements.

- $S_1$  : There exist random variables  $X$  and  $Y$  such that  $(\mathbb{E}[(X - \mathbb{E}(X))(Y - \mathbb{E}(Y))])^2 > \text{Var}[X]\text{Var}[Y]$
- $S_2$  : For all random variables  $X$  and  $Y$ ,  $\text{Cov}[X, Y] = \mathbb{E} [|X - \mathbb{E}[X]| |Y - \mathbb{E}[Y]|]$

Which one of the following choices is correct?

- A. Both  $S_1$  and  $S_2$  are true  
B.  $S_1$  is true, but  $S_2$  is false

C.  $S_1$  is false, but  $S_2$  is true

D. Both  $S_1$  and  $S_2$  are false

gatecse-2021-set1 probability random-variable difficult two-marks expectation

Answer key 

### 7.7.9 Expectation: GATE CSE 2021 Set 2 | Question: 29

In an examination, a student can choose the order in which two questions (QuesA and QuesB) must be attempted.

- If the first question is answered wrong, the student gets zero marks.
- If the first question is answered correctly and the second question is not answered correctly, the student gets the marks only for the first question.
- If both the questions are answered correctly, the student gets the sum of the marks of the two questions.

The following table shows the probability of correctly answering a question and the marks of the question respectively.

question	probability of answering correctly	marks
QuesA	0.8	10
QuesB	0.5	20

Assuming that the student always wants to maximize her expected marks in the examination, in which order should she attempt the questions and what is the expected marks for that order (assume that the questions are independent)?

- A. First QuesA and then QuesB. Expected marks 14.
- B. First QuesB and then QuesA. Expected marks 14.
- C. First QuesB and then QuesA. Expected marks 22.
- D. First QuesA and then QuesB. Expected marks 16.

gatecse-2021-set2 probability expectation two-marks

Answer key 

### 7.7.10 Expectation: GATE DA 2025 | Question: 1

Suppose  $X$  and  $Y$  are random variables. The conditional expectation of  $X$  given  $Y$  is denoted by  $E[X | Y]$ . Then  $E[E[X | Y]]$  equals

- A.  $E[X | Y]$
- B.  $\frac{E[X]}{E[Y]}$
- C.  $E[X]$
- D.  $E[Y]$

gateda-2025 probability random-variable expectation one-mark

Answer key 

### 7.7.11 Expectation: GATE DA 2025 | Question: 10

Let  $X = aZ + b$ , where  $Z$  is a standard normal random variable, and  $a, b$  are two unknown constants. It is given that

$$E[X] = 1, \quad E[(X - E[X])Z] = -2, \quad E[(X - E[X])^2] = 4$$

where  $E[X]$  denotes the expectation of random variable  $X$ . The values of  $a, b$  are:

- A.  $a = -2, b = 1$
- B.  $a = 2, b = -1$
- C.  $a = -2, b = -1$
- D.  $a = 1, b = 1$

gateda-2025 probability expectation random-variable one-mark

Answer key 

### 7.7.12 Expectation: GATE DA 2025 | Question: 51

A bag contains 5 white balls and 10 black balls. In a random experiment,  $n$  balls are drawn from the bag one at a time with replacement. Let  $S_n$  denote the total number of black balls drawn in the experiment.

The expectation of  $S_{100}$  denoted by  $E[S_{100}] = \underline{\hspace{2cm}}$ . (Round off to one decimal place)

gateda-2025 probability expectation numerical-answers two-marks

[Answer key](#)

### 7.7.13 Expectation: GATE DS&AI 2024 | Question: 26



A fair six-sided die (with faces numbered 1,2,3,4,5,6) is repeatedly thrown independently.

What is the expected number of times the die is thrown until two consecutive throws of even numbers are seen?

A. 2

B. 4

C. 6

D. 8

gate-ds-ai-2024 probability expectation two-marks

[Answer key](#)

7.8

## Exponential Distribution (5)



### 7.8.1 Exponential Distribution: GATE CSE 2021 Set 1 | Question: 18

The lifetime of a component of a certain type is a random variable whose probability density function is exponentially distributed with parameter 2. For a randomly picked component of this type, the probability that its lifetime exceeds the expected lifetime (rounded to 2 decimal places) is \_\_\_\_\_.

gatcse-2021-set1 probability random-variable numerical-answers one-mark exponential-distribution

[Answer key](#)

### 7.8.2 Exponential Distribution: GATE DA 2025 | Question: 11



It is given that  $P(X \geq 2) = 0.25$  for an exponentially distributed random variable  $X$  with  $E[X] = \frac{1}{\lambda}$ , where  $E[X]$  denotes the expectation of  $X$ . What is the value of  $\lambda$ ? ( $\ln$  denotes natural logarithm)

A.  $\ln 2$

B.  $\ln 4$

C.  $\ln 3$

D.  $\ln 0.25$

gateda-2025 probability exponential-distribution expectation one-mark

[Answer key](#)

### 7.8.3 Exponential Distribution: GATE DA 2025 | Question: 31



For  $x \in \mathbb{R}$ , the floor function is denoted by  $f(x) = \lfloor x \rfloor$  and defined as follows

$$\lfloor x \rfloor = k, \quad k \leq x < k+1,$$

where  $k$  is an integer. Let  $Y = \lfloor X \rfloor$ , where  $X$  is an exponentially distributed random variable with mean  $\frac{1}{\ln 10}$ , where  $\ln$  denotes natural logarithm. For any positive integer  $\ell$ , one can write the probability of the event  $Y = \ell$  as follows

$$P(Y = \ell) = q^\ell (1 - q)$$

The value of  $q$  is

A. 0.1

B. 0.01

C. 0.5

D. 0.434

gateda-2025 probability random-variable exponential-distribution two-marks

[Answer key](#)

### 7.8.4 Exponential Distribution: GATE DS&AI 2024 | Question: 47



Let  $X$  be a random variable exponentially distributed with parameter  $\lambda > 0$ . The probability density function of  $X$  is given by:

$$f_X(x) = \begin{cases} \lambda e^{-\lambda x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

If  $5E(X) = \text{Var}(X)$ , where  $E(X)$  and  $\text{Var}(X)$  indicate the expectation and variance of  $X$ , respectively, the value of  $\lambda$  is \_\_\_\_\_ (rounded off to one decimal place).



### 7.9.5 Independent Events: GATE DA 2025 | Question: 44

Consider a coin-toss experiment where the probability of head showing up is  $p$ . In the  $i^{\text{th}}$  coin toss, let  $X_i = 1$  if head appears, and  $X_i = 0$  if tail appears. Consider

$$\hat{p} = \frac{1}{n} \sum_{i=1}^n X_i$$

where  $n$  is the total number of independent coin tosses.

Which of the following statements is/are correct?

- A.  $E[\hat{p}] = p$   
B.  $E[\hat{p}] = \frac{p}{n}$   
C. As  $n$  increases, variance of  $\hat{p}$  decreases  
D. Variance of  $\hat{p}$  does not depend on  $n$

gateda-2025 probability independent-events multiple-selects two-marks

Answer key 

### 7.9.6 Independent Events: GATE DS&AI 2024 | Question: 2

Three fair coins are tossed independently.  $T$  is the event that two or more tosses result in heads.  $S$  is the event that two or more tosses result in tails.

What is the probability of the event  $T \cap S$ ?

- A. 0      B. 0.5      C. 0.25      D. 1

gate-ds-ai-2024 probability independent-events one-mark

Answer key 

## 7.10

### Normal Distribution (2)

#### 7.10.1 Normal Distribution: GATE CSE 2008 | Question: 29

Let  $X$  be a random variable following normal distribution with mean  $+1$  and variance  $4$ . Let  $Y$  be another normal variable with mean  $-1$  and variance unknown. If  $P(X \leq -1) = P(Y \geq 2)$ , the standard deviation of  $Y$  is

- A. 3      B. 2      C.  $\sqrt{2}$       D. 1

gatecse-2008 random-variable normal-distribution probability normal

Answer key 

#### 7.10.2 Normal Distribution: GATE CSE 2017 Set 1 | Question: 19

Let  $X$  be a Gaussian random variable with mean  $0$  and variance  $\sigma^2$ . Let  $Y = \max(X, 0)$  where  $\max(a, b)$  is the maximum of  $a$  and  $b$ . The median of  $Y$  is \_\_\_\_\_.

gatecse-2017-set1 probability numerical-answers normal-distribution

Answer key 

## 7.11

### Poisson Distribution (4)

#### 7.11.1 Poisson Distribution: GATE CSE 1989 | Question: 4-viii

$P_n(t)$  is the probability of  $n$  events occurring during a time interval  $t$ . How will you express  $P_0(t+h)$  in terms of  $P_0(h)$ , if  $P_0(t)$  has stationary independent increments? (Note:  $P_t(t)$  is the probability density function).

gate1989 descriptive probability poisson-distribution

Answer key 

#### 7.11.2 Poisson Distribution: GATE CSE 2013 | Question: 2

Suppose  $p$  is the number of cars per minute passing through a certain road junction between 5 PM and 6 PM, and  $p$  has a Poisson distribution with mean 3. What is the probability of observing fewer than 3 cars during any given minute in this interval?

A.  $\frac{8}{(2e^3)}$

B.  $\frac{9}{(2e^3)}$

C.  $\frac{17}{(2e^3)}$

D.  $\frac{26}{(2e^3)}$

gatecse-2013 probability poisson-distribution normal

Answer key 



#### 7.11.3 Poisson Distribution: GATE CSE 2017 Set 2 | Question: 48

If a random variable  $X$  has a Poisson distribution with mean 5, then the expectation  $E[(x+2)^2]$  equals \_\_\_\_.

gatecse-2017-set2 expectation poisson-distribution numerical-answers probability

Answer key 



#### 7.11.4 Poisson Distribution: GATE IT 2007 | Question: 57

In a multi-user operating system on an average, 20 requests are made to use a particular resource per hour. The arrival of requests follows a Poisson distribution. The probability that either one, three or five requests are made in 45 minutes is given by :

A.  $6.9 \times 10^6 \times e^{-20}$

C.  $6.9 \times 10^3 \times e^{-20}$

B.  $1.02 \times 10^6 \times e^{-20}$

D.  $1.02 \times 10^3 \times e^{-20}$

gateit-2007 probability poisson-distribution normal

Answer key 

### 7.12

### Probability (28)



#### 7.12.1 Probability: GATE CSE 1995 | Question: 1.18

The probability that a number selected at random between 100 and 999 (both inclusive) will not contain the digit 7 is:

A.  $\frac{16}{25}$

B.  $\left(\frac{9}{10}\right)^3$

C.  $\frac{27}{75}$

D.  $\frac{18}{25}$

gate1995 probability normal

Answer key 



#### 7.12.2 Probability: GATE CSE 1995 | Question: 2.14

A bag contains 10 white balls and 15 black balls. Two balls are drawn in succession. The probability that one of them is black and the other is white is:

A.  $\frac{2}{3}$

B.  $\frac{4}{5}$

C.  $\frac{1}{2}$

D.  $\frac{1}{3}$

gate1995 probability normal

Answer key 



#### 7.12.3 Probability: GATE CSE 1996 | Question: 1.5

Two dice are thrown simultaneously. The probability that at least one of them will have 6 facing up is

A.  $\frac{1}{36}$

B.  $\frac{1}{3}$

C.  $\frac{25}{36}$

D.  $\frac{11}{36}$

gate1996 probability easy

Answer key 



#### 7.12.4 Probability: GATE CSE 1996 | Question: 2.7

The probability that top and bottom cards of a randomly shuffled deck are both aces is

A.  $\frac{4}{52} \times \frac{4}{52}$

C.  $\frac{4}{52} \times \frac{3}{51}$

B.  $\frac{4}{52} \times \frac{3}{52}$

D.  $\frac{4}{52} \times \frac{4}{51}$

gate1996 probability easy

Answer key 



### 7.12.5 Probability: GATE CSE 1997 | Question: 1.1

The probability that it will rain today is 0.5. The probability that it will rain tomorrow is 0.6. The probability that it will rain either today or tomorrow is 0.7. What is the probability that it will rain today and tomorrow?

- A. 0.3      B. 0.25      C. 0.35      D. 0.4

gate1997 probability easy

[Answer key](#)



### 7.12.6 Probability: GATE CSE 1998 | Question: 1.1

A die is rolled three times. The probability that exactly one odd number turns up among the three outcomes is

- A.  $\frac{1}{6}$       B.  $\frac{3}{8}$       C.  $\frac{1}{8}$       D.  $\frac{1}{2}$

gate1998 probability easy

[Answer key](#)



### 7.12.7 Probability: GATE CSE 2001 | Question: 2.4

Seven (distinct) car accidents occurred in a week. What is the probability that they all occurred on the same day?

- A.  $\frac{1}{7^7}$       B.  $\frac{1}{2^6}$       C.  $\frac{1}{2^7}$       D.  $\frac{7}{2^7}$

gatecse-2001 probability normal

[Answer key](#)



### 7.12.8 Probability: GATE CSE 2004 | Question: 25

If a fair coin is tossed four times. What is the probability that two heads and two tails will result?

- A.  $\frac{3}{8}$       B.  $\frac{1}{2}$       C.  $\frac{5}{8}$       D.  $\frac{3}{4}$

gatecse-2004 probability easy

[Answer key](#)



### 7.12.9 Probability: GATE CSE 2010 | Question: 26

Consider a company that assembles computers. The probability of a faulty assembly of any computer is  $p$ . The company therefore subjects each computer to a testing process. This testing process gives the correct result for any computer with a probability of  $q$ . What is the probability of a computer being declared faulty?

- A.  $pq + (1 - p)(1 - q)$       B.  $(1 - q)p$       C.  $(1 - p)q$       D.  $pq$

gatecse-2010 probability easy

[Answer key](#)



### 7.12.10 Probability: GATE CSE 2010 | Question: 27

What is the probability that divisor of  $10^{99}$  is a multiple of  $10^{96}$ ?

- A.  $\left(\frac{1}{625}\right)$       B.  $\left(\frac{4}{625}\right)$       C.  $\left(\frac{12}{625}\right)$       D.  $\left(\frac{16}{625}\right)$

gatecse-2010 probability normal

[Answer key](#)



### 7.12.11 Probability: GATE CSE 2011 | Question: 34

A deck of 5 cards (each carrying a distinct number from 1 to 5) is shuffled thoroughly. Two cards are then removed one at a time from the deck. What is the probability that the two cards are selected with the number on the first card being one higher than the number on the second card?



A.  $\left(\frac{1}{5}\right)$

B.  $\left(\frac{4}{25}\right)$

C.  $\left(\frac{1}{4}\right)$

D.  $\left(\frac{2}{5}\right)$

gatecse-2011 probability normal

Answer key 



#### 7.12.12 Probability: GATE CSE 2014 Set 1 | Question: 48

Four fair six-sided dice are rolled. The probability that the sum of the results being 22 is  $\frac{X}{1296}$ . The value of  $X$  is \_\_\_\_\_.

gatecse-2014-set1 probability numerical-answers normal

Answer key 



#### 7.12.13 Probability: GATE CSE 2014 Set 2 | Question: 1

The security system at an IT office is composed of 10 computers of which exactly four are working. To check whether the system is functional, the officials inspect four of the computers picked at random (without replacement). The system is deemed functional if at least three of the four computers inspected are working. Let the probability that the system is deemed functional be denoted by  $p$ . Then  $100p = \underline{\hspace{2cm}}$ .

gatecse-2014-set2 probability numerical-answers normal

Answer key 



#### 7.12.14 Probability: GATE CSE 2014 Set 2 | Question: 48

The probability that a given positive integer lying between 1 and 100 (both inclusive) is NOT divisible by 2, 3 or 5 is \_\_\_\_\_.

gatecse-2014-set2 probability numerical-answers normal

Answer key 



#### 7.12.15 Probability: GATE CSE 2014 Set 3 | Question: 48

Let  $S$  be a sample space and two mutually exclusive events  $A$  and  $B$  be such that  $A \cup B = S$ . If  $P(\cdot)$  denotes the probability of the event, the maximum value of  $P(A)P(B)$  is \_\_\_\_\_.

gatecse-2014-set3 probability numerical-answers normal

Answer key 



#### 7.12.16 Probability: GATE CSE 2016 Set 1 | Question: 29

Consider the following experiment.

**Step 1.** Flip a fair coin twice.

**Step 2.** If the outcomes are (TAILS, HEADS) then output  $Y$  and stop.

**Step 3.** If the outcomes are either (HEADS, HEADS) or (HEADS, TAILS), then output  $N$  and stop.

**Step 4.** If the outcomes are (TAILS, TAILS), then go to Step 1.

The probability that the output of the experiment is  $Y$  is (up to two decimal places)

gatecse-2016-set1 probability normal numerical-answers

Answer key 



#### 7.12.17 Probability: GATE CSE 2018 | Question: 15

Two people,  $P$  and  $Q$ , decide to independently roll two identical dice, each with 6 faces, numbered 1 to 6. The person with the lower number wins. In case of a tie, they roll the dice repeatedly until there is no tie. Define a trial as a throw of the dice by  $P$  and  $Q$ . Assume that all 6 numbers on each dice are equi-probable and that all trials are independent. The probability (rounded to 3 decimal places) that one of them wins on the third trial is \_\_\_\_\_.

gatecse-2018 probability normal numerical-answers one-mark

Answer key 

### 7.12.18 Probability: GATE CSE 2021 Set 2 | Question: 33

A bag has  $r$  red balls and  $b$  black balls. All balls are identical except for their colours. In a trial, a ball is randomly drawn from the bag, its colour is noted and the ball is placed back into the bag along with another ball of the same colour. Note that the number of balls in the bag will increase by one, after the trial. A sequence of four such trials is conducted. Which one of the following choices gives the probability of drawing a red ball in the fourth trial?

- A.  $\frac{r}{r+b}$
- B.  $\frac{r}{r+b+3}$
- C.  $\frac{r+3}{r+b+3}$
- D.  $\left(\frac{r}{r+b}\right)\left(\frac{r+1}{r+b+1}\right)\left(\frac{r+2}{r+b+2}\right)\left(\frac{r+3}{r+b+3}\right)$

gatecse-2021-set2 probability normal two-marks

Answer key 

### 7.12.19 Probability: GATE CSE 2024 | Set 1 | Question: 17

Let  $A$  and  $B$  be two events in a probability space with  $P(A) = 0.3$ ,  $P(B) = 0.5$ , and  $P(A \cap B) = 0.1$ . Which of the following statements is/are TRUE?

- A. The two events  $A$  and  $B$  are independent
- B.  $P(A \cup B) = 0.7$
- C.  $P(A \cap B^c) = 0.2$ , where  $B^c$  is the complement of the event  $B$
- D.  $P(A^c \cap B^c) = 0.4$ , where  $A^c$  and  $B^c$  are the complements of the events  $A$  and  $B$ , respectively

gatecse2024-set1 multiple-selects probability one-mark

Answer key 

### 7.12.20 Probability: GATE CSE 2024 | Set 2 | Question: 8

When six unbiased dice are rolled simultaneously, the probability of getting all distinct numbers (*i.e.*, 1, 2, 3, 4, 5, and 6) is

- A.  $\frac{1}{324}$
- B.  $\frac{5}{324}$
- C.  $\frac{7}{324}$
- D.  $\frac{11}{324}$

gatecse2024-set2 probability one-mark

Answer key 

### 7.12.21 Probability: GATE CSE 2025 | Set 1 | Question: 22

A box contains 5 coins: 4 regular coins and 1 fake coin. When a regular coin is tossed, the probability  $P(\text{head}) = 0.5$  and for a fake coin,  $P(\text{head}) = 1$ . You pick a coin at random and toss it twice, and get two heads. The probability that the coin you have chosen is the fake coin is \_\_\_\_\_. (rounded off to two decimal places)

gatecse2025-set1 probability numerical-answers one-mark

Answer key 

### 7.12.22 Probability: GATE DA 2025 | Question: 35

A random experiment consists of throwing 100 fair dice, each die having six faces numbered 1 to 6. An event  $A$  represents the set of all outcomes where at least one of the dice shows a 1. Then,  $P(A) =$

- A. 0
- B. 1
- C.  $1 - \left(\frac{5}{6}\right)^{100}$
- D.  $\left(\frac{5}{6}\right)^{100}$

gateda-2025 probability two-marks

[Answer key](#)

### 7.12.23 Probability: GATE DS&AI 2024 | Question: 48



Consider two events  $T$  and  $S$ . Let  $\bar{T}$  denote the complement of the event  $T$ . The probability associated with different events are given as follows:

$$P(\bar{T}) = 0.6, \quad P(S | T) = 0.3, \quad P(S | \bar{T}) = 0.6$$

Then,  $P(T | S)$  is \_\_\_\_\_ (rounded off to two decimal places).

gate-ds-ai-2024 numerical-answers probability two-marks

[Answer key](#)

### 7.12.24 Probability: GATE Data Science and Artificial Intelligence 2024 | Sample Paper | Question: 7



A fair coin is flipped twice and it is known that at least one tail is observed. The probability of getting two tails is

- A.  $\frac{1}{2}$       B.  $\frac{1}{3}$       C.  $\frac{2}{3}$       D.  $\frac{1}{4}$

gateda-sample-paper-2024 engineering-mathematics probability

[Answer key](#)

### 7.12.25 Probability: GATE IT 2004 | Question: 1



In a population of  $N$  families, 50% of the families have three children, 30% of the families have two children and the remaining families have one child. What is the probability that a randomly picked child belongs to a family with two children?

- A.  $\left(\frac{3}{23}\right)$       B.  $\left(\frac{6}{23}\right)$       C.  $\left(\frac{3}{10}\right)$       D.  $\left(\frac{3}{5}\right)$

gateit-2004 probability normal

[Answer key](#)

### 7.12.26 Probability: GATE IT 2005 | Question: 1



A bag contains 10 blue marbles, 20 green marbles and 30 red marbles. A marble is drawn from the bag, its colour recorded and it is put back in the bag. This process is repeated 3 times. The probability that no two of the marbles drawn have the same colour is

- A.  $\left(\frac{1}{36}\right)$       B.  $\left(\frac{1}{6}\right)$       C.  $\left(\frac{1}{4}\right)$       D.  $\left(\frac{1}{3}\right)$

gateit-2005 probability normal

[Answer key](#)

### 7.12.27 Probability: GATE IT 2008 | Question: 2



A sample space has two events  $A$  and  $B$  such that probabilities  $P(A \cap B) = \frac{1}{2}$ ,  $P(A') = \frac{1}{3}$ ,  $P(B') = \frac{1}{3}$ . What is  $P(A \cup B)$ ?

- A.  $\left(\frac{11}{12}\right)$       B.  $\left(\frac{10}{12}\right)$       C.  $\left(\frac{9}{12}\right)$       D.  $\left(\frac{8}{12}\right)$

gateit-2008 probability easy

[Answer key](#)

### 7.12.28 Probability: GATE IT 2008 | Question: 23



What is the probability that in a randomly chosen group of  $r$  people at least three people have the same birthday?

- A.  $1 - \frac{365 - 364 \dots (365 - r + 1)}{365^r}$

- B.  $\frac{365 \cdot 364 \dots (365 - r + 1)}{365^r} + {}^r C_1 \cdot 365 \cdot \frac{364 \cdot 363 \dots (364 - (r - 2) + 1)}{364^{r+2}}$
- C.  $1 - \frac{365 \cdot 364 \dots (365 - r + 1)}{365^r} - {}^r C_2 \cdot 365 \cdot \frac{364 \cdot 363 \dots (364 - (r - 2) + 1)}{364^{r-2}}$
- D.  $\frac{365 \cdot 364 \dots (365 - r + 1)}{365^r}$

gateit-2008 probability normal

[Answer key](#)

## 7.13

### Probability Density Function (1)

#### 7.13.1 Probability Density Function: GATE CSE 2003 | Question: 60, ISRO2007-45



A program consists of two modules executed sequentially. Let  $f_1(t)$  and  $f_2(t)$  respectively denote the probability density functions of time taken to execute the two modules. The probability density function of the overall time taken to execute the program is given by

- A.  $f_1(t) + f_2(t)$
- B.  $\int_0^t f_1(x)f_2(t-x)dx$
- C.  $\int_0^t f_1(x)f_2(t-x)dx$
- D.  $\max\{f_1(t), f_2(t)\}$

gatecse-2003 probability normal isro2007 probability-density-function

[Answer key](#)

## 7.14

### Probability Distribution (1)

#### 7.14.1 Probability Distribution: GATE CSE 2025 | Set 1 | Question: 48



Consider a probability distribution given by the density function  $P(x)$ .

$$P(x) = \begin{cases} Cx^2, & \text{for } 1 \leq x \leq 4 \\ 0, & \text{for } x < 1 \text{ or } x > 4 \end{cases}$$

The probability that  $x$  lies between 2 and 3, i.e.,  $P(2 \leq x \leq 3)$  is \_\_\_\_\_. (rounded off to three decimal places)

gatecse2025-set1 probability probability-distribution numerical-answers two-marks

[Answer key](#)

## 7.15

### Random Variable (8)

#### 7.15.1 Random Variable: GATE CSE 2005 | Question: 12, ISRO2009-64



Let  $f(x)$  be the continuous probability density function of a random variable  $x$ , the probability that  $a < x \leq b$ , is :

- A.  $f(b-a)$
- B.  $f(b) - f(a)$
- C.  $\int_a^b f(x)dx$
- D.  $\int_a^b xf(x)dx$

gatecse-2005 probability random-variable easy isro2009

[Answer key](#)

#### 7.15.2 Random Variable: GATE CSE 2011 | Question: 33



Consider a finite sequence of random values  $X = [x_1, x_2, \dots, x_n]$ . Let  $\mu_x$  be the mean and  $\sigma_x$  be the standard deviation of  $X$ . Let another finite sequence  $Y$  of equal length be derived from this as  $y_i = a * x_i + b$ , where  $a$  and  $b$  are positive constants. Let  $\mu_y$  be the mean and  $\sigma_y$  be the standard deviation of this sequence.

Which one of the following statements is **INCORRECT**?

- A. Index position of mode of  $X$  in  $X$  is the same as the index position of mode of  $Y$  in  $Y$
- B. Index position of median of  $X$  in  $X$  is the same as the index position of median of  $Y$  in  $Y$
- C.  $\mu_y = a\mu_x + b$
- D.  $\sigma_y = a\sigma_x + b$

**Answer key****7.15.3 Random Variable: GATE CSE 2012 | Question: 21**

Consider a random variable  $X$  that takes values  $+1$  and  $-1$  with probability  $0.5$  each. The values of the cumulative distribution function  $F(x)$  at  $x = -1$  and  $+1$  are

- A. 0 and 0.5      B. 0 and 1      C. 0.5 and 1      D. 0.25 and 0.75

**Answer key****7.15.4 Random Variable: GATE CSE 2015 Set 3 | Question: 37**

Suppose  $X_i$  for  $i = 1, 2, 3$  are independent and identically distributed random variables whose probability mass functions are  $Pr[X_i = 0] = Pr[X_i = 1] = \frac{1}{2}$  for  $i = 1, 2, 3$ . Define another random variable  $Y = X_1 X_2 \oplus X_3$ , where  $\oplus$  denotes XOR. Then  $Pr[Y = 0 | X_3 = 0] = \underline{\hspace{2cm}}$ .

**Answer key****7.15.5 Random Variable: GATE DA 2025 | Question: 29**

Consider the cumulative distribution function (CDF) of a random variable  $X$ :

$$F_X(x) = \begin{cases} 0 & x \leq -1 \\ \frac{1}{4}(x+1)^2 & -1 \leq x \leq 1 \\ 1 & x \geq 1 \end{cases}$$

The value of  $P(X^2 \leq 0.25)$  is

- A. 0.625      B. 0.25      C. 0.5      D. 0.5625

**Answer key****7.15.6 Random Variable: GATE DA 2025 | Question: 9**

Let  $X$  be a continuous random variable whose cumulative distribution function (CDF)  $F_X(x)$ , for some  $t$ , is given as follows:

$$F_X(x) = \begin{cases} 0 & x \leq t \\ \frac{x-t}{4-t} & t \leq x \leq 4 \\ 1 & x \geq 4 \end{cases}$$

If the median of  $X$  is 3, then what is the value of  $t$ ?

- A. 2      B. 1      C. -1      D. 0

**Answer key****7.15.7 Random Variable: GATE DS&AI 2024 | Question: 1**

Consider the following statements:

- i. The mean and variance of a Poisson random variable are equal.
- ii. For a standard normal random variable, the mean is zero and the variance is one.

Which **ONE** of the following options is **correct**?

- A. Both (i) and (ii) are true
- B. (i) is true and (ii) is false
- C. (ii) is true and (i) is false
- D. Both (i) and (ii) are false

gate-ds-ai-2024 probability random-variable one-mark

[Answer key](#) 

#### 7.15.8 Random Variable: GATE DS&AI 2024 | Question: 55



Two fair coins are tossed independently.  $X$  is a random variable that takes a value of 1 if both tosses are heads and 0 otherwise.  $Y$  is a random variable that takes a value of 1 if at least one of the tosses is heads and 0 otherwise.

The value of the covariance of  $X$  and  $Y$  is \_\_\_\_\_ (rounded off to three decimal places).

gate-ds-ai-2024 probability random-variable numerical-answers two-marks

[Answer key](#) 

#### 7.16

#### Square Invariant (1)

##### 7.16.1 Square Invariant: GATE CSE 2025 | Set 2 | Question: 54



A quadratic polynomial  $(x - \alpha)(x - \beta)$  over complex numbers is said to be square invariant if  $(x - \alpha)(x - \beta) = (x - \alpha^2)(x - \beta^2)$ . Suppose from the set of all square invariant quadratic polynomials we choose one at random.

The probability that the roots of the chosen polynomial are equal is \_\_\_\_\_. (rounded off to one decimal place)

gatecse2025-set2 probability square-invariant numerical-answers two-marks

[Answer key](#) 

#### 7.17

#### Statistics (2)

##### 7.17.1 Statistics: GATE CSE 2021 Set 2 | Question: 22



For a given biased coin, the probability that the outcome of a toss is a head is 0.4. This coin is tossed 1,000 times. Let  $X$  denote the random variable whose value is the number of times that head appeared in these 1,000 tosses. The standard deviation of  $X$  (rounded to 2 decimal place) is \_\_\_\_\_

gatecse-2021-set2 numerical-answers probability random-variable one-mark statistics

[Answer key](#) 

##### 7.17.2 Statistics: GATE CSE 2024 | Set 2 | Question: 34



Let  $x$  and  $y$  be random variables, not necessarily independent, that take real values in the interval  $[0, 1]$ . Let  $z = xy$  and let the mean values of  $x, y, z$  be  $\bar{x}, \bar{y}, \bar{z}$ , respectively. Which one of the following statements is TRUE?

- A.  $\bar{z} = \bar{x}\bar{y}$
- B.  $\bar{z} \leq \bar{x}\bar{y}$
- C.  $\bar{z} \geq \bar{x}\bar{y}$
- D.  $\bar{z} \leq \bar{x}$

gatecse2024-set2 probability random-variable statistics two-marks

[Answer key](#) 

#### 7.18

#### Uniform Distribution (10)

##### 7.18.1 Uniform Distribution: GATE CSE 1998 | Question: 3a



Two friends agree to meet at a park with the following conditions. Each will reach the park between 4:00 pm and 5:00 pm and will see if the other has already arrived. If not, they will wait for 10 minutes or the end of the hour whichever is earlier and leave. What is the probability that the two will not meet?

gate1998 probability normal numerical-answers uniform-distribution

[Answer key](#) 

### 7.18.2 Uniform Distribution: GATE CSE 2004 | Question: 78

Two  $n$  bit binary strings,  $S_1$  and  $S_2$  are chosen randomly with uniform probability. The probability that the Hamming distance between these strings (the number of bit positions where the two strings differ) is equal to  $d$  is

A.  $\frac{nC_d}{2^n}$

B.  $\frac{nC_d}{2^d}$

C.  $\frac{d}{2^n}$

D.  $\frac{1}{2^d}$

gatecse-2004 probability normal uniform-distribution

Answer key



### 7.18.3 Uniform Distribution: GATE CSE 2004 | Question: 80

A point is randomly selected with uniform probability in the  $X - Y$  plane within the rectangle with corners at  $(0,0), (1,0), (1,2)$  and  $(0,2)$ . If  $p$  is the length of the position vector of the point, the expected value of  $p^2$  is

A.  $\left(\frac{2}{3}\right)$

B. 1

C.  $\left(\frac{4}{3}\right)$

D.  $\left(\frac{5}{3}\right)$

gatecse-2004 probability uniform-distribution expectation normal

Answer key



### 7.18.4 Uniform Distribution: GATE CSE 2007 | Question: 24

Suppose we uniformly and randomly select a permutation from the  $20!$  permutations of  $1, 2, 3, \dots, 20$ . What is the probability that 2 appears at an earlier position than any other even number in the selected permutation?

A.  $\left(\frac{1}{2}\right)$

B.  $\left(\frac{1}{10}\right)$

C.  $\left(\frac{9!}{20!}\right)$

D. None of these

gatecse-2007 probability easy uniform-distribution

Answer key



### 7.18.5 Uniform Distribution: GATE CSE 2014 Set 1 | Question: 2

Suppose you break a stick of unit length at a point chosen uniformly at random. Then the expected length of the shorter stick is \_\_\_\_\_.

gatecse-2014-set1 probability uniform-distribution expectation numerical-answers normal

Answer key



### 7.18.6 Uniform Distribution: GATE CSE 2019 | Question: 47

Suppose  $Y$  is distributed uniformly in the open interval  $(1, 6)$ . The probability that the polynomial  $3x^2 + 6xY + 3Y + 6$  has only real roots is (rounded off to 1 decimal place) \_\_\_\_\_

gatecse-2019 numerical-answers engineering-mathematics probability uniform-distribution two-marks

Answer key



### 7.18.7 Uniform Distribution: GATE CSE 2020 | Question: 45

For  $n > 2$ , let  $a \in \{0, 1\}^n$  be a non-zero vector. Suppose that  $x$  is chosen uniformly at random from  $\{0, 1\}^n$ . Then, the probability that  $\sum_{i=1}^n a_i x_i$  is an odd number is \_\_\_\_\_

gatecse-2020 numerical-answers probability uniform-distribution two-marks

Answer key



### 7.18.8 Uniform Distribution: GATE CSE 2024 | Set 1 | Question: 4

Consider a permutation sampled uniformly at random from the set of all permutations of  $\{1, 2, 3, \dots, n\}$  for some  $n \geq 4$ . Let  $X$  be the event that 1 occurs before 2 in the permutation, and  $Y$  the event that 3 occurs before 4. Which one of the following statements is TRUE?

- A. The events  $X$  and  $Y$  are mutually exclusive  
C. Either event  $X$  or  $Y$  must occur

- B. The events  $X$  and  $Y$  are independent  
D. Event  $X$  is more likely than event  $Y$

gatecse2024-set1 probability uniform-distribution one-mark

Answer key



### 7.18.9 Uniform Distribution: GATE CSE 2025 | Set 2 | Question: 55



The unit interval  $(0,1)$  is divided at a point chosen uniformly distributed over  $(0,1)$  in  $\mathbb{R}$  into two disjoint subintervals.

The expected length of the subinterval that contains 0.4 is \_\_\_\_\_. (rounded off to two decimal places)

gatecse2025-set2 probability uniform-distribution numerical-answers two-marks

Answer key



### 7.18.10 Uniform Distribution: GATE DS&AI 2024 | Question: 46

Let  $X$  be a random variable uniformly distributed in the interval  $[1, 3]$  and  $Y$  be a random variable uniformly distributed in the interval  $[2, 4]$ . If  $X$  and  $Y$  are independent of each other, the probability  $P(X \geq Y)$  is \_\_\_\_\_ (rounded off to three decimal places).

gate-ds-ai-2024 numerical-answers random-variable probability uniform-distribution two-marks

Answer key

## 7.19

### Variance (1)



### 7.19.1 Variance: GATE DA 2025 | Question: 26

Let  $Y = Z^2$ ,  $Z = \frac{X - \mu}{\sigma}$ , where  $X$  is a normal random variable with mean  $\mu$  and variance  $\sigma^2$ . The variance of  $Y$  is

A. 1

B. 2

C. 3

D. 4

gateda-2025 probability random-variable variance two-marks

## Answer Keys

7.1.1	0.25:0.25	7.2.1	C	7.2.2	0.125	7.3.1	A	7.4.1	C
7.4.2	D	7.4.3	A	7.4.4	A	7.4.5	A	7.4.6	C
7.5.1	D	7.5.2	N/A	7.5.3	D	7.5.4	A	7.5.5	C
7.5.6	B	7.5.7	A	7.5.8	B	7.5.9	0.55	7.5.10	A
7.5.11	0.60 : 0.61	7.5.12	0.04 : 0.04	7.5.13	0.375	7.5.14	C	7.6.1	0.5
7.7.1	C	7.7.2	D	7.7.3	D	7.7.4	C	7.7.5	C
7.7.6	3.8 : 3.9	7.7.7	B	7.7.8	D	7.7.9	D	7.7.10	C
7.7.11	A	7.7.12	66.6:66.7	7.7.13	C	7.8.1	0.35 : 0.39	7.8.2	A
7.8.3	A	7.8.4	0.2	7.8.5	C	7.9.1	0.93	7.9.2	C
7.9.3	D	7.9.4	C;D	7.9.5	A;C	7.9.6	A	7.10.1	A
7.10.2	0	7.11.1	N/A	7.11.2	C	7.11.3	54	7.11.4	B
7.12.1	D	7.12.2	C	7.12.3	D	7.12.4	C	7.12.5	D
7.12.6	B	7.12.7	B	7.12.8	A	7.12.9	A	7.12.10	A
7.12.11	A	7.12.12	10	7.12.13	11.85 : 11.95	7.12.14	0.259 : 0.261	7.12.15	0.25
7.12.16	0.33 : 0.34	7.12.17	0.0230 : 0.0232	7.12.18	A	7.12.19	B;C	7.12.20	B
7.12.21	0.49:0.51	7.12.22	C	7.12.23	0.25	7.12.24	B	7.12.25	B
7.12.26	B	7.12.27	B	7.12.28	X	7.13.1	C	7.14.1	0.300:0.302
7.15.1	C	7.15.2	D	7.15.3	C	7.15.4	0.75	7.15.5	C

7.15.6	A
7.17.2	D
7.18.5	0.24 : 0.27
7.18.10	0.125

7.15.7	A
7.18.1	0.69:0.70
7.18.6	0.8
7.19.1	B

7.15.8	0.062:0.063
7.18.2	A
7.18.7	0.5

7.16.1	0.5:0.5
7.18.3	D
7.18.8	B

7.17.1	15.00 : 16.00
7.18.4	B
7.18.9	0.70:0.80



Logic: deduction and induction, Analogy, Numerical relations and reasoning

#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
1 Mark Count	2	0	0	1	1	1	0	0	0	0.63	2
2 Marks Count	0	2	0	1	1	1	1	1	0	0.88	2
Total Marks	2	4	0	3	3	3	2	2	0	2.38	4

## 8.1

## Age Relation (2)



## 8.1.1 Age Relation: GATE CSE 2010 | Question: 62

Hari(H), Gita(G), Irfan(I) and Saira(S) are siblings (i.e., brothers and sisters). All were born on 1<sup>st</sup> January. The age difference between any two successive siblings (that is born one after another) is less than three years. Given the following facts:

- i. Hari's age + Gita's age > Irfan's age + Saira's age
- ii. The age difference between Gita and Saira is one year. However Gita is not the oldest and Saira is not the youngest.
- iii. There are no twins.

In what order they were born (oldest first)?

- A. HSIG      B. SGHI      C. IGSH      D. IHSG

gatecse-2010 analytical-aptitude logical-reasoning normal age-relation

Answer key

## 8.1.2 Age Relation: GATE2013 CE: GA-10



Abhishek is elder to Savar. Savar is younger to Anshul. Which of the given conclusions is logically valid and is inferred from the above statements?

- A. Abhishek is elder to Anshul  
 C. Abhishek and Anshul are of the same age      B. Anshul is elder to Abhishek  
 D. No conclusion follows

gate2013-ce logical-reasoning age-relation

Answer key

## 8.2

## Code Words (5)



## 8.2.1 Code Words: GATE CSE 2015 Set 3 | Question: GA-1

If ROAD is written as URDG, then SWAN should be written as:

- A. VXDQ      B. VZDQ      C. VZDP      D. UXDQ

gatecse-2015-set3 analytical-aptitude easy logical-reasoning code-words code-language

Answer key

## 8.2.2 Code Words: GATE CSE 2016 Set 1 | Question: GA04



If 'relftaga' means carefree, 'otaga' means careful and 'fertaga' means careless, which of the following could mean 'aftercare'?

- A. zentaga      B. tagafer.      C. tagazen.      D. relffer.

gatecse-2016-set1 analytical-aptitude logical-reasoning normal code-words

Answer key

## 8.2.3 Code Words: GATE2014 EC-4: GA-7



If 'KCLFTSB' stands for 'best of luck' and 'SHSWDG' stands for 'good wishes', which of the following indicates 'ace the exam'?

- A. MCHTX      B. MXHTC      C. XMHCT      D. XMHTC

**Answer key****8.2.4 Code Words: GATE2018 EE: GA-7**

In a certain code, *AMCF* is written as *EQGJ* and *NKUF* is written as *ROYJ*. How will *DHLP* be written in that code?

- A. *RSTN*      B. *TLPH*      C. *HLPT*      D. *XSVR*

**Answer key****8.2.5 Code Words: GATE2019 CE-1: GA-4**

If  $E = 10$ ,  $J = 20$ ,  $O = 30$ , and  $T = 40$ , what will be  $P + E + S + T$ ?

- A. 51      B. 82      C. 120      D. 164

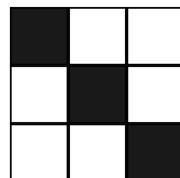
**Answer key****8.3****Coding Decoding (1)****8.3.1 Coding Decoding: GATE CSE 2025 | Set 2 | GA Question: 7**

If **IMAGE** and **FIELD** are coded as **FHBNJ** and **EMFJG** respectively then, which one among the given options is the most appropriate code for **BEACH**?

- A. **CEADP**      B. **IDBFC**      C. **JGIBC**      D. **IBCEC**

**Answer key****8.4****Counting Figure (1)****8.4.1 Counting Figure: GATE Civil 2023 Set 2 | GA Question: 3**

In how many ways can cells in a  $3 \times 3$  grid be shaded, such that each row and each column have exactly one shaded cell? An example of one valid shading is shown.



- A. 2      B. 9      C. 3      D. 6

**Answer key****8.5****Direction Sense (12)****8.5.1 Direction Sense: GATE CSE 2015 Set 2 | Question: GA-7**

Four branches of a company are located at **M**, **N**, **O** and **P**. **M** is north of **N** at a distance of 4 km; **P** is south of **O** at a distance of 2 km; **N** is southeast of **O** by 1 km. What is the distance between **M** and **P** in km?

- A. 5.34      B. 6.74      C. 28.5      D. 45.49

**Answer key**

### 8.5.2 Direction Sense: GATE CSE 2017 Set 2 | Question: GA-3

There are five buildings called  $V$ ,  $W$ ,  $X$ ,  $Y$  and  $Z$  in a row (not necessarily in that order).  $V$  is to the West of  $W$ .  $Z$  is to the East of  $X$  and the West of  $V$ .  $W$  is to the West of  $Y$ . Which is the building in the middle?

- A.  $V$       B.  $W$       C.  $X$       D.  $Y$

gatecse-2017-set2 analytical-aptitude direction-sense normal

[Answer key](#)



### 8.5.3 Direction Sense: GATE CSE 2019 | Question: GA-10

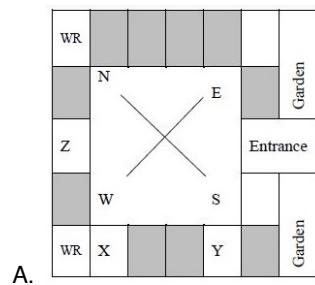
Three of the five students are allocated to a hostel put in special requests to the warden, Given the floor plan of the vacant rooms, select the allocation plan that will accommodate all their requests.

Request by X: Due to pollen allergy, I want to avoid a wing next to the garden.

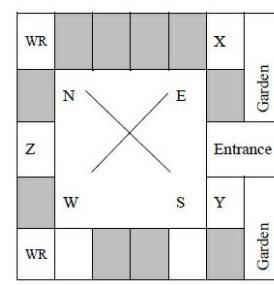
Request by Y: I want to live as far from the washrooms as possible, since I am very much sensitive to smell.

Request by Z: I believe in Vaastu and so I want to stay in South-West wing.

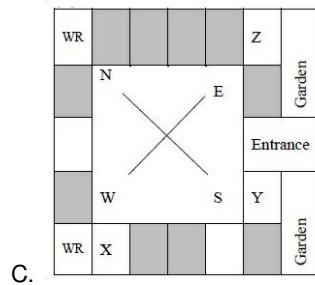
The shaded rooms are already occupied. WR is washroom



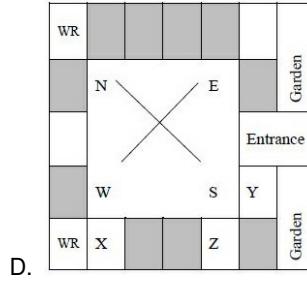
A.



B.



C.



D.

gatecse-2019 general-aptitude analytical-aptitude direction-sense two-marks

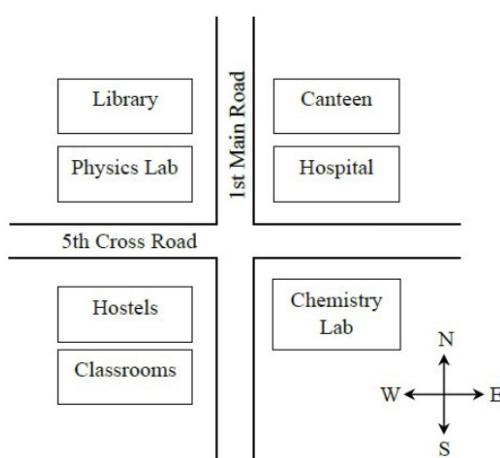
[Answer key](#)

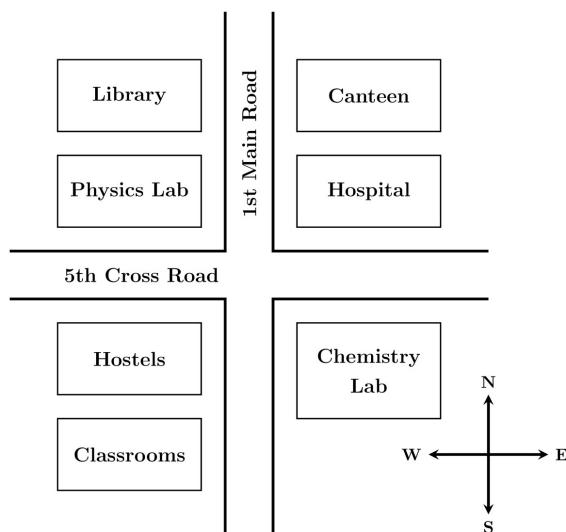


### 8.5.4 Direction Sense: GATE CSE 2025 | Set 1 | GA Question: 5

According to the map shown in the figure, which one of the following statements is correct?

Note: The figure shown is representative.





- A. The library is located to the northwest of the canteen.
- B. The hospital is located to the east of the chemistry lab.
- C. The chemistry lab is to the southeast of physics lab.
- D. The classrooms and canteen are next to each other.

gatecse2025-set1 analytical-aptitude direction-sense one-mark

**Answer key**

#### 8.5.5 Direction Sense: GATE Civil 2021 Set 2 | GA Question: 6

On a planar field, you travelled 3 units East from a point  $O$ . Next you travelled 4 units South to arrive at point  $P$ . Then you travelled from  $P$  in the North-East direction such that you arrive at a point that is 6 units East of point  $O$ . Next, you travelled in the North-West direction, so that you arrive at point  $Q$  that is 8 units North of point  $P$ . The distance of point  $Q$  to point  $O$ , in the same units, should be \_\_\_\_\_

- A. 3
- B. 4
- C. 5
- D. 6

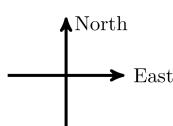
gatecivil-2021-set2 analytical-aptitude direction-sense

**Answer key**

#### 8.5.6 Direction Sense: GATE Civil 2022 Set 2 | GA Question: 10

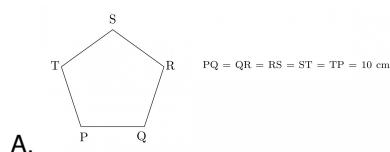
An ant walks in a straight line on a plane leaving behind a trace of its movement. The initial position of the ant is at point  $P$  facing east.

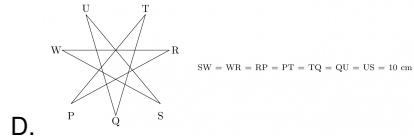
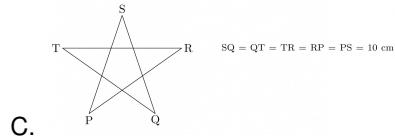
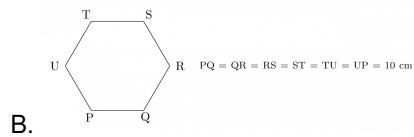
The ant first turns  $72^\circ$  anticlockwise at  $P$ , and then does the following two steps in sequence exactly FIVE times before halting.



1. moves forward for 10 cm.
2. turns  $144^\circ$  clockwise.

The pattern made by the trace left behind by the ant is





gatecivil-2022-set2 analytical-aptitude direction-sense

[Answer key](#)

#### 8.5.7 Direction Sense: GATE Mechanical 2021 Set 1 | GA Question: 2

Ms. X came out of a building through its front door to find her shadow due to the morning sun failing to her right side with the building to her back. From this, it can be inferred that building is facing \_\_\_\_\_

- A. North      B. East      C. West      D. South

gateme-2021-set1 analytical-aptitude direction-sense

[Answer key](#)

#### 8.5.8 Direction Sense: GATE Mechanical 2021 Set 2 | GA Question: 5

The front door of Mr. X's house faces East. Mr. X leaves the house, walking 50 m straight from the back door that is situated directly opposite to the front door. He then turns to his right, walks for another 50 m and stops. The direction of the point Mr. X is now located at with respect to the starting point is \_\_\_\_\_

- A. South-East      B. North-East      C. West      D. North-West

gateme-2021-set2 analytical-aptitude direction-sense

[Answer key](#)

#### 8.5.9 Direction Sense: GATE2014 AG: GA-9

X is 1 km northeast of Y. Y is 1 km southeast of Z. W is 1 km west of Z. P is 1 km south of W. Q is 1 km east of P. What is the distance between X and Q in km?

- A. 1      B.  $\sqrt{2}$       C.  $\sqrt{3}$       D. 2

gate2014-ag analytical-aptitude direction-sense normal

[Answer key](#)

#### 8.5.10 Direction Sense: GATE2015 CE-2: GA-4

Mr. Vivek walks 6 meters North-east, then turns and walks 6 meters South-east, both at 60 degrees to east. He further moves 2 meters South and 4 meters West. What is the straight distance in meters between the point he started from and the point he finally reached?

- A.  $2\sqrt{2}$       B. 2      C.  $\sqrt{2}$       D.  $1/\sqrt{2}$

gate2015-ce-2 analytical-aptitude general-aptitude direction-sense

[Answer key](#)

#### 8.5.11 Direction Sense: GATE2016 EC-2: GA-9

M and N start from the same location. M travels 10 km East and then 10 km North-East. N travels 5 km South and then 4 km South-East. What is the shortest distance (in km) between M and N at the end of their travel?

A. 18.60

B. 22.50

C. 20.61

D. 25.00

gate2016-ec-2 direction-sense analytical-aptitude

Answer key 

#### 8.5.12 Direction Sense: GATE2017 EC-2: GA-4

Fatima starts from point  $P$ , goes North for 3 km, and then East for 4 km to reach point  $Q$ . She then turns to face point  $P$  and goes 15 km in that direction. She then goes North for 6 km. How far is she from point  $P$ , and in which direction should she go to reach point  $P$ ?

A. 8 km, East

B. 12 km, North

C. 6 km, East

D. 10 km, North

gate2017-ec-2 general-aptitude analytical-aptitude direction-sense

Answer key 

8.6

#### Family Relationship (7)

##### 8.6.1 Family Relationship: GATE CSE 2025 | Set 1 | GA Question: 4

Consider the relationships among  $P, Q, R, S$ , and  $T$ :

- $P$  is the brother of  $Q$ .
- $S$  is the daughter of  $Q$ .
- $T$  is the sister of  $S$ .
- $R$  is the mother of  $Q$ .

The following statements are made based on the relationships given above.

1.  $R$  is the grandmother of  $S$ .
2.  $P$  is the uncle of  $S$  and  $T$ .
3.  $R$  has only one son.
4.  $Q$  has only one daughter.

Which one of the following options is correct?

- |                               |                               |
|-------------------------------|-------------------------------|
| A. Both (1) and (2) are true. | B. Both (1) and (3) are true. |
| C. Only (3) is true.          | D. Only (4) is true.          |

gatecse2025-set1 analytical-aptitude logical-reasoning family-relationship one-mark

Answer key 

##### 8.6.2 Family Relationship: GATE Civil 2021 Set 1 | GA Question: 6

Statement: Either  $P$  marries  $Q$  or  $X$  marries  $Y$

Among the options below, the logical NEGATION of the above statement is :

- A.  $P$  does not marry  $Q$  and  $X$  marries  $Y$
- B. Neither  $P$  marries  $Q$  nor  $X$  marries  $Y$
- C.  $X$  does not marry  $Y$  and  $P$  marries  $Q$
- D.  $P$  marries  $Q$  and  $X$  marries  $Y$

gatcivil-2021-set1 analytical-aptitude logical-reasoning family-relationship

Answer key 

##### 8.6.3 Family Relationship: GATE Civil 2022 Set 1 | GA Question: 4

Given the statements:

- $P$  is the sister of  $Q$ .
- $Q$  is the husband of  $R$ .
- $R$  is the mother of  $S$ .
- $T$  is the husband of  $P$ .

Based on the above information,  $T$  is \_\_\_\_\_ of  $S$ .

- A. the grandfather      B. an uncle      C. the father      D. a brother

gatecivil-2022-set1 analytical-aptitude logical-reasoning family-relationship

Answer key 

#### 8.6.4 Family Relationship: GATE2016 EC-3: GA-3

M has a son Q and a daughter R. He has no other children. E is the mother of P and daughter-inlaw of M. How is P related to M?

- A. P is the son-in-law of M.  
C. P is the daughter-in law of M.
- B. P is the grandchild of M.  
D. P is the grandfather of M.

gate2016-ec-3 family-relationship logical-reasoning

Answer key 

#### 8.6.5 Family Relationship: GATE2017 EC-2: GA-7

Each of P, Q, R, S, W, X, Y and Z has been married at most once. X and Y are married and have two children P and Q. Z is the grandfather of the daughter S of P. Further, Z and W are married and are parents of R. Which one of the following must necessarily be FALSE?

- A. X is the mother-in-law of R  
C. P is a son of X and Y
- B. P and R are not married to each other  
D. Q cannot be married to R

gate2017-ec-2 general-aptitude logical-reasoning family-relationship

Answer key 

#### 8.6.6 Family Relationship: GATE2019 CE-1: GA-10

P, Q, R, S, and T are related and belong to the same family. P is the brother of S, Q is the wife of P. R and T are the children of the siblings P and S respectively. Which one of the following statement is necessarily FALSE?

- A. S is the aunt of R  
C. S is the sister-in-law of Q
- B. S is the aunt of T  
D. S is the brother of P

gate2019-ce-1 general-aptitude logical-reasoning family-relationship

Answer key 

#### 8.6.7 Family Relationship: GATE2019 ME-1: GA-10

M and N had four children P, Q, R and S. Of them, only P and R were married. They had children X and Y respectively. If Y is a legitimate child of W, which of the following statements is necessarily FALSE?

- A. M is the grandmother of Y  
C. W is the wife of R
- B. R is the father of Y  
D. W is the wife of P

gate2019-me-1 analytical-aptitude family-relationship

Answer key 

### 8.7

#### Inequality (1)

##### 8.7.1 Inequality: GATE2014 EC-3: GA-5

In which of the following options will the expression  $P < M$  be definitely true?

- A.  $M < R > P > S$   
C.  $Q < M < F = P$
- B.  $M > S < P < F$   
D.  $P = A < R < M$

gate2014-ec-3 logical-reasoning analytical-aptitude inequality

Answer key 

### 8.8

#### Logical Inference (1)

##### 8.8.1 Logical Inference: GATE CSE 2025 | Set 2 | GA Question: 6

Based only on the conversation below, identify the logically correct inference:

"Even if I had known that you were in the hospital, I would not have gone there to see you", Ramya told Josephine.

- A. Ramya knew that Josephine was in the hospital.  
B. Ramya did not know that Josephine was in the hospital.

- C. Ramya and Josephine were once close friends; but now, they are not.  
D. Josephine was in the hospital due to an injury to her leg.

gatecse2025-set2 analytical-aptitude logical-inference two-marks

**Answer key**

**8.9**

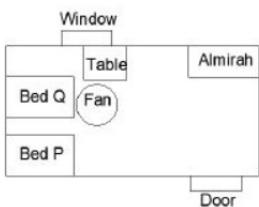
### Logical Reasoning (39)



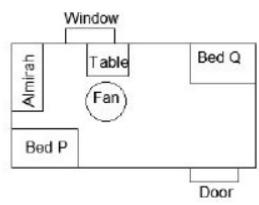
#### 8.9.1 Logical Reasoning: GATE 2024 Electrical | GA Question: 2

P and Q have been allotted a hostel room with two beds, a study table, and an almirah. P is an avid bird-watcher and wants to sit at the table and watch birds outside the window. Q does not mind that as long as his bed is close to the ceiling fan.

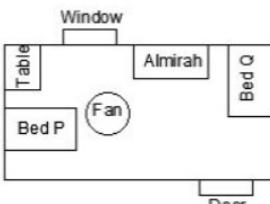
Which one of the following arrangements suits them the most?



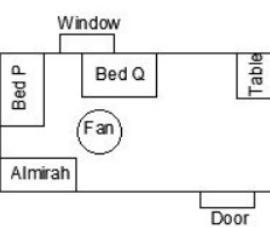
A.



B.



C.



D.

gate2024-ee analytical-aptitude logical-reasoning

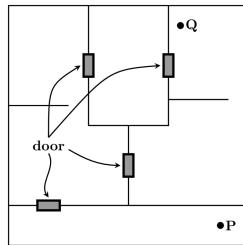
**Answer key**



#### 8.9.2 Logical Reasoning: GATE CH 2022 | GA Question: 5

A building has several rooms and doors as shown in the top view of the building given below. The doors are closed initially.

What is the minimum number of doors that need to be opened in order to go from the point P to the point Q?



A. 4

B. 3

C. 2

D. 1

gatech-2022 analytical-aptitude logical-reasoning

Answer key

**8.9.3 Logical Reasoning: GATE CSE 2010 | Question: 61**If  $137 + 276 = 435$  how much is  $731 + 672$ ?

A. 534

B. 1403

C. 1623

D. 1513

gatecse-2010 analytical-aptitude normal logical-reasoning

Answer key

**8.9.4 Logical Reasoning: GATE CSE 2015 Set 3 | Question: GA-7**

The head of newly formed government desires to appoint five of the six selected members  $P, Q, R, S, T$  and  $U$  to portfolios of Home, Power, Defense, Telecom, and Finance.  $U$  does not want any portfolio if  $S$  gets one of the five.  $R$  wants either Home or Finance or no portfolio.  $Q$  says that if  $S$  gets Power or Telecom, then she must get the other one.  $T$  insists on a portfolio if  $P$  gets one.

Which is the valid distribution of portfolios?

- A.  $P$ -Home,  $Q$ -Power,  $R$ -Defense,  $S$ -Telecom,  $T$ -Finance
- B.  $R$ -Home,  $S$ -Power,  $P$ -Defense,  $Q$ -Telecom,  $T$ -Finance
- C.  $P$ -Home,  $Q$ -Power,  $T$ -Defense,  $S$ -Telecom,  $U$ -Finance
- D.  $Q$ -Home,  $U$ -Power,  $T$ -Defense,  $R$ -Telecom,  $P$ -Finance

gatecse-2015-set3 analytical-aptitude normal logical-reasoning

Answer key

**8.9.5 Logical Reasoning: GATE CSE 2017 Set 2 | Question: GA-7**

There are three boxes. One contains apples, another contains oranges and the last one contains both apples and oranges. All three are known to be incorrectly labeled. If you are permitted to open just one box and then pull out and inspect only one fruit, which box would you open to determine the contents of all three boxes?

- A. The box labeled 'Apples'
- B. The box labeled 'Apples and Oranges'
- C. The box labeled 'Oranges'
- D. Cannot be determined

gatecse-2017-set2 analytical-aptitude normal tricky logical-reasoning

Answer key

**8.9.6 Logical Reasoning: GATE CSE 2021 Set 2 | GA Question: 10**

Six students  $P, Q, R, S, T$  and  $U$ , with distinct heights, compare their heights and make the following observations.

- Observation I:  $S$  is taller than  $R$ .
- Observation II:  $Q$  is the shortest of all.
- Observation III:  $U$  is taller than only one student.
- Observation IV:  $T$  is taller than  $S$  but is not the tallest

The number of students that are taller than  $R$  is the same as the number of students shorter than \_\_\_\_\_.A.  $T$ B.  $R$ C.  $S$ D.  $P$ 

gatecse-2021-set2 analytical-aptitude logical-reasoning two-marks

[Answer key](#)

### 8.9.7 Logical Reasoning: GATE CSE 2023 | GA Question: 4



A survey for a certain year found that 90% of pregnant women received medical care at least once before giving birth. Of these women, 60% received medical care from doctors, while 40% received medical care from other healthcare providers.

Given this information, which one of the following statements can be inferred with *certainty*?

- A. More than half of the pregnant women received medical care at least once from a doctor.
- B. Less than half of the pregnant women received medical care at least once from a doctor.
- C. More than half of the pregnant women received medical care at most once from a doctor.
- D. Less than half of the pregnant women received medical care at most once from a doctor.

gatecse-2023 analytical-aptitude logical-reasoning one-mark

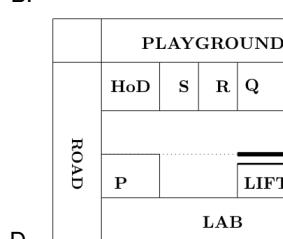
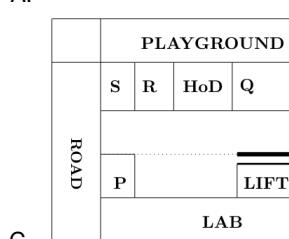
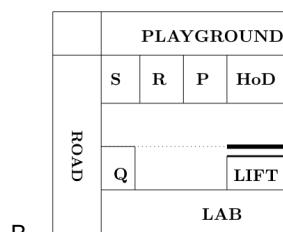
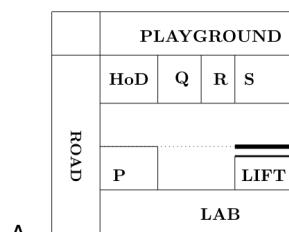
[Answer key](#)

### 8.9.8 Logical Reasoning: GATE Civil 2020 Set 2 | GA Question: 4



After the inauguration of the new building, the Head of the Department (HoD) collated faculty preferences for office space. *P* wanted a room adjacent to the lab. *Q* wanted to be close to the lift. *R* wanted a view of the playground and *S* wanted a corner office.

Assuming that everyone was satisfied, which among the following shows a possible allocation?



gate2020-ce-2 analytical-aptitude logical-reasoning

[Answer key](#)

### 8.9.9 Logical Reasoning: GATE Civil 2022 Set 1 | GA Question: 9

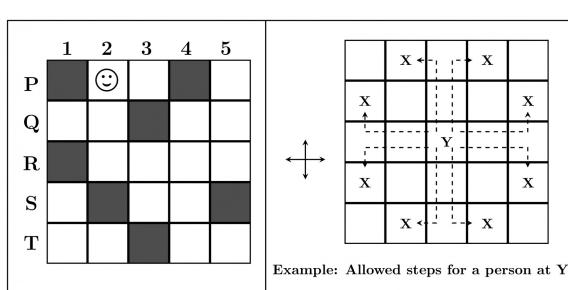


In the square grid shown on the left, a person standing at P2 position is required to move to P5 position.

The only movement allowed for a step involves, “two moves along one direction followed by one move in a perpendicular direction”. The permissible directions for movement are shown as dotted arrows in the right.

For example, a person at a given position Y can move only to the positions marked X on the right.

Without occupying any of the shaded squares at the end of each step, the minimum number of steps required to go from P2 to P5 is



A. 4

B. 5

C. 6

D. 7

gatecivil-2022-set1 analytical-aptitude logical-reasoning

Answer key 

### 8.9.10 Logical Reasoning: GATE Civil 2023 Set 2 | GA Question: 6



Elvesland is a country that has peculiar beliefs and practices. They express almost all their emotions by gifting flowers. For instance, if anyone gifts a white flower to someone, then it is always taken to be a declaration of one's love for that person. In a similar manner, the gifting of a yellow flower to someone often means that one is angry with that person.

Based only on the information provided above, which one of the following sets of statement(s) can be logically inferred with *certainty*?

- i. In Elvesland, one always declares one's love by gifting a white flower.
- ii. In Elvesland, all emotions are declared by gifting flowers.
- iii. In Elvesland, sometimes one expresses one's anger by gifting a flower that is not yellow.
- iv. In Elvesland, sometimes one expresses one's love by gifting a white flower

A. only (ii)

B. (i), (ii) and (iii)

C. (i), (iii) and (iv)

D. only (iv)

gatecivil-2022-set2 analytical-aptitude logical-reasoning

Answer key 

### 8.9.11 Logical Reasoning: GATE ECE 2023 | GA Question: 9



Out of 1000 individuals in a town, 100 unidentified individuals are covid positive. Due to lack of adequate covid-testing kits, the health authorities of the town devised a strategy to identify these covid-positive individuals. The strategy is to:

- i. Collect saliva samples from all 1000 individuals and randomly group them into sets of 5.
- ii. Mix the samples within each set and test the mixed sample for covid.
- iii. If the test done in (ii) gives a negative result, then declare all the 5 individuals to be covid negative.
- iv. If the test done in (ii) gives a positive result, then all the 5 individuals are separately tested for covid.

Given this strategy, no more than \_\_\_\_\_ testing kits will be required to identify all the 100 covid positive individuals irrespective of how they are grouped.

A. 700

B. 600

C. 800

D. 1000

gateece-2023 analytical-aptitude logical-reasoning

Answer key 

### 8.9.12 Logical Reasoning: GATE ECE 2024 | GA Question: 2



P, Q, R, S, and T have launched a new startup. Two of them are siblings. The office of the startup has just three rooms. All of them agree that the siblings should not share the same room.

If S and Q are single children, and the room allocations shown below are acceptable to all.

PR	TS	Q
----	----	---

PQ	RT	S
----	----	---

then, which one of the given options is the siblings?

A. P and T  
C. T and Q

B. P and S  
D. T and R

gateece-2024 logical-reasoning analytical-aptitude

Answer key 

### 8.9.13 Logical Reasoning: GATE Electrical 2023 | GA Question: 4



A recent survey shows that 65% of tobacco users were advised to stop consuming tobacco. The survey also shows that 3 out of 10 tobacco users attempted to stop using tobacco.

Based only on the information in the above passage, which one of the following options can be logically inferred with *certainty*?

- A. A majority of tobacco users who were advised to stop consuming tobacco made an attempt to do so.
- B. A majority of tobacco users who were advised to stop consuming tobacco did not attempt to do so.
- C. Approximately 30% of tobacco users successfully stopped consuming tobacco.
- D. Approximately 65% of tobacco users successfully stopped consuming tobacco.

gate2023-ee analytical-aptitude logical-reasoning

[Answer key](#)

### 8.9.14 Logical Reasoning: GATE Electrical 2023 | GA Question: 6



Students of all the departments of a college who have successfully completed the registration process are eligible to vote in the upcoming college elections. However, by the time the due date for registration was over, it was found that surprisingly none of the students from the Department of Human Sciences had completed the registration process.

Based only on the information provided above, which one of the following sets of statement(s) can be logically inferred with *certainty*?

- i. All those students who would not be eligible to vote in the college elections would certainly belong to the Department of Human Sciences.
  - ii. None of the students from departments other than Human Sciences failed to complete the registration process within the due time.
  - iii. All the eligible voters would certainly be students who are not from the Department of Human Sciences.
- 
- A. (i) and (ii)
  - B. (i) and (iii)
  - C. only (i)
  - D. only (iii)

gate2023-ee analytical-aptitude logical-reasoning

[Answer key](#)

### 8.9.15 Logical Reasoning: GATE IN 2023 | GA Question: 6



Residency is a famous housing complex with many well-established individuals among its residents. A recent survey conducted among the residents of the complex revealed that all of those residents who are well established in their respective fields happen to be academicians. The survey also revealed that most of these academicians are authors of some best-selling books.

Based only on the information provided above, which one of the following statements can be logically inferred with *certainty*?

- A. Some residents of the complex who are well established in their fields are also authors of some best-selling books.
- B. All academicians residing in the complex are well established in their fields.
- C. Some authors of best-selling books are residents of the complex who are well established in their fields.
- D. Some academicians residing in the complex are well established in their fields.

gatein-2023 analytical-aptitude logical-reasoning

[Answer key](#)

### 8.9.16 Logical Reasoning: GATE IN 2023 | GA Question: 8



The information contained in DNA is used to synthesize proteins that are necessary for the functioning of life. DNA is composed of four nucleotides: Adenine (A), Thymine (T), Cytosine (C), and Guanine (G). The information contained in DNA can then be thought of as a sequence of these four nucleotides: A, T, C, and G. DNA has coding and non-coding regions. Coding regions-where the sequence of these nucleotides are read in groups of three to produce individual amino acids - constitute only about 2% of human DNA. For example, the triplet of nucleotides CCG codes for the amino acid glycine, while the triplet GGA codes for the amino acid proline. Multiple amino acids are then assembled to form a protein.

Based only on the information provided above, which of the following statements can be logically inferred with certainty?

- i. The majority of human DNA has no role in the synthesis of proteins.
- ii. The function of about 98% of human DNA is not understood.

A. only (i)  
C. both (i) and (ii)

B. only (ii)  
D. neither (i) nor (ii)

gatein-2023 analytical-aptitude logical-reasoning

Answer key 

#### 8.9.17 Logical Reasoning: GATE Mechanical 2021 Set 1 | GA Question: 4

If  $\left\{ \begin{array}{l} “\oplus” \text{ means } “-” \\ “\otimes” \text{ means } “\div” \\ “\triangle” \text{ means } “+” \\ “\triangledown” \text{ means } “\times” \end{array} \right.$



then, the value of the expression  $\triangle 2 \oplus 3\triangle ((4 \otimes 2) \triangledown 4) =$

- A. -1      B. -0.5      C. 6      D. 7

gateme-2021-set1 analytical-aptitude logical-reasoning

Answer key 



#### 8.9.18 Logical Reasoning: GATE Mechanical 2021 Set 2 | GA Question: 4

If  $\oplus \div \odot = 2$ ;  $\oplus \div \Delta = 3$ ;  $\odot + \Delta = 5$ ;  $\Delta \times \otimes = 10$ ,



Then, the value of  $(\otimes - \oplus)^2$ , is :

- A. 0      B. 1      C. 4      D. 16

gateme-2021-set2 analytical-aptitude logical-reasoning

Answer key 



#### 8.9.19 Logical Reasoning: GATE Mechanical 2022 Set 1 | GA Question: 4

Four girls P, Q, R and S are studying languages in a University. P is learning French and Dutch. Q is learning Chinese and Japanese. R is learning Spanish and French. S is learning Dutch and Japanese.

Given that: French is easier than Dutch; Chinese is harder than Japanese; Dutch is easier than Japanese, and Spanish is easier than French.

Based on the above information, which girl is learning the most difficult pair of languages?

- A. P      B. Q      C. R      D. S

gateme-2022-set1 analytical-aptitude logical-reasoning

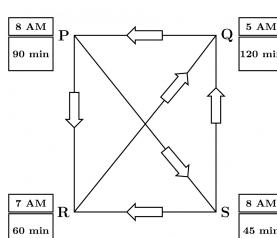
Answer key 



#### 8.9.20 Logical Reasoning: GATE Mechanical 2022 Set 2 | GA Question: 9

Four cities P, Q, R and S are connected through one-way routes as shown in the figure. The travel time between any two connected cities is one hour. The boxes beside each city name describe the starting time of first train of the day and their frequency of operation. For example, from city P, the first trains of the day start at 8 AM with a frequency of 90 minutes to each of R and S. A person does not spend additional time at any city other than the waiting time for the next connecting train.

If the person starts from R at 7 AM and is required to visit S and return to R, what is the minimum time required?



- A. 6 hours 30 minutes  
C. 4 hours 30 minutes

- B. 3 hours 45 minutes  
D. 5 hours 15 minutes

gateme-2022-set2 analytical-aptitude logical-reasoning

Answer key 

#### 8.9.21 Logical Reasoning: GATE2011 GG: GA-8

Three sisters ( $R$ ,  $S$ , and  $T$ ) received a total of 24 toys during Christmas. The toys were initially divided among them in a certain proportion. Subsequently,  $R$  gave some toys to  $S$  which doubled the share of  $S$ . Then  $S$  in turn gave some of her toys to  $T$ , which doubled  $T$ 's share. Next, some of  $T$ 's toys were given to  $R$ , which doubled the number of toys that  $R$  currently had. As a result of all such exchanges, the three sisters were left with equal number of toys. How many toys did  $R$  have originally?

- A. 8      B. 9      C. 11      D. 12

gate2011-gg logical-reasoning analytical-aptitude

Answer key 

#### 8.9.22 Logical Reasoning: GATE2011 MN: GA-63

$L$ ,  $M$  and  $N$  are waiting in a queue meant for children to enter the zoo. There are 5 children between  $L$  and  $M$ , and 8 children between  $M$  and  $N$ . If there are 3 children ahead of  $N$  and 21 children behind  $L$ , then what is the minimum number of children in the queue?

- A. 28      B. 27      C. 41      D. 40

analytical-aptitude gate2011-mn logical-reasoning

Answer key 

#### 8.9.23 Logical Reasoning: GATE2012 AR: GA-8

Ravi is taller than Arun but shorter than Iqbal. Sam is shorter than Ravi. Mohan is shorter than Arun. Balu is taller than Mohan and Sam. The tallest person can be

- A. Mohan      B. Ravi      C. Balu      D. Arun

gate2012-ar logical-reasoning

Answer key 

#### 8.9.24 Logical Reasoning: GATE2012 CY: GA-9

There are eight bags of rice looking alike, seven of which have equal weight and one is slightly heavier. The weighing balance is of unlimited capacity. Using this balance, the minimum number of weighings required to identify the heavier bag is

- A. 2      B. 3      C. 4      D. 8

gate2012-cy analytical-aptitude logical-reasoning

Answer key 

#### 8.9.25 Logical Reasoning: GATE2014 AE: GA-7

Anuj, Bhola, Chandan, Dilip, Eswar and Faisal live on different floors in a six-storeyed building (the ground floor is numbered 1, the floor above it 2, and so on) Anuj lives on an even-numbered floor, Bhola does not live on an odd numbered floor. Chandan does not live on any of the floors below Faisal's floor. Dilip does not live on floor number 2. Eswar does not live on a floor immediately above or immediately below Bhola. Faisal lives three floors above Dilip. Which of the following floor-person combinations is correct?

	Anuj	Bhola	Chandan	Dilip	Eswar	Faisal
(A)	6	2	5	1	3	4
(B)	2	6	5	1	3	4
(C)	4	2	6	3	1	5
(D)	2	4	6	1	3	5

gate2014-ae logical-reasoning analytical-aptitude descriptive

Answer key 

### 8.9.26 Logical Reasoning: GATE2014 EC-2: GA-7

Lights of four colors (red, blue, green, yellow) are hung on a ladder. On every step of the ladder there are two lights. If one of the lights is red, the other light on that step will always be blue. If one of the lights on a step is green, the other light on that step will always be yellow. Which of the following statements is not necessarily correct?

- A. The number of red lights is equal to the number of blue lights
- B. The number of green lights is equal to the number of yellow lights
- C. The sum of the red and green lights is equal to the sum of the yellow and blue lights
- D. The sum of the red and blue lights is equal to the sum of the green and yellow lights

gate2014-ec-2 analytical-aptitude logical-reasoning normal

Answer key 

### 8.9.27 Logical Reasoning: GATE2015 EC-1: GA-4

Operators  $\square$ ,  $\diamond$  and  $\rightarrow$  are defined by:  $a \square b = \frac{a-b}{a+b}$ ;  $a \diamond b = \frac{a+b}{a-b}$ ;  $a \rightarrow b = ab$ .

Find the value of  $(66 \square 6) \rightarrow (66 \diamond 6)$ .

- A. -2
- B. -1
- C. 1
- D. 2

gate2015-ec-1 logical-reasoning easy

Answer key 

### 8.9.28 Logical Reasoning: GATE2016 EC-1: GA-5

Michael lives 10 km away from where I live. Ahmed lives 5 km away and Susan lives 7 km away from where I live. Arun is farther away than Ahmed but closer than Susan from where I live. From the information provided here, what is one possible distance (in km) at which I live from Arun's place?

- A. 3.00
- B. 4.99
- C. 6.02
- D. 7.01

gate2016-ec-1 logical-reasoning analytical-aptitude

Answer key 

### 8.9.29 Logical Reasoning: GATE2016 EC-3: GA-8

A flat is shared by four first year undergraduate students. They agreed to allow the oldest of them to enjoy some extra space in the flat. Manu is two months older than Sravan, who is three months younger than Trideep. Pavan is one month older than Sravan. Who should occupy the extra space in the flat?

- A. Manu
- B. Sravan
- C. Trideep
- D. Pavan

gate2016-ec-3 logical-reasoning

Answer key 

### 8.9.30 Logical Reasoning: GATE2017 CE-1: GA-7

Students applying for hostel rooms are allotted rooms in order of seniority. Students already staying in a room will move if they get a room in their preferred list. Preferences of lower ranked applicants are ignored during allocation.

Given the data below, which room will Ajit stay in ?

Names	Student seniority	Current room	Room preference list
Amar	1	P	R, S, Q
Akbar	2	None	R, S
Anthony	3	Q	P
Ajit	4	S	Q, P, R

A. *P*B. *Q*C. *R*D. *S*

gate2017-ce-1 logical-reasoning normal

Answer key

**8.9.31 Logical Reasoning: GATE2017 CE-2: GA-3**

Four cards lie on table. Each card has a number printed on one side and a colour on the other. The faces visible on the cards are 2, 3, red, and blue.

Proposition: If a card has an even value on one side, then its opposite face is red.

The card which MUST be turned over to verify the above proposition are

A. 2, red

B. 2, 3, red

C. 2, blue

D. 2, red, blue

gate2017-ce-2 logical-reasoning propositional-logic

Answer key

**8.9.32 Logical Reasoning: GATE2017 EC-2: GA-3**

A rule states that in order to drink beer, one must be over 18 years old. In a bar, there are 4 people. *P* is 16 years old. *Q* is 25 years old. *R* is drinking milkshake and *S* is drinking a beer. What must be checked to ensure that the rule is being followed?

A. Only *P*'s drinkC. Only *S*'s ageB. Only *P*'s drink and *S*'s ageD. Only *P*'s drink, *Q*'s drink and *S*'s age

gate2017-ec-2 general-aptitude analytical-aptitude logical-reasoning

Answer key

**8.9.33 Logical Reasoning: GATE2017 ME-1: GA-5**

*P*, *Q* and *R* talk about *S*'s car collection. *P* states that *S* has at least 3 cars. *Q* believes that *S* has less than 3 cars. *R* indicates that to his knowledge, *S* has at least one car. Only one of *P*, *Q* and *R* is right. The number of cars owned by *S* is.

A. 0

C. 3

B. 1

D. Cannot be determined.

gate2017-me-1 general-aptitude logical-reasoning

Answer key

**8.9.34 Logical Reasoning: GATE2017 ME-2: GA-5**

*P* looks at *Q* while *Q* looks at *R*. *P* is married, *R* is not. The number of pairs of people in which a married person is looking at an unmarried person is

A. 0

C. 2

B. 1

D. Cannot be determined.

gate2017-me-2 analytical-aptitude logical-reasoning

Answer key

**8.9.35 Logical Reasoning: GATE2018 CE-1: GA-10**

Each of the letters arranged as below represents a unique integer from 1 to 9. The letters are positioned in the figure such that  $(A \times B \times C), (B \times G \times E)$  and  $(D \times E \times F)$  are equal. Which integer among the following choices cannot be represented by the letters *A*, *B*, *C*, *D*, *E*, *F* or *G*?





A. 4

B. 5

C. 6

D. 9

gate2018-ce-1 general-aptitude analytical-aptitude logical-reasoning

Answer key

**8.9.36 Logical Reasoning: GATE2018 EE: GA-10**

*P, Q, R, and S* crossed a lake in a boat that can hold a maximum of two persons, with only one set of oars. The following additional facts are available.

- The boat held two persons on each of the three forward trips across the lake and one person on each of the two return trips.
- P* is unable to row when someone else is in the boat.
- Q* is unable to row with anyone else except *R*.
- Each person rowed for at least one trip.
- Only one person can row during a trip.

Who rowed twice?

A. *P*B. *Q*C. *R*D. *S*

analytical-aptitude normal gate2018-ee logical-reasoning

Answer key

**8.9.37 Logical Reasoning: GATE2019 CE-2: GA-6**

Mohan, the manager, wants his four workers to work in pairs. No pair should work for more than 5 hours. Ram and John have worked together for 5 hours. Krishna and Amir have worked as a team for 2 hours. Krishna does not want to work with Ram. Whom should Mohan allot to work with John, if he wants all the workers to continue working?

A. Amir

B. Krishna

C. Ram

D. None of three

gate2019-ce-2 general-aptitude logical-reasoning

Answer key

**8.9.38 Logical Reasoning: GATE2019 EE: GA-10**

Consider five people- Mita, Ganga, Rekha, Lakshmi, and Sana. Ganga is taller than both Rekha and Lakshmi. Lakshmi is taller than Sana. Mita is taller than Ganga.

Which of the following conclusions are true?

- Lakshmi is taller than Rekha
- Rekha is shorter than Mita
- Rekha is taller than Sana
- Sana is shorter than Ganga

A. 1 and 3

B. 3 only

C. 2 and 4

D. 1 only

gate2019-ee general-aptitude logical-reasoning

Answer key

**8.9.39 Logical Reasoning: GATE2019 IN: GA-4**

Five numbers 10, 7, 5, 4 and 2 are to be arranged in a sequence from left to right following the directions given below:

- No two odd or even numbers are next to each other.
- The second number from the left is exactly half of the left-most number.
- The middle number is exactly twice the right-most number.

Which is the second number from the right?

A. 2

B. 4

C. 7

D. 10

gate2019-in general-aptitude analytical-aptitude logical-reasoning

[Answer key](#)

8.10

### Number Relations (3)

#### 8.10.1 Number Relations: GATE CSE 2024 | Set 2 | GA Question: 10



In the  $4 \times 4$  array shown below, each cell of the first three rows has either a cross ( $X$ ) or a number.

1	X	4	3
X	5	5	4
3	X	6	X

The number in a cell represents the count of the immediate neighboring cells (left, right, top, bottom, diagonals) NOT having a cross ( $X$ ). Given that the last row has no crosses ( $X$ ), the sum of the four numbers to be filled in the last row is

- A. 11      B. 10      C. 12      D. 9

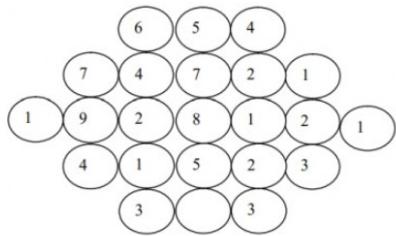
gatecse2024-set2 analytical-aptitude number-relations two-marks

[Answer key](#)



#### 8.10.2 Number Relations: GATE2015 EC-1: GA-8

Fill in the missing value



gate2015-ec-1 analytical-aptitude numerical-answers number-relations

[Answer key](#)



#### 8.10.3 Number Relations: GATE2018 CE-2: GA-10

Each of the letters in the figure below represents a unique integer from 1 to 9. The letters are positioned in the figure such that each of  $(A+B+C)$ ,  $(C+D+E)$ ,  $(E+F+G)$  and  $(G+H+K)$  is equal to 13. Which integer does  $E$  represent?

A	B	C
D		
E	F	G

H	K
---	---

- A. 1      B. 4      C. 6      D. 7

gate2018-ce-2 general-aptitude analytical-aptitude number-relations

[Answer key](#)

### Odd One (6)

#### 8.11.1 Odd One: GATE CSE 2016 Set 2 | Question: GA-04



Pick the odd one from the following options.

- A. CADBE      B. JHKIL      C. XVYWZ      D. ONPMQ

**Answer key****8.11.2 Odd One: GATE Mechanical 2024 | GA Question: 2**

Find the odd one out in the set: {19, 37, 21, 17, 23, 29, 31, 11}

- A. 21      B. 29      C. 37      D. 23

**Answer key****8.11.3 Odd One: GATE2014 AE: GA-6**

Find the odd one in the following group: ALRVX, EPVZB, ITZDF, OYEIK

- A. ALRVX      B. EPVZB      C. ITZDF      D. OYEIK

**Answer key****8.11.4 Odd One: GATE2014 EC-1: GA-6**

Find the odd one from the following group:

W,E,K,O      I,Q,W,A      F,N,T,X      N,V,B,D

- A. W,E,K,O      B. I,Q,W,A      C. F,N,T,X      D. N,V,B,D

**Answer key****8.11.5 Odd One: GATE2014 EC-2: GA-6**

Find the odd one in the following group

Q,W,Z,B      B,H,K,M      W,C,G,J      M,S,V,X

- A. Q,W,Z,B      B. B,H,K,M      C. W,C,G,J      D. M,S,V,X

**Answer key****8.11.6 Odd One: GATE2016 EC-3: GA-4**

The number that least fits this set: (324, 441, 97 and 64) is \_\_\_\_\_.

- A. 324      B. 441      C. 97      D. 64

**Answer key****8.12****Passage Reading (6)****8.12.1 Passage Reading: GATE CH 2022 | GA Question: 6**

Rice, a versatile and inexpensive source of carbohydrate, is a critical component of diet worldwide. Climate change, causing extreme weather, poses a threat to sustained availability of rice. Scientists are working on developing Green Super Rice (GSR), which is resilient under extreme weather conditions yet gives higher yields sustainably.

Which one of the following is the CORRECT logical inference based on the information given in the above passage?

- A. GSR is an alternative to regular rice, but it grows only in an extreme weather
- B. GSR may be used in future in response to adverse effects of climate change
- C. GSR grows in an extreme weather, but the quantity of produce is lesser than regular rice
- D. Regular rice will continue to provide good yields even in extreme weather

[Answer key](#)

### 8.12.2 Passage Reading: GATE CSE 2022 | GA Question: 7



In a recently conducted national entrance test, boys constituted 65% of those who appeared for the test. Girls constituted the remaining candidates and they accounted for 60% of the qualified candidates.

Which one of the following is the correct logical inference based on the information provided in the above passage?

- A. Equal number of boys and girls qualified
- B. Equal number of boys and girls appeared for the test
- C. The number of boys who appeared for the test is less than the number of girls who appeared
- D. The number of boys who qualified the test is less than the number of girls who qualified

gatecse-2022 analytical-aptitude logical-reasoning passage-reading two-marks

[Answer key](#)

### 8.12.3 Passage Reading: GATE CSE 2023 | GA Question: 6



The country of Zombieland is in distress since more than 75% of its working population is suffering from serious health issues. Studies conducted by competent health experts concluded that a complete lack of physical exercise among its working population was one of the leading causes of their health issues. As one of the measures to address the problem, the Government of Zombieland has decided to provide monetary incentives to those who ride bicycles to work.

Based only on the information provided above, which one of the following statements can be logically inferred with *certainty*?

- A. All the working population of Zombieland will henceforth ride bicycles to work.
- B. Riding bicycles will ensure that all of the working population of Zombieland is free of health issues.
- C. The health experts suggested to the Government of Zombieland to declare riding bicycles as mandatory.
- D. The Government of Zombieland believes that riding bicycles is a form of physical exercise.

gatecse-2023 analytical-aptitude logical-reasoning passage-reading two-marks

[Answer key](#)

### 8.12.4 Passage Reading: GATE ECE 2022 | GA Question: 6



Mosquitoes pose a threat to human health. Controlling mosquitoes using chemicals may have undesired consequences. In Florida, authorities have used genetically modified mosquitoes to control the overall mosquito population. It remains to be seen if this novel approach has unforeseen consequences.

Which one of the following is the correct logical inference based on the information in the above passage?

- A. Using chemicals to kill mosquitoes is better than using genetically modified mosquitoes because genetic engineering is dangerous
- B. Using genetically modified mosquitoes is better than using chemicals to kill mosquitoes because they do not have any side effects
- C. Both using genetically modified mosquitoes and chemicals have undesired consequences and can be dangerous
- D. Using chemicals to kill mosquitoes may have undesired consequences but it is not clear if using genetically modified mosquitoes has any negative consequence

gateece-2022 analytical-aptitude logical-reasoning passage-reading

[Answer key](#)

### 8.12.5 Passage Reading: GATE Electrical 2020 | GA Question: 6



Non-performing Assets (NPAs) of a bank in India is defined as an asset, which remains unpaid by a borrower for a certain period of time in terms of interest, principal, or both. Reserve Bank of India (RBI) has changed the definition of NPA thrice during 1993 – 2004, in terms of the holding period of loans. The holding period was reduced by one quarter each time. In 1993, the holding period was four quarters (360 days).

Based on the above paragraph, the holding period of loans in 2004 after the third revision was \_\_\_\_\_ days.

- A. 45
- B. 90
- C. 135
- D. 180

**Answer key****8.12.6 Passage Reading: GATE Electrical 2022 | GA Question: 6**

Altruism is the human concern for the wellbeing of others. Altruism has been shown to be motivated more by social bonding, familiarity and identification of belongingness to a group. The notion that altruism may be attributed to empathy or guilt has now been rejected.

Which one of the following is the CORRECT logical inference based on the information in the above passage?

- A. Humans engage in altruism due to guilt but not empathy
- B. Humans engage in altruism due to empathy but not guilt
- C. Humans engage in altruism due to group identification but not empathy
- D. Humans engage in altruism due to empathy but not familiarity

**Answer key****8.13****Round Table Arrangement (6)****8.13.1 Round Table Arrangement: GATE CH 2022 | GA Question: 4**

Six persons P, Q, R, S, T and U are sitting around a circular table facing the center not necessarily in the same order. Consider the following statements:

- P sits next to S and T.
- Q sits diametrically opposite to P.
- The shortest distance between S and R is equal to the shortest distance between T and U.

Based on the above statements, Q is a neighbor of

- A. U and S
- B. R and T
- C. R and U
- D. P and S

**Answer key****8.13.2 Round Table Arrangement: GATE CSE 2017 Set 1 | Question: GA-7**

Six people are seated around a circular table. There are at least two men and two women. There are at least three right-handed persons. Every woman has a left-handed person to her immediate right. None of the women are right-handed. The number of women at the table is

- A. 2
- B. 3
- C. 4
- D. Cannot be determined

**Answer key****8.13.3 Round Table Arrangement: GATE Chemical 2020 | GA Question: 7**

P, Q, R, S, T, U, V, and W are seated around a circular table.

- I. S is seated opposite to W
- II. U is seated at the second place to the right of R
- III. T is seated at the third place to the left of R
- IV. V is a neighbour of S

Which of the following must be true?

- A. P is a neighbour of R
- B. Q is a neighbour of R
- C. P is not seated opposite to Q
- D. R is the left neighbour of S

**Answer key**

#### 8.13.4 Round Table Arrangement: GATE Civil 2023 Set 2 | GA Question: 7

Three husband-wife pairs are to be seated at a circular table that has six identical chairs. Seating arrangements are defined only by the relative position of the people. How many seating arrangements are possible such that every husband sits next to his wife?

- A. 16
- B. 4
- C. 120
- D. 720

gatecivil-2023-set2 analytical-aptitude round-table-arrangement

[Answer key](#)



#### 8.13.5 Round Table Arrangement: GATE2017 CE-2: GA-8

$P, Q, R, S, T$ , and  $U$  are seated around a circular table.  $R$  is seated two places to the right of  $Q$ .  $P$  is seated three places to the left of  $R$ .  $S$  is seated opposite  $U$ . If  $P$  and  $U$  now switch seats, which of the following must necessarily be true?

- A.  $P$  is immediately to the right of  $R$
- B.  $T$  is immediately to the left of  $P$
- C.  $T$  is immediately to the left of  $P$  or  $P$  is immediately to the right of  $Q$
- D.  $U$  is immediately to the right of  $R$  or  $P$  is immediately to the left of  $T$

gate2017-ce-2 logical-reasoning round-table-arrangement

[Answer key](#)



#### 8.13.6 Round Table Arrangement: GATE2017 EC-1: GA-7

$S, T, U, V, W, X, Y$  and  $Z$  are seated around a circular table.  $T$ 's neighbors are  $Y$  and  $V$ .  $Z$  is seated third to the left of  $T$  and second to the right of  $S$ .  $U$ 's neighbors are  $S$  and  $Y$ ; and  $T$  and  $W$  are not seated opposite each other. Who is third to the left of  $V$ ?

- A.  $X$
- B.  $W$
- C.  $U$
- D.  $T$

gate2017-ec-1 analytical-aptitude round-table-arrangement

[Answer key](#)



#### 8.14

#### Seating Arrangement (4)

#### 8.14.1 Seating Arrangement: GATE CSE 2017 Set 1 | Question: GA-3

Rahul, Murali, Srinivas and Arul are seated around a square table. Rahul is sitting to the left of Murali. Srinivas is sitting to the right of Arul. Which of the following pairs are seated opposite each other?

- A. Rahul and Murali
- B. Srinivas and Arul
- C. Srinivas and Murali
- D. Srinivas and Rahul

gatecse-2017-set1 analytical-aptitude logical-reasoning seating-arrangement

[Answer key](#)



#### 8.14.2 Seating Arrangement: GATE Civil 2020 Set 1 | GA Question: 7

Five friends  $P, Q, R, S$  and  $T$  went camping. At night, they had to sleep in a row inside the tent.  $P, Q$ , and  $T$  refused to sleep next to  $R$  since he snored loudly.  $P$  and  $S$  wanted to avoid  $Q$  as he usually hugged people in sleep.

Assuming everyone was satisfied with the sleeping arrangements, what is the order in which they slept?

- A.  $RSPTQ$
- B.  $SPRTQ$
- C.  $QRSPT$
- D.  $QTSPR$

gate2020-ce-1 analytical-aptitude logical-reasoning seating-arrangement

[Answer key](#)



#### 8.14.3 Seating Arrangement: GATE Electrical 2021 | GA Question: 10

Seven cars  $P, Q, R, S, T, U$  and  $V$  are parked in a row not necessarily in that order. The cars  $T$  and  $U$  should be parked next to each other. The cars  $S$  and  $V$  also should be parked next to each other, whereas  $P$  and  $Q$  cannot be parked next to each other.  $Q$  and  $S$  must be parked next to each other.  $R$  is parked to the immediate right of  $V$ .  $T$  is parked to the left of  $U$ .



Based on the above statements, the only INCORRECT option given below is:

- A. There are two cars parked in between  $Q$  and  $V$ .  
B.  $Q$  and  $R$  are not parked together.  
C.  $V$  is the only car parked in between  $S$  and  $R$ .  
D. Car  $P$  is parked at the extreme end.

gateee-2021 analytical-aptitude logical-reasoning seating-arrangement

[Answer key](#)

#### 8.14.4 Seating Arrangement: GATE2019 EC: GA-6

Four people are standing in a line facing you. They are Rahul, Mathew, Seema and Lohit. One is an engineer, one is a doctor, one a teacher and another a dancer. You are told that:

1. Mathew is not standing next to Seema
2. There are two people standing between Lohit and the engineer
3. Rahul is not a doctor
4. The teacher and the dancer are standing next to each other
5. Seema is turning to her right to speak to the doctor standing next to her

Who among them is an engineer?

- A. Seema      B. Lohit      C. Rahul      D. Mathew

gate2019-ec general-aptitude analytical-aptitude logical-reasoning seating-arrangement

[Answer key](#)

#### 8.15

#### Sequence Series (12)

##### 8.15.1 Sequence Series: GATE CSE 2020 | Question: GA-7

If  $P = 3, R = 27, T = 243$ , then  $Q + S = \underline{\hspace{2cm}}$

- A. 40      B. 80      C. 90      D. 110

gatecse-2020 analytical-aptitude logical-reasoning sequence-series two-marks

[Answer key](#)

##### 8.15.2 Sequence Series: GATE CSE 2024 | Set 2 | GA Question: 5

In the sequence  $6, 9, 14, x, 30, 41$ , a possible value of  $x$  is

- A. 25      B. 21      C. 18      D. 20

gatecse2024-set2 analytical-aptitude sequence-series one-mark

[Answer key](#)

##### 8.15.3 Sequence Series: GATE Civil 2020 Set 1 | GA Question: 4

If  $0, 1, 2, \dots, 7, 8, 9$  are coded as  $O, P, Q, \dots, V, W, X$ , then 45 will be coded as  $\underline{\hspace{2cm}}$ .

- A.  $TS$       B.  $ST$       C.  $SS$       D.  $SU$

gate2020-ce-1 analytical-aptitude logical-reasoning sequence-series easy

[Answer key](#)

##### 8.15.4 Sequence Series: GATE Civil 2024 Set 1 | GA Question: 4

Which one of the given options is a possible value of  $x$  in the following sequence?

$$3, 7, 15, x, 63, 127, 255$$

- A. 35      B. 40      C. 45      D. 31

gatecivil-2024-set1 analytical-aptitude sequence-series

[Answer key](#)

##### 8.15.5 Sequence Series: GATE Electrical 2020 | GA Question: 7

Select the next element of the series: Z, WV, RQP,  $\underline{\hspace{2cm}}$

A. LKJI

B. JIHG

C. KJIH

D. NMLK

gate2020-ee analytical-aptitude logical-reasoning sequence-series

Answer key 



#### 8.15.6 Sequence Series: GATE Electrical 2020 | GA Question: 8

In four-digit integer numbers from 1001 to 9999, the digit group “37” (in the same sequence) appears \_\_\_\_\_ times.

A. 270

B. 279

C. 280

D. 299

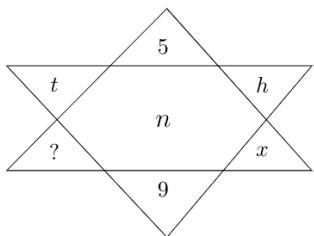
gate2020-ee analytical-aptitude logical-reasoning sequence-series

Answer key 



#### 8.15.7 Sequence Series: GATE Mechanical 2020 Set 2 | GA Question: 7

Find the missing element in the following figure.



A. *d*

B. *e*

C. *w*

D. *y*

gateme-2020-set2 analytical-aptitude logical-reasoning sequence-series

Answer key 



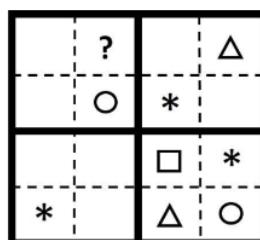
#### 8.15.8 Sequence Series: GATE Mechanical 2023 | GA Question: 5

The symbols  $\bigcirc$ ,  $*$ ,  $\triangle$ , and  $\square$  are to be filled, one in each box, as shown below.

The rules for filling in the four symbols are as follows.

1. Every row and every column must contain each of the four symbols.
2. Every  $2 \times 2$  square delineated by bold lines must contain each of the four symbols.

Which symbol will occupy the box marked with '?' in the partially filled figure?



A.  $\bigcirc$

B.  $*$

C.  $\triangle$

D.  $\square$

gateme-2023 analytical-aptitude sequence-series

Answer key 



#### 8.15.9 Sequence Series: GATE2010 MN: GA-7

Given the sequence  $A, B, B, C, C, C, D, D, D, D, \dots$  etc., that is one  $A$ , two  $B$ 's, three  $C$ 's, four  $D$ 's, five  $E$ 's and so on, the  $240^{\text{th}}$  letter in the sequence will be :

A. *V*

B. *U*

C. *T*

D. *W*

**Answer key****8.15.10 Sequence Series: GATE2014 EC-3: GA-6**Find the next term in the sequence:  $7G, 11K, 13M, \underline{\hspace{2cm}}$ .

- A.  $15Q$       B.  $17Q$       C.  $15P$       D.  $17P$

**Answer key****8.15.11 Sequence Series: GATE2015 EC-3: GA-4**

Find the missing sequence in the letter series below:

 $A, CD, GHI, ?, UVWXYZ$ 

- A.  $LMN$       B.  $MNO$       C.  $MNOP$       D.  $NOPQ$

**Answer key****8.15.12 Sequence Series: GATE2018 ME-2: GA-3**

Find the missing group of letters in the following series:

 $BC, FGH, LMNO, \underline{\hspace{2cm}}$ 

- A.  $UVWXYZ$       B.  $TUVWX$       C.  $STUVW$       D.  $RSTUV$

**Answer key****8.16****Statements Follow (33)****8.16.1 Statements Follow: GATE CH 2022 | GA Question: 9**

Given below are three statements and four conclusions drawn based on the statements.

Statement 1 : Some engineers are writers.

Statement 2 : No writer is an actor.

Statement 3 : All actors are engineers.

Conclusion I : Some writers are engineers.

Conclusion II : All engineers are actors.

Conclusion III : No actor is a writer.

Conclusion IV : Some actors are writers.

Which one of the following options can be logically inferred?

- A. Only conclusion I is correct  
 B. Only conclusion II and conclusion III are correct  
 C. Only conclusion I and conclusion III are correct  
 D. Either conclusion III or conclusion IV is correct

**Answer key****8.16.2 Statements Follow: GATE CH 2023 | GA Question: 6**Human beings are one among many creatures that inhabit an imagined world. In this imagined world, some creatures are cruel. If in this imagined world, it is given that the statement "Some human beings are not cruel creatures" is FALSE, then which of the following set of statement(s) can be logically inferred with *certainty*?

- i. All human beings are cruel creatures.

- ii. Some human beings are cruel creatures.
- iii. Some creatures that are cruel are human beings.
- iv. No human beings are cruel creatures.

A. only (i)      B. only (iii) and (iv)      C. only (i) and (ii)      D. (i), (ii) and (iii)

gatech-2023 analytical-aptitude statements-follow

[Answer key](#)



### 8.16.3 Statements Follow: GATE CSE 2016 Set 1 | Question: GA08

Consider the following statements relating to the level of poker play of four players  $P, Q, R$  and  $S$ .

- I.  $P$  always beats  $Q$
- II.  $R$  always beats  $S$
- III.  $S$  loses to  $P$  only sometimes.
- IV.  $R$  always loses to  $Q$

Which of the following can be logically inferred from the above statements?

- i.  $P$  is likely to beat all the three other players
  - ii.  $S$  is the absolute worst player in the set
- |                       |                         |
|-----------------------|-------------------------|
| A. (i). only          | B. (ii) only            |
| C. (i) and (ii) only' | D. neither (i) nor (ii) |

gatecse-2016-set1 analytical-aptitude normal statements-follow

[Answer key](#)



### 8.16.4 Statements Follow: GATE CSE 2016 Set 2 | Question: GA-08

All hill-stations have a lake. Ooty has two lakes.

Which of the statement(s) below is/are logically valid and can be inferred from the above sentences?

- i. Ooty is not a hill-station.
  - ii. No hill-station can have more than one lake.
- |                      |                         |
|----------------------|-------------------------|
| A. (i) only.         | B. (ii) only.           |
| C. Both (i) and (ii) | D. Neither (i) nor (ii) |

gatecse-2016-set2 analytical-aptitude easy statements-follow

[Answer key](#)



### 8.16.5 Statements Follow: GATE CSE 2021 Set 1 | GA Question: 9

Given below are two statements 1 and 2, and two conclusions I and II

- Statement 1: All bacteria are microorganisms.
- Statement 2: All pathogens are microorganisms.
- Conclusion I: Some pathogens are bacteria.
- Conclusion II: All pathogens are not bacteria.

Based on the above statements and conclusions, which one of the following options is logically CORRECT?

- |   |   |
|---|---|
| A. Only conclusion I is correct         | B. Only conclusion II is correct          |
| C. Either conclusion I or II is correct | D. Neither conclusion I nor II is correct |

gatecse-2021-set1 analytical-aptitude logical-reasoning statements-follow two-marks

[Answer key](#)



### 8.16.6 Statements Follow: GATE CSE 2022 | GA Question: 4

Given below are four statements.

- Statement 1 : All students are inquisitive.
- Statement 2 : Some students are inquisitive.
- Statement 3 : No student is inquisitive.
- Statement 4 : Some students are not inquisitive.

From the given four statements, find the two statements that CANNOT BE TRUE simultaneously, assuming that there is at least one student in the class.

- A. Statement 1 and Statement 3  
B. Statement 1 and Statement 2  
C. Statement 2 and Statement 4  
D. Statement 3 and Statement 4

gatecse-2022 analytical-aptitude logical-reasoning statements-follow one-mark

Answer key 

#### 8.16.7 Statements Follow: GATE Civil 2021 Set 2 | GA Question: 8



1. Some football players play cricket.
2. All cricket players play hockey.

Among the options given below, the statement that logically follows from the two statements 1 and 2 above, is :

- A. No football player plays hockey  
B. Some football players play hockey  
C. All football players play hockey  
D. All hockey players play football

gatcivil-2021-set2 analytical-aptitude logical-reasoning statements-follow

Answer key 

#### 8.16.8 Statements Follow: GATE Civil 2022 Set 2 | GA Question: 9



Given below are two statements and four conclusions drawn based on the statements.

- Statement 1 : Some soaps are clean.
- Statement 2 : All clean objects are wet.

Conclusion I: Some clean objects are soaps.

Conclusion II: No clean object is a soap.

Conclusion III: Some wet objects are soaps.

Conclusion IV: All wet objects are soaps.

Which one of the following options can be logically inferred?

- A. Only conclusion I is correct  
B. Either conclusion I or conclusion II is correct  
C. Either conclusion III or conclusion IV is correct  
D. Only conclusion I and conclusion III are correct

gatcivil-2022-set2 analytical-aptitude statements-follow

Answer key 

#### 8.16.9 Statements Follow: GATE Civil 2023 Set 1 | GA Question: 4



A duck named Donald Duck says "All ducks always lie."

Based only on the information above, which one of the following statements can be logically inferred with *certainty*?

- A. Donald Duck always lies.  
B. Donald Duck always tells the truth.  
C. Donald Duck's statement is true.  
D. Donald Duck's statement is false.

gatcivil-2023-set1 analytical-aptitude statements-follow

Answer key 

#### 8.16.10 Statements Follow: GATE Civil 2023 Set 1 | GA Question: 6



Based only on the truth of the statement 'Some humans are intelligent', which one of the following options can be logically inferred with *certainty*?

- A. No human is intelligent.  
B. All humans are intelligent.  
C. Some non-humans are intelligent.  
D. Some intelligent beings are humans.

gatcivil-2023-set1 analytical-aptitude statements-follow

Answer key 

### 8.16.11 Statements Follow: GATE Civil 2024 Set 2 | GA Question: 2



Statements:

1. All heroes are winners.
2. All winners are lucky people.

Inferences:

- I. All lucky people are heroes.
- II. Some lucky people are heroes.
- III. Some winners are heroes.

Which of the above inferences can be logically deduced from statements 1 and 2?

- A. Only I and II      B. Only II and III      C. Only I and III      D. Only III

gatecivil-2024-set2 analytical-aptitude logical-reasoning statements-follow

[Answer key](#)

### 8.16.12 Statements Follow: GATE DS&AI 2024 | GA Question: 6



Thousands of years ago, some people began dairy farming. This coincided with a number of mutations in a particular gene that resulted in these people developing the ability to digest dairy milk.

Based on the given passage, which of the following can be inferred?

- A. All human beings can digest dairy milk.  
B. No human being can digest dairy milk.  
C. Digestion of dairy milk is essential for human beings.  
D. In human beings, digestion of dairy milk resulted from a mutated gene.

gate-ds-ai-2024 analytical-aptitude logical-reasoning statements-follow two-marks

[Answer key](#)

### 8.16.13 Statements Follow: GATE ECE 2021 | GA Question: 6



Given below are two statements and two conclusions.

- Statement 1: All purple are green.
- Statement 2: All black are green.
- Conclusion I: Some black are purple.
- Conclusion II: No black is purple.

Based on the above statements and conclusions, which one of the following options is logically CORRECT?

- A. Only conclusion I is correct      B. Only conclusion II is correct  
C. Either conclusion I or II is correct      D. Both conclusion I and II are correct

gateec-2021 analytical-aptitude logical-reasoning statements-follow

[Answer key](#)

### 8.16.14 Statements Follow: GATE ECE 2022 | GA Question: 9



In a class of five students P, Q, R, S and T, only one student is known to have copied in the exam. The disciplinary committee has investigated the situation and recorded the statements from the students as given below.

- Statement of P: R has copied in the exam.  
Statement of Q: S has copied in the exam.  
Statement of R: P did not copy in the exam.  
Statement of S: Only one of us is telling the truth.  
Statement of T: R is telling the truth.

The investigating team had authentic information that S never lies.

Based on the information given above, the person who has copied in the exam is

A. R

B. P

C. Q

D. T

gateece-2022 analytical-aptitude logical-reasoning statements-follow

Answer key 

#### 8.16.15 Statements Follow: GATE ECE 2023 | GA Question: 6

Forestland is a planet inhabited by different kinds of creatures. Among other creatures, it is populated by animals all of whom are ferocious. There are also creatures that have claws and some that do not. All creatures that have claws are ferocious.

Based only on the information provided above, which one of the following options can be logically inferred with *certainty*?

- A. All creatures with claws are animals.
- B. Some creatures with claws are non-ferocious.
- C. Some non-ferocious creatures have claws.
- D. Some ferocious creatures are creatures with claws.

gateee-2023 analytical-aptitude logical-reasoning statements-follow

Answer key 

#### 8.16.16 Statements Follow: GATE Electrical 2022 | GA Question: 4

Given below are two statements and four conclusions drawn based on the statements.

Statement 1: Some bottles are cups.

Statement 2: All cups are knives.

Conclusion I : Some bottles are knives.

Conclusion II : Some knives are cups.

Conclusion III : All cups are bottles.

Conclusion IV : All knives are cups.

Which one of the following options can be logically inferred?

- A. Only conclusion I and conclusion II are correct
- B. Only conclusion II and conclusion III are correct
- C. Only conclusion II and conclusion IV are correct
- D. Only conclusion III and conclusion IV are correct

gate2022-ee analytical-aptitude statements-follow

Answer key 

#### 8.16.17 Statements Follow: GATE Electrical 2022 | GA Question: 9

The letters P, Q, R, S, T and U are to be placed one per vertex on a regular convex hexagon, but not necessarily in the same order.

Consider the following statements:

- The line segment joining R and S is longer than the line segment joining P and Q.
- The line segment joining R and S is perpendicular to the line segment joining P and Q.
- The line segment joining R and U is parallel to the line segment joining T and Q.

Based on the above statements, which one of the following options is CORRECT?

- A. The line segment joining R and T is parallel to the line segment joining Q and S
- B. The line segment joining T and Q is parallel to the line joining P and U
- C. The line segment joining R and P is perpendicular to the line segment joining U and Q
- D. The line segment joining Q and S is perpendicular to the line segment joining R and P

gate2022-ee analytical-aptitude logical-reasoning statements-follow

[Answer key](#)

### 8.16.18 Statements Follow: GATE Mechanical 2021 Set 2 | GA Question: 6



Given below are two statements 1 and 2, and two conclusions I and II.

- Statement 1 : All entrepreneurs are wealthy.
- Statement 2 : All wealthy are risk seekers.
- Conclusion I : All risk seekers are wealthy.
- Conclusion II : Only some entrepreneurs are risk seekers.

Based on the above statements and conclusions, which one of the following options is CORRECT?

- A. Only conclusion I is correct      B. Only conclusion II is correct  
C. Neither conclusion I nor II is correct      D. Both conclusions I and II are correct

gateme-2021-set2 analytical-aptitude logical-reasoning statements-follow

[Answer key](#)

### 8.16.19 Statements Follow: GATE Mechanical 2022 Set 1 | GA Question: 9



Given below are three conclusions drawn based on the following three statements.

Statement 1 : All teachers are professors.

Statement 2 : No professor is a male.

Statement 3 : Some males are engineers.

Conclusion I: No engineer is a professor.

Conclusion II: Some engineers are professors.

Conclusion III: No male is a teacher.

Which one of the following options can be logically inferred?

- A. Only conclusion III is correct  
B. Only conclusion I and conclusion II are correct  
C. Only conclusion II and conclusion III are correct  
D. Only conclusion I and conclusion III are correct

gateme-2022-set1 analytical-aptitude statements-follow

[Answer key](#)

### 8.16.20 Statements Follow: GATE2013 AE: GA-9



- All professors are researchers
- Some scientists are professors

Which of the given conclusions is logically valid and is inferred from the above arguments?

- A. All scientists are researchers      B. All professors are scientists  
C. Some researchers are scientists      D. No conclusion follows

gate2013-ae analytical-aptitude logical-reasoning statements-follow

[Answer key](#)

### 8.16.21 Statements Follow: GATE2014 AG: GA-6



In a group of four children, Som is younger to Riaz. Shiv is elder to Ansu. Ansu is youngest in the group. Which of the following statements is/are required to find the eldest child in the group?

#### Statements

1. Shiv is younger to Riaz.
  2. Shiv is elder to Som.
- A. Statement 1 by itself determines the eldest child.  
B. Statement 2 by itself determines the eldest child.  
C. Statements 1 and 2 are both required to determine the eldest child.  
D. Statements 1 and 2 are not sufficient to determine the eldest child.

**Answer key****8.16.22 Statements Follow: GATE2014 EC-1: GA-2**

Read the statements:

- All women are entrepreneurs.
- Some women are doctors.

Which of the following conclusions can be logically inferred from the above statements?

- |                                |                                   |
|--------------------------------|-----------------------------------|
| A. All women are doctors       | B. All doctors are entrepreneurs  |
| C. All entrepreneurs are women | D. Some entrepreneurs are doctors |

**Answer key****8.16.23 Statements Follow: GATE2015 EC-1: GA-10**

Humpty Dumpty sits on a wall every day while having lunch. The wall sometimes breaks. A person sitting on the wall falls if the wall breaks.

Which one of the statements below is logically valid and can be inferred from the above sentences?

- A. Humpty Dumpty always falls while having lunch
- B. Humpty Dumpty does not fall sometimes while having lunch
- C. Humpty Dumpty never falls during dinner
- D. When Humpty Dumpty does not sit on the wall, the wall does not break

**Answer key****8.16.24 Statements Follow: GATE2015 EC-2: GA- 7**

Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.

Statements:

- I. All film stars are playback singers.
- II. All film directors are film stars.

Conclusions:

- I. All film directors are playback singers.
  - II. Some film stars are film directors.
- |   |                                      |
|---|--------------------------------------|
| A. Only conclusion I follows.           | B. Only conclusion II follows.       |
| C. Neither conclusion I nor II follows. | D. Both conclusions I and II follow. |

**Answer key****8.16.25 Statements Follow: GATE2015 ME-3: GA-4**

1. Tanya is older than Eric.
2. Cliff is older than Tanya.
3. Eric is older than Cliff.

If the first two statements are true, then the third statement is:

- |              |                      |
|--------------|----------------------|
| A. True      | B. False             |
| C. Uncertain | D. Data insufficient |

[Answer key](#)

### 8.16.26 Statements Follow: GATE2015 ME-3: GA-7



Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.

Statements:

- I. No manager is a leader.
- II. All leaders are executives.

Conclusions:

- I. No manager is an executive.
- II. No executive is a manager.
- A. Only conclusion I follows.
- B. Only conclusion II follows.
- C. Neither conclusion I nor II follows.
- D. Both conclusions I and II follow.

gate2015-me-3 analytical-aptitude statements-follow

[Answer key](#)

### 8.16.27 Statements Follow: GATE2016 CE-2: GA-8



Fact 1: Humans are mammals.

Fact 2: Some humans are engineers.

Fact 3: Engineers build houses.

If the above statements are facts, which of the following can be logically inferred?

- I. All mammals build houses.
  - II. Engineers are mammals.
  - III. Some humans are not engineers.
- 
- A. II only.
  - B. III only.
  - C. I, II and III.
  - D. I only.

gate2016-ce-2 analytical-aptitude logical-reasoning statements-follow

[Answer key](#)

### 8.16.28 Statements Follow: GATE2016 ME-2: GA-4



**Fact:** If it rains, then the field is wet.

Read the following statements:

- i. It rains
- ii. The field is not wet
- iii. The field is wet
- iv. It did not rain

Which one of the options given below is **NOT** logically possible, based on the given fact?

- A. If (iii), then (iv).
- B. If (i), then (iii).
- C. If (i), then (ii).
- D. If (ii), then (iv).

gate2016-me-2 analytical-aptitude statements-follow

[Answer key](#)

### 8.16.29 Statements Follow: GATE2017 CE-1: GA-3



Consider the following sentences:

All benches are beds. No bed is bulb. Some bulbs are lamps.

Which of the following can be inferred?

- i. Some beds are lamps.
  - ii. Some lamps are beds.
- 
- A. Only i
  - B. Only ii
  - C. Both i and ii
  - D. Neither i nor ii

Answer key

### **8.16.30 Statements Follow: GATE2017 EC-1: GA-5**



Some tables are shelves. Some shelves are chairs. All chairs are benches. Which of the following conclusion can be deduced from the preceding sentences?

- i. At least one bench is a table
  - ii. At least one shelf is a bench
  - iii. At least one chair is a table
  - iv. All benches are chairs

A. Only i                                    B. Only ii                                    C. Only ii and iii                            D. Only iv

## Answer key

### **8.16.31 Statements Follow: GATE2017 ME-2: GA-9**



All people in a certain island are either 'Knights' or 'Knaves' and each person knows every other person's identity. Knights never lie, and Knaves ALWAYS lie.

$P$  says "Both of us are Knights".  $Q$  says "None of us are Knaves".

Which one of the following can be logically inferred from the above?

- A. Both  $P$  and  $Q$  are knights.  
 C. Both  $P$  and  $Q$  are Knaves.

B.  $P$  is a knight;  $Q$  is a Knave.  
 D. The identities of  $P, Q$  cannot be determined.

## Answer key

8.16.32 Statements Follow: GATE2018 ME-1: GA-10



Consider the following three statements:

- i. Some roses are red.
  - ii. All red flowers fade quickly.
  - iii. Some roses fade quickly.

Which of the following statements can be logically inferred from the above statements?

- A. If (i) is true and (ii) is false, then (iii) is false.
  - B. If (i) is true and (ii) is false, then (iii) is true.
  - C. If (i) and (ii) are true, then (iii) is true.
  - D. If (i) and (ii) are false, then (iii) is false.

Answer key

### **8.16.33 Statements Follow: GATE2019 IN: GA-2**



Some students were not involved in the strike.

If the above statement is true, which of the following conclusions is/are logically necessary?

1. Some who were involved in the strike were students.
  2. No student was involved in the strike.
  3. At least one student was involved in the strike.
  4. Some who were not involved in the strike were students.



Answer key

# Answer Keys

8.1.1	B	8.1.2	D	8.2.1	B	8.2.2	C	8.2.3	B
8.2.4	C	8.2.5	C	8.3.1	B	8.4.1	D	8.5.1	A
8.5.2	A	8.5.3	D	8.5.4	C	8.5.5	C	8.5.6	C
8.5.7	D	8.5.8	D	8.5.9	C	8.5.10	A	8.5.11	C
8.5.12	A	8.6.1	A	8.6.2	B	8.6.3	B	8.6.4	B
8.6.5	D	8.6.6	B	8.6.7	D	8.7.1	D	8.8.1	B
8.9.1	A	8.9.2	C	8.9.3	C	8.9.4	B	8.9.5	B
8.9.6	C	8.9.7	A	8.9.8	C	8.9.9	B	8.9.10	D
8.9.11	A	8.9.12	A	8.9.13	B	8.9.14	D	8.9.15	X
8.9.16	D	8.9.17	D	8.9.18	B	8.9.19	B	8.9.20	A
8.9.21	C	8.9.22	A	8.9.23	C	8.9.24	A	8.9.25	B
8.9.26	X	8.9.27	C	8.9.28	C	8.9.29	C	8.9.30	B
8.9.31	C	8.9.32	B	8.9.33	A	8.9.34	B	8.9.35	B
8.9.36	C	8.9.37	B	8.9.38	C	8.9.39	C	8.10.1	A
8.10.2	3	8.10.3	B	8.11.1	D	8.11.2	A	8.11.3	D
8.11.4	D	8.11.5	C	8.11.6	C;D	8.12.1	B	8.12.2	D
8.12.3	D	8.12.4	D	8.12.5	B	8.12.6	C	8.13.1	C
8.13.2	A	8.13.3	C	8.13.4	A	8.13.5	C	8.13.6	A
8.14.1	C	8.14.2	A	8.14.3	A	8.14.4	D	8.15.1	C
8.15.2	B	8.15.3	B	8.15.4	D	8.15.5	C	8.15.6	C
8.15.7	A	8.15.8	B	8.15.9	A	8.15.10	B	8.15.11	C
8.15.12	B	8.16.1	C	8.16.2	D	8.16.3	D	8.16.4	D
8.16.5	C;D	8.16.6	A	8.16.7	B	8.16.8	D	8.16.9	D
8.16.10	D	8.16.11	B	8.16.12	D	8.16.13	C	8.16.14	B
8.16.15	D	8.16.16	A	8.16.17	A	8.16.18	C	8.16.19	A
8.16.20	C	8.16.21	A	8.16.22	D	8.16.23	B	8.16.24	D
8.16.25	B	8.16.26	C	8.16.27	B	8.16.28	C	8.16.29	D
8.16.30	B	8.16.31	D	8.16.32	C	8.16.33	C		



**Syllabus:** Numerical computation, Numerical estimation, Numerical reasoning and data interpretation

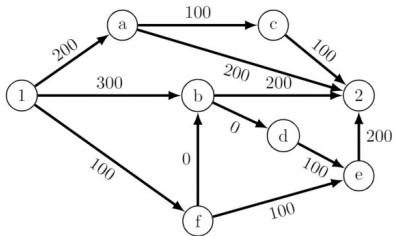
#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
1 Mark Count	1	2	4	3	1	2	1	2	1	2	4
2 Marks Count	3	3	2	2	2	2	3	2	2	2.38	3
Total Marks	7	8	8	7	5	6	7	6	5	6.75	8

#### 9.0.1 GATE CSE 2020 | Question: GA-5



There are multiple routes to reach from node 1 to node 2, as shown in the network.



The cost of travel on an edge between two nodes is given in rupees. Nodes 'a', 'b', 'c', 'd', 'e', and 'f' are toll booths. The toll price at toll booths marked 'a' and 'e' is Rs. 200, and is Rs. 100 for the other toll booths. Which is the cheapest route from node 1 to node 2?

- A. 1 – a – c – 2      B. 1 – f – b – 2      C. 1 – b – 2      D. 1 – f – e – 2

gatecse-2020 quantitative-aptitude graph-theory one-mark

Answer key

#### 9.0.2 GATE CSE 2025 | Set 2 | GA Question: 3



If  $P e^{-x} = Q e^{-x}$  for all real values of  $x$ , which one of the following statements is true?

- A.  $P = Q = 0$       B.  $P = Q = 1$       C.  $P = 1; Q = -1$       D.  $\frac{P}{Q} = 0$

gatecse2025-set2 quantitative-aptitude mathematical-logic one-mark

Answer key

#### 9.1

#### Absolute Value (7)

##### 9.1.1 Absolute Value: GATE CSE 2014 Set 2 | Question: GA-8



If  $x$  is real and  $|x^2 - 2x + 3| = 11$ , then possible values of  $|-x^3 + x^2 - x|$  include

- A. 2,4      B. 2,14      C. 4,52      D. 14,52

gatecse-2014-set2 quantitative-aptitude normal absolute-value

Answer key

##### 9.1.2 Absolute Value: GATE CSE 2017 Set 1 | Question: GA-8



The expression  $\frac{(x+y)-|x-y|}{2}$  is equal to :

- A. The maximum of  $x$  and  $y$   
B. The minimum of  $x$  and  $y$   
C. 1      D. None of the above

gatecse-2017-set1 general-aptitude quantitative-aptitude maxima-minima absolute-value

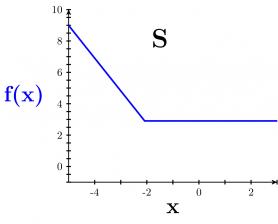
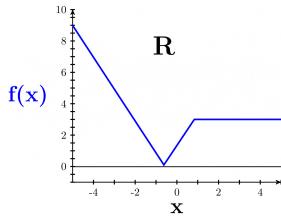
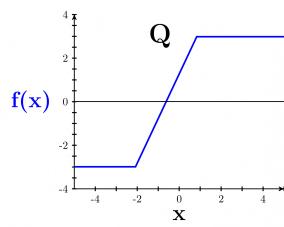
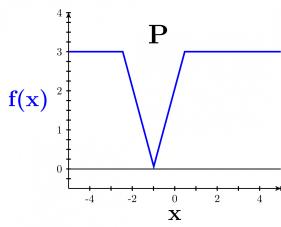
Answer key

##### 9.1.3 Absolute Value: GATE IN 2023 | GA Question: 9



Which one of the given figures P, Q, R and S represents the graph of the following function?

$$f(x) = ||x+2| - |x-1||$$



A. P

B. Q

C. R

D. S

gatein-2023 quantitative-aptitude absolute-value

[Answer key](#)



#### 9.1.4 Absolute Value: GATE2011 AG: GA-7

Given that  $f(y) = \frac{|y|}{y}$ , and  $q$  is non-zero real number, the value of  $|f(q) - f(-q)|$  is

- A. 0      B. -1  
C. 1      D. 2

general-aptitude quantitative-aptitude gate2011-ag absolute-value

[Answer key](#)



#### 9.1.5 Absolute Value: GATE2013 AE: GA-8

If  $|-2X + 9| = 3$  then the possible value of  $|-X| - X^2$  would be:

- A. 30      B. -30      C. -42      D. 42

gate2013-ae quantitative-aptitude absolute-value

[Answer key](#)



#### 9.1.6 Absolute Value: GATE2013 CE: GA-7

If  $|4X - 7| = 5$  then the values of  $2|X| - |-X|$  is:

- A.  $2, \left(\frac{1}{3}\right)$       B.  $\left(\frac{1}{2}\right), 3$       C.  $\left(\frac{3}{2}\right), 9$       D.  $\left(\frac{2}{3}\right), 9$

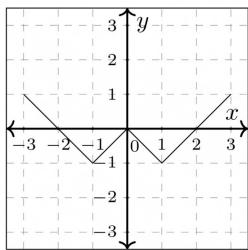
gate2013-ce quantitative-aptitude absolute-value

[Answer key](#)



#### 9.1.7 Absolute Value: GATE2018 ME-1: GA-9

Which of the following functions describe the graph shown in the below figure?



- A.  $y = |x| + 1 - 2$   
B.  $y = |x| - 1 - 1$

- C.  $y = |x| + 1 - 1$   
D.  $y = ||x - 1| - 1|$

gate2018-me-1 general-aptitude quantitative-aptitude functions absolute-value

Answer key 

9.2

### Age Relation (1)

#### 9.2.1 Age Relation: GATE2018 CE-1: GA-3



Hema's age is 5 years more than twice Hari's age. Suresh's age is 13 years less than 10 times Hari's age. If Suresh is 3 times as old as Hema, how old is Hema?

- A. 14      B. 17      C. 18      D. 19

gate2018-ce-1 general-aptitude quantitative-aptitude age-relation

Answer key 

9.3

### Algebra (6)

#### 9.3.1 Algebra: GATE Civil 2021 Set 1 | GA Question: 4



$\oplus$  and  $\odot$  are two operators on numbers  $p$  and  $q$  such that  $p \oplus q = \frac{p^2 + q^2}{pq}$  and  $p \odot q = \frac{p^2}{q}$ ;

If  $x \oplus y = 2 \odot 2$ , then  $x =$

- A.  $\frac{y}{2}$       B.  $y$       C.  $\frac{3y}{2}$       D.  $2y$

gatcivil-2021-set1 quantitative-aptitude algebra

Answer key 

#### 9.3.2 Algebra: GATE Civil 2021 Set 2 | GA Question: 4



$\oplus$  and  $\odot$  are two operators on numbers  $p$  and  $q$  such that  $p \odot q = p - q$ , and  $p \oplus q = p \times q$

Then,  $(9 \odot (6 \oplus 7)) \odot (7 \oplus (6 \odot 5)) =$

- A. 40      B. -26      C. -33      D. -40

gatecivil-2021-set2 quantitative-aptitude algebra easy

Answer key 

#### 9.3.3 Algebra: GATE ECE 2021 | GA Question: 2



$p$  and  $q$  are positive integers and  $\frac{p}{q} + \frac{q}{p} = 3$ , then,  $\frac{p^2}{q^2} + \frac{q^2}{p^2} =$

- A. 3      B. 7      C. 9      D. 11

gateec-2021 quantitative-aptitude algebra

Answer key 

#### 9.3.4 Algebra: GATE ECE 2024 | GA Question: 5



The greatest prime factor of  $(3^{199} - 3^{196})$  is

- A. 13      B. 17      C. 3      D. 11

gateece-2024 quantitative-aptitude algebra

Answer key 

#### 9.3.5 Algebra: GATE2011 MN: GA-61



If  $\frac{(2y+1)}{(y+2)} < 1$ , then which of the following alternatives gives the CORRECT range of  $y$  ?

- A.  $-2 < y < 2$   
C.  $-3 < y < 1$

- B.  $-2 < y < 1$   
D.  $-4 < y < 1$

quantitative-aptitude gate2011-mm algebra

Answer key 

### 9.3.6 Algebra: GATE2018 CE-2: GA-3



$\underbrace{a + a + a + \dots + a}_{n \text{ times}} = a^2 b$  and  $\underbrace{b + b + b + \dots + b}_{m \text{ times}} = ab^2$ , where  $a, b, n, m$  are natural numbers. What is the value of  $\left( \underbrace{m + m + m + \dots + m}_{n \text{ times}} \right) \left( \underbrace{n + n + n + \dots + n}_{m \text{ times}} \right)$ ?

- A.  $2a^2b^2$       B.  $a^4b^4$       C.  $ab(a+b)$       D.  $a^2 + b^2$

gate2018-ce-2 algebra quantitative-aptitude

Answer key 

## 9.4

### Alligation Mixture (3)



#### 9.4.1 Alligation Mixture: GATE CH 2023 | GA Question: 7

To construct a wall, sand and cement are mixed in the ratio of 3 : 1. The cost of sand and that of cement are in the ratio of 1 : 2.

If the total cost of sand and cement to construct the wall is 1000 rupees, then what is the cost (in rupees) of cement used?

- A. 400      B. 600      C. 800      D. 200

gatech-2023 quantitative-aptitude alligation-mixture

Answer key 

#### 9.4.2 Alligation Mixture: GATE CSE 2011 | Question: 65



A container originally contains 10 litres of pure spirit. From this container, 1 litre of spirit replaced with 1 litre of water. Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much spirit is now left in the container?

- A. 7.58 litres      B. 7.84 litres  
C. 7 litres      D. 7.29 litres

gatecse-2011 quantitative-aptitude normal alligation-mixture

Answer key 

#### 9.4.3 Alligation Mixture: GATE2010 TF: GA-9



A tank has 100 liters of water. At the end of every hour, the following two operations are performed in sequence: i) water equal to  $m\%$  of the current contents of the tank is added to the tank , ii) water equal to  $n\%$  of the current contents of the tank is removed from the tank. At the end of 5 hours, the tank contains exactly 100 liters of water . The relation between  $m$  and  $n$  is :

- A.  $m = n$       B.  $m > n$   
C.  $m < n$       D. None of the previous

general-aptitude quantitative-aptitude gate2010-tf alligation-mixture

Answer key 

## 9.5

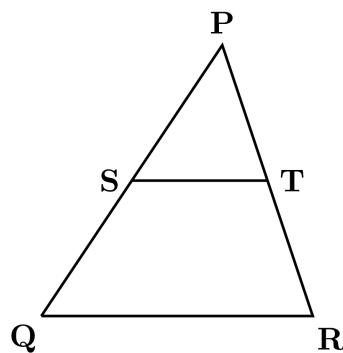
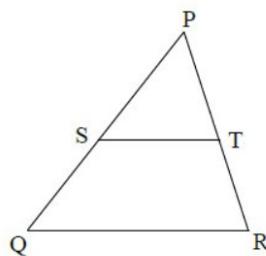
### Area (2)



#### 9.5.1 Area: GATE CSE 2025 | Set 1 | GA Question: 7

In the diagram, the lines QR and ST are parallel to each other. The shortest distance between these two lines is half the shortest distance between the point P and line QR. What is the ratio of the area of the triangle PST to the area of the trapezium SQRT?

Note: The figure shown is representative.



- A.  $\frac{1}{3}$       B.  $\frac{1}{4}$       C.  $\frac{2}{5}$       D.  $\frac{1}{2}$

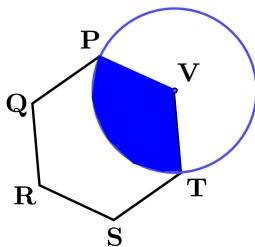
gatecse2025-set1 quantitative-apitude geometry area two-marks

[Answer key](#)



#### 9.5.2 Area: GATE Civil 2023 Set 1 | GA Question: 3

In the given figure,  $PQRSTV$  is a regular hexagon with each side of length 5 cm. A circle is drawn with its centre at  $V$  such that it passes through  $P$ . What is the area (in  $\text{cm}^2$ ) of the shaded region? (The diagram is representative)



- A.  $\frac{25\pi}{3}$       B.  $\frac{20\pi}{3}$       C.  $6\pi$       D.  $7\pi$

gatecivil-2023-set1 quantitative-apitude geometry area

[Answer key](#)



#### 9.6

#### Arithmetic Series (9)

##### 9.6.1 Arithmetic Series: GATE CSE 2013 | Question: 58

What will be the maximum sum of  $44, 42, 40, \dots$ ?

- A. 502      B. 504      C. 506      D. 500

gatecse-2013 quantitative-apitude easy arithmetic-series

[Answer key](#)

### 9.6.2 Arithmetic Series: GATE CSE 2015 Set 2 | Question: GA-6

If the list of letters  $P, R, S, T, U$  is an arithmetic sequence, which of the following are also in arithmetic sequence?

- I.  $2P, 2R, 2S, 2T, 2U$
- II.  $P - 3, R - 3, S - 3, T - 3, U - 3$
- III.  $P^2, R^2, S^2, T^2, U^2$

A. I only      B. I and II      C. II and III      D. I and III

gatecse-2015-set2 quantitative-apptitude normal arithmetic-series

[Answer key](#)

### 9.6.3 Arithmetic Series: GATE Chemical 2020 | GA Question: 5

The difference between the sum of the first  $2n$  natural numbers and the sum of the first  $n$  odd natural numbers is \_\_\_\_\_.

- A.  $n^2 - n$       B.  $n^2 + n$       C.  $2n^2 - n$       D.  $2n^2 + n$

gate2020-ch quantitative-apptitude arithmetic-series

[Answer key](#)

### 9.6.4 Arithmetic Series: GATE Civil 2020 Set 1 | GA Question: 8

Insert seven numbers between 2 and 34, such that the resulting sequence including 2 and 34 is an arithmetic progression. The sum of these inserted seven numbers is \_\_\_\_\_.

- A. 120      B. 124      C. 126      D. 130

gate2020-ce-1 quantitative-apptitude arithmetic-series

[Answer key](#)

### 9.6.5 Arithmetic Series: GATE Civil 2024 Set 1 | GA Question: 2

In a locality, the houses are numbered in the following way:

The house-numbers on one side of a road are consecutive odd integers starting from 301, while the house-numbers on the other side of the road are consecutive even numbers starting from 302. The total number of houses is the same on both sides of the road.

If the difference of the sum of the house-numbers between the two sides of the road is 27, then the number of houses on each side of the road is

- A. 27      B. 52      C. 54      D. 26

gatecivil-2024-set1 quantitative-apptitude arithmetic-series

[Answer key](#)

### 9.6.6 Arithmetic Series: GATE Civil 2024 Set 2 | GA Question: 4

If the sum of the first 20 consecutive positive odd numbers is divided by  $20^2$ , the result is

- A. 1      B. 20      C. 2      D. 1/2

gatecivil-2024-set2 quantitative-apptitude arithmetic-series

[Answer key](#)

### 9.6.7 Arithmetic Series: GATE Mechanical 2020 Set 1 | GA Question: 8

The sum of the first  $n$  terms in the sequence 8, 88, 888, 8888, ... is \_\_\_\_\_.

A.  
$$\frac{81}{80}(10^n - 1) + \frac{9}{8}n$$

B.

$$\frac{81}{80}(10^n - 1) - \frac{9}{8}n$$

C.

$$\frac{80}{81}(10^n - 1) + \frac{8}{9}n$$

D.  $\frac{80}{81}(10^n - 1) - \frac{8}{9}n$

gateme-2020-set1 quantitative-aptitude arithmetic-series

Answer key 



### 9.6.8 Arithmetic Series: GATE2011 AG: GA-6

The sum of  $n$  terms of the series  $4 + 44 + 444 + \dots$  is

A.  $\frac{4}{81}[10^{n+1} - 9n - 1]$

B.  $\frac{4}{81}[10^{n-1} - 9n - 1]$

C.  $\frac{4}{81}[10^{n+1} - 9n - 10]$

D.  $\frac{4}{81}[10^n - 9n - 10]$

general-aptitude quantitative-aptitude gate2011-ag arithmetic-series

Answer key 



### 9.6.9 Arithmetic Series: GATE2019 EE: GA-6

How many integers are there between 100 and 1000 all of whose digits are even?

A. 60

B. 80

C. 100

D. 90

gate2019-ee general-aptitude quantitative-aptitude arithmetic-series

Answer key 

## 9.7

### Average (3)



#### 9.7.1 Average: GATE CSE 2025 | Set 1 | GA Question: 3

The average marks obtained by a class in an examination were calculated as 30.8. However, while checking the marks entered, the teacher found that the marks of one student were entered incorrectly as 24 instead of 42. After correcting the marks, the average becomes 31.4. How many students does the class have?

A. 25

B. 28

C. 30

D. 32

gatecse2025-set1 quantitative-aptitude average one-mark

Answer key 



#### 9.7.2 Average: GATE Mechanical 2022 Set 1 | GA Question: 2

The average of the monthly salaries of M, N and S is ₹4000. The average of the monthly salaries of N, S and P is ₹5000. The monthly salary of P is ₹6000.

What is the monthly salary of M as a percentage of the monthly salary of P?

A. 50%

B. 75%

C. 100%

D. 125%

**Answer key****9.7.3 Average: GATE Mechanical 2022 Set 2 | GA Question: 7**

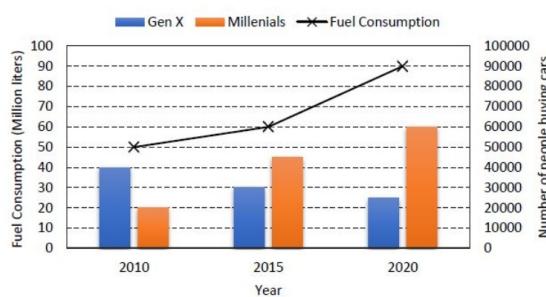
For the past  $m$  days, the average daily production at a company was 100 units per day.

If today's production of 180 units changes the average to 110 units per day, What is the value of  $m$ ?

- A. 18      B. 10      C. 7      D. 5

**Answer key****9.8****Bar Graph (18)****9.8.1 Bar Graph: GATE 2024 Electrical | GA Question: 8**

The chart below shows the data of the number of cars bought by Millennials and Gen X people in a country from the year 2010 to 2020 as well as the yearly fuel consumption of the country (in Million liters).

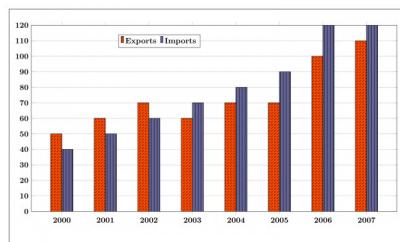


Considering the data presented in the chart, which one of the following options is true?

- A. The percentage increase in fuel consumption from 2010 to 2015 is more than the percentage increase in fuel consumption from 2015 to 2020.
- B. The increase in the number of Millennial car buyers from 2015 to 2020 is less than the decrease in the number of Gen X car buyers from 2010 to 2015.
- C. The increase in the number of Millennial car buyers from 2010 to 2015 is more than the decrease in the number of Gen X car buyers from 2010 to 2015.
- D. The decrease in the number of Gen X car buyers from 2015 to 2020 is more than the increase in the number of Millennial car buyers from 2010 to 2015.

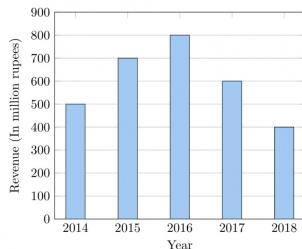
**Answer key****9.8.2 Bar Graph: GATE CSE 2015 Set 3 | Question: GA-10**

The exports and imports (in crores of *Rs.*) of a country from the year 2000 to 2007 are given in the following bar chart. In which year is the combined percentage increase in imports and exports the highest?

**Answer key**

### 9.8.3 Bar Graph: GATE CSE 2020 | Question: GA-10

The total revenue of a company during 2014 – 2018 is shown in the bar graph. If the total expenditure of the company in each year is 500 million rupees, then the aggregate profit or loss (in percentage) on the total expenditure of the company during 2014 – 2018 is \_\_\_\_\_.

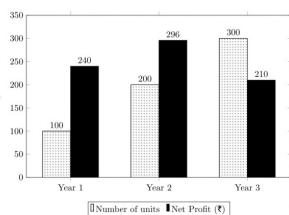


- A. 16.67% profit  
B. 16.67% loss  
C. 20% profit  
D. 20% loss

gatecse-2020 quantitative-apitude data-interpretation bar-graph two-marks

[Answer key](#)

### 9.8.4 Bar Graph: GATE CSE 2021 Set 2 | GA Question: 9



The number of units of a product sold in three different years and the respective net profits are presented in the figure above. The cost/unit in Year 3 was ₹ 1, which was half the cost/unit in Year 2. The cost/unit in Year 3 was one-third of the cost/unit in Year 1. Taxes were paid on the selling price at 10%, 13%, and 15% respectively for the three years. Net profit is calculated as the difference between the selling price and the sum of cost and taxes paid in that year.

The ratio of the selling price in Year 2 to the selling price in Year 3 is \_\_\_\_\_.

- A. 4 : 3      B. 1 : 1      C. 3 : 4      D. 1 : 2

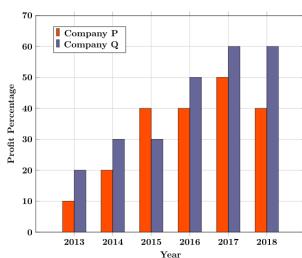
gatecse-2021-set2 quantitative-apitude data-interpretation bar-graph two-marks

[Answer key](#)

### 9.8.5 Bar Graph: GATE Chemical 2020 | GA Question: 10



The profit shares of two companies  $P$  and  $Q$  are shown in the figure. If the two companies have invested a fixed and equal amount every year, then the ratio of the total revenue of company  $P$  to the revenue of company  $Q$ , during 2013 – 2018 is \_\_\_\_\_.



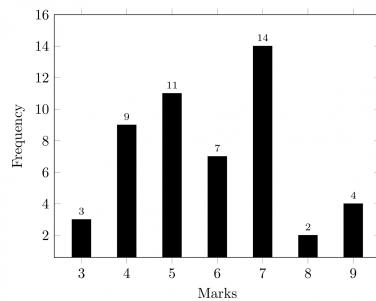
- A. 15 : 17      B. 16 : 17      C. 17 : 15      D. 17 : 16

gate2020-ch quantitative-apitude data-interpretation bar-graph

[Answer key](#)

### 9.8.6 Bar Graph: GATE Civil 2022 Set 1 | GA Question: 8





The above frequency chart shows the frequency distribution of marks obtained by a set of students in an exam.

From the data presented above, which one of the following is CORRECT?

- A. mean > mode > median
- B. mode > median > mean
- C. mode > mean > median
- D. median > mode > mean

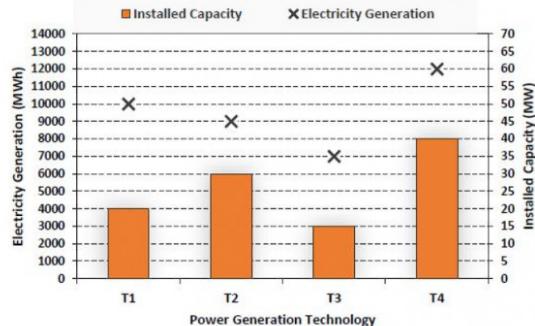
gatecivil-2022-set1 quantitative-apitude data-interpretation bar-graph statistics

[Answer key](#)

#### 9.8.7 Bar Graph: GATE Civil 2024 Set 1 | GA Question: 8



The chart given below compares the Installed Capacity (MW) of four power generation technologies, T1, T2, T3, and T4, and their Electricity Generation (MWh) in a time of 1000 hours (h).



The Capacity Factor of a power generation technology is:

$$\text{Capacity Factor} = \frac{\text{Electricity Generation (MWh)}}{\text{Installed Capacity (MW)} \times 1000(\text{h})}$$

Which one of the given technologies has the highest Capacity Factor?

- A. T1
- B. T2
- C. T3
- D. T4

gatecivil-2024-set1 quantitative-apitude bar-graph data-interpretation

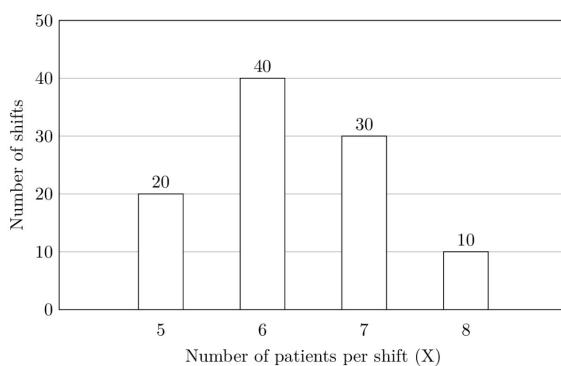
[Answer key](#)

#### 9.8.8 Bar Graph: GATE DA 2025 | GA Question: 10



The number of patients per shift ( $X$ ) consulting Dr. Gita in her past 100 shifts is shown in the figure. If the amount she earns is ₹ 1000( $X - 0.2$ ), what is the average amount (in ₹) she has earned per shift in the past 100 shifts?

Note: The figure shown is representative.



- A. 6,100      B. 6,300      C. 6,000      D. 6,500

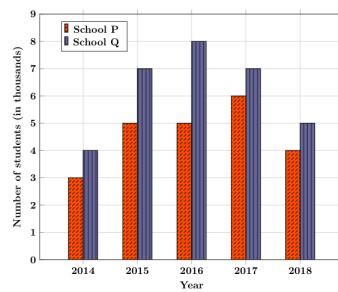
gateda-2025 quantitative-apitude bar-graph data-interpretation two-marks

[Answer key](#)



#### 9.8.9 Bar Graph: GATE ECE 2020 | GA Question: 10

The following figure shows the data of students enrolled in 5 years (2014 to 2018) for two schools  $P$  and  $Q$ . During this period, the ratio of the average number of the students enrolled in school  $P$  to the average of the difference of the number of students enrolled in schools  $P$  and  $Q$  is \_\_\_\_\_.



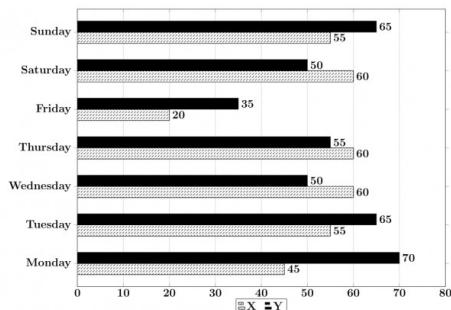
- A. 8 : 23      B. 23 : 8      C. 23 : 31      D. 31 : 23

gate2020-ec quantitative-apitude data-interpretation bar-graph

[Answer key](#)



#### 9.8.10 Bar Graph: GATE ECE 2021 | GA Question: 9



The number of minutes spent by two students,  $X$  and  $Y$ , exercising every day in a given week are shown in the bar chart above.

The number of days in the given week in which one of the students spent a minimum of 10% more than the other

student, on a given day, is

A. 4

B. 5

C. 6

D. 7

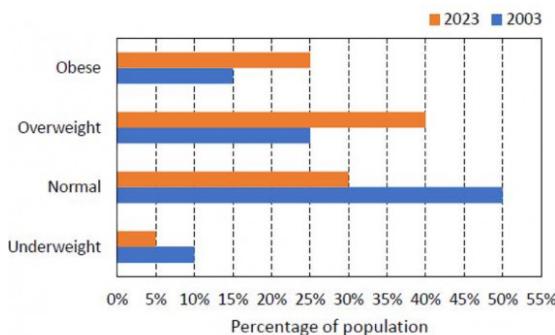
gateec-2021 quantitative-aptitude data-interpretation bar-graph

Answer key ↗

#### 9.8.11 Bar Graph: GATE ECE 2024 | GA Question: 8



The bar chart shows the data for the percentage of population falling into different categories based on Body Mass Index (BMI) in 2003 and 2023.



Based on the data provided, which one of the following options is INCORRECT?

- A. The ratio of the percentage of population falling into overweight category to the percentage of population falling into normal category has increased in 20 years.
- B. The ratio of the percentage of population falling into underweight category to the percentage of population falling into normal category has decreased in 20 years.
- C. The ratio of the percentage of population falling into obese category to the percentage of population falling into normal category has decreased in 20 years.
- D. The percentage of population falling into normal category has decreased in 20 years.

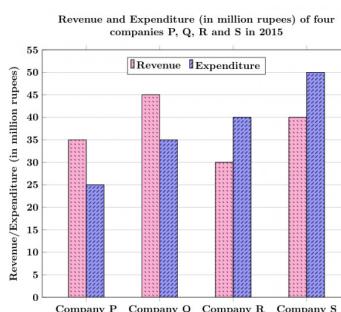
gateece-2024 data-interpretation bar-graph quantitative-aptitude

Answer key ↗

#### 9.8.12 Bar Graph: GATE Electrical 2020 | GA Question: 10



The revenue and expenditure of four different companies P, Q, R and S in 2015 are shown in the figure. If the revenue of company Q in 2015 was 20% more than that in 2014, and company Q had earned a profit of 10% on expenditure in 2014, then its expenditure (in million rupees) in 2014 was \_\_\_\_\_.



A. 32.7

B. 33.7

C. 34.1

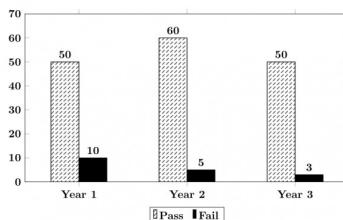
D. 35.1

gate2020-ee quantitative-aptitude data-interpretation bar-graph

Answer key ↗

#### 9.8.13 Bar Graph: GATE Electrical 2021 | GA Question: 9





The number of students passing or failing in an exam for a particular subject is presented in the bar chart above. Students who pass the exam cannot appear for the exam again. Students who fail the exam in the first attempt must appear for the exam in the following year. Students always pass the exam in their second attempt.

The number of students who took the exam for the first time in the year 2 and the year 3 respectively, are \_\_\_\_\_.

- A. 65 and 53      B. 60 and 50      C. 55 and 53      D. 55 and 48

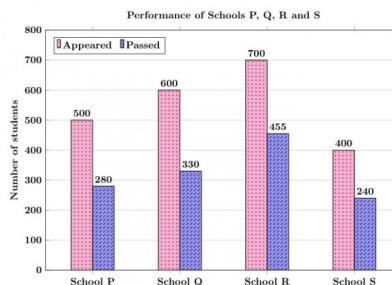
gateee-2021 quantitative-apitude data-interpretation bar-graph

[Answer key](#)



#### 9.8.14 Bar Graph: GATE Mechanical 2020 Set 1 | GA Question: 10

The bar graph shows the data of the students who appeared and passed in an examination for four schools  $P, Q, R$ , and  $S$ . The average of success rates (in percentage) of these four schools is \_\_\_\_\_.



- A. 58.5%      B. 58.8%      C. 59.0%      D. 59.3%

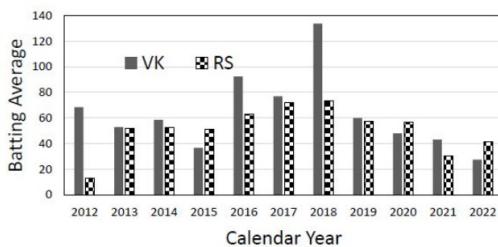
gateme-2020-set1 quantitative-apitude data-interpretation bar-graph

[Answer key](#)



#### 9.8.15 Bar Graph: GATE Mechanical 2024 | GA Question: 8

The bar chart gives the batting averages of VK and RS for 11 calendar years from 2012 to 2022. Considering that 2015 and 2019 are world cup years, which one of the following options is true?



- A. RS has a higher yearly batting average than that of VK in every world cup year.  
 B. VK has a higher yearly batting average than that of RS in every world cup year.  
 C. VK's yearly batting average is consistently higher than that of RS between the two world cup years.  
 D. RS's yearly batting average is consistently higher than that of VK in the last three years.

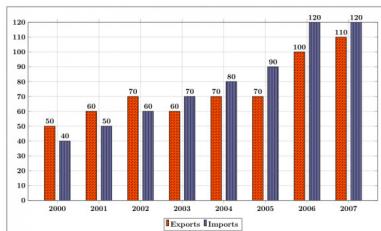
gateme-2024 quantitative-apitude bar-graph data-interpretation

[Answer key](#)



### 9.8.16 Bar Graph: GATE2014 EC-1: GA-9

The exports and imports (in crores of Rs.) of a country from 2000 to 2007 are given in the following bar chart. If the trade deficit is defined as excess of imports over exports, in which year is the trade deficit 1/5th of the exports?



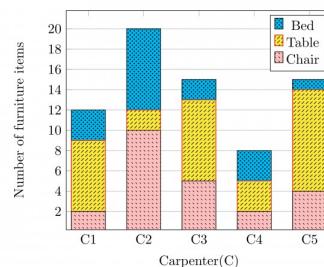
- A. 2005      B. 2004      C. 2007      D. 2006

gate2014-ec-1 quantitative-apitude data-interpretation bar-graph normal

[Answer key](#)

### 9.8.17 Bar Graph: GATE2017 CE-1: GA-10

The bar graph below shows the output of five carpenters over one month, each of whom made different items of furniture: chairs, tables, and beds.



Consider the following statements.

- i. The number of beds made by carpenter  $C_2$  is exactly the same as the number of tables made by carpenter  $C_3$   
ii. The total number of chairs made by all carpenters is less than the total number of tables.

Which one of the following is true?

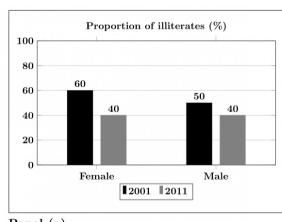
- A. Only i      B. Only ii      C. Both i and ii      D. Neither i nor ii

gate2017-ce-1 general-apitude quantitative-apitude data-interpretation bar-graph

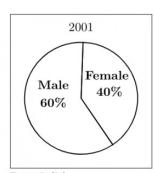
[Answer key](#)

### 9.8.18 Bar Graph: GATE2019 EC: GA-7

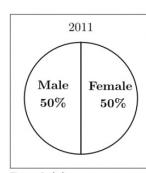
The bar graph in panel (a) shows the proportion of male and female illiterates in 2001 and 2011. The proportions of males and females in 2001 and 2011 are given in Panel (b) and (c), respectively. The total population did not change during this period. The percentage increase in the total number of literates from 2001 to 2011 is \_\_\_\_\_.



Panel (a)



Panel (b)



Panel (c)

A. 30.43

B. 33.43

C. 34.43

D. 35.43

gate2019-ec quantitative-aptitude data-interpretation bar-graph

Answer key 

9.9

Calendar (2)



#### 9.9.1 Calendar: GATE Civil 2020 Set 2 | GA Question: 7

For the year 2019, which of the previous year's calendar can be used?

A. 2011

B. 2012

C. 2013

D. 2014

gate2020-ce-2 quantitative-aptitude calendar

Answer key 



#### 9.9.2 Calendar: GATE Mechanical 2022 Set 2 | GA Question: 4

A person was born on the fifth Monday of February in a particular year.

Which one of the following statements is correct based on the above information?

- A. The 2<sup>nd</sup> February of that year is a Tuesday
- B. There will be five Sundays in the month of February in that year
- C. The 1<sup>st</sup> February of that year is a Sunday
- D. All Mondays of February in that year have even dates

gateme-2022-set2 quantitative-aptitude calendar

Answer key 

9.10

Cartesian Coordinates (10)



#### 9.10.1 Cartesian Coordinates: GATE CSE 2020 | Question: GA-9

Two straight lines are drawn perpendicular to each other in  $X - Y$  plane. If  $\alpha$  and  $\beta$  are the acute angles the straight lines make with the X-axis, then  $\alpha + \beta$  is \_\_\_\_\_.

A.  $60^\circ$

B.  $90^\circ$

C.  $120^\circ$

D.  $180^\circ$

gatecse-2020 quantitative-aptitude geometry cartesian-coordinates two-marks

Answer key 



#### 9.10.2 Cartesian Coordinates: GATE CSE 2022 | GA Question: 2

A function  $y(x)$  is defined in the interval  $[0, 1]$  on the  $x$ -axis as

$$y(x) = \begin{cases} 2 & \text{if } 0 \leq x < \frac{1}{3} \\ 3 & \text{if } \frac{1}{3} \leq x < \frac{3}{4} \\ 1 & \text{if } \frac{3}{4} \leq x \leq 1 \end{cases}$$

Which one of the following is the area under the curve for the interval  $[0, 1]$  on the  $x$ -axis?

A.  $\frac{5}{6}$

B.  $\frac{6}{5}$

C.  $\frac{13}{6}$

D.  $\frac{6}{13}$

gatecse-2022 quantitative-aptitude cartesian-coordinates area one-mark

Answer key 



#### 9.10.3 Cartesian Coordinates: GATE Civil 2022 Set 1 | GA Question: 2

Two straight lines pass through the origin  $(x_0, y_0) = (0, 0)$ . One of them passes through the point  $(x_1, y_1) = (1, 3)$  and the other passes through the point  $(x_2, y_2) = (1, 2)$ .

What is the area enclosed between the straight lines in the interval  $[0, 1]$  on the  $x$ -axis?

A. 0.5

B. 1.0

C. 1.5

D. 2.0

gatecivil-2022-set1 quantitative-aptitude cartesian-coordinates area

[Answer key](#)

#### 9.10.4 Cartesian Coordinates: GATE ECE 2022 | GA Question: 8



Four points  $P(0, 1)$ ,  $Q(0, -3)$ ,  $R(-2, -1)$ , and  $S(2, -1)$  represent the vertices of a quadrilateral.  
What is the area enclosed by the quadrilateral?

- A. 4      B.  $4\sqrt{2}$       C. 8      D.  $8\sqrt{2}$

gateece-2022 quantitative-aptitude cartesian-coordinates area

[Answer key](#)

#### 9.10.5 Cartesian Coordinates: GATE Mechanical 2022 Set 2 | GA Question: 3



If  $f(x) = 2 \ln(\sqrt{e^x})$ , what is the area bounded by  $f(x)$  for the interval  $[0, 2]$  on the  $x$ -axis?

- A.  $\frac{1}{2}$       B. 1      C. 2      D. 4

gateme-2022-set2 quantitative-aptitude cartesian-coordinates area

[Answer key](#)

#### 9.10.6 Cartesian Coordinates: GATE2012 AE: GA-9



Two points  $(4, p)$  and  $(0, q)$  lie on a straight line having a slope of  $3/4$ . The value of  $(p-q)$  is

- A. -3      B. 0      C. 3      D. 4

gate2012-ae quantitative-aptitude cartesian-coordinates geometry

[Answer key](#)

#### 9.10.7 Cartesian Coordinates: GATE2014 AE: GA-4



If  $y = 5x^2 + 3$ , then the tangent at  $x = 0, y = 3$

- A. passes through  $x = 0, y = 0$   
C. is parallel to the  $x$ -axis      B. has a slope of +1  
D. has a slope of -1

gate2014-ae quantitative-aptitude geometry cartesian-coordinates

[Answer key](#)

#### 9.10.8 Cartesian Coordinates: GATE2016 EC-3: GA-10



A straight line is fit to a data set  $(\ln x, y)$ . This line intercepts the abscissa at  $\ln x = 0.1$  and has a slope of  $-0.02$ .  
What is the value of  $y$  at  $x = 5$  from the fit?

- A. -0.030      B. -0.014      C. 0.014      D. 0.030

gate2016-ec-3 quantitative-aptitude cartesian-coordinates

[Answer key](#)

#### 9.10.9 Cartesian Coordinates: GATE2016 EC-3: GA-9



Find the area bounded by the lines  $3x + 2y = 14$ ,  $2x - 3y = 5$  in the first quadrant.

- A. 14.95      B. 15.25      C. 15.70      D. 20.35

gate2016-ec-3 cartesian-coordinates geometry normal

[Answer key](#)

#### 9.10.10 Cartesian Coordinates: GATE2017 ME-1: GA-8



Let  $S_1$  be the plane figure consisting of the points  $(x, y)$  given by the inequalities  $|x - 1| \leq 2$  and  $|y + 2| \leq 3$ . Let  $S_2$  be the plane figure given by the inequalities  $x - y \geq -2$ ,  $y \geq 1$ , and  $x \leq 3$ . Let  $S$  be the union of  $S_1$  and  $S_2$ .  
The area of  $S$  is.

- A. 26      B. 28      C. 32      D. 34

gate2017-me-1 general-aptitude quantitative-aptitude geometry cartesian-coordinates

[Answer key](#)

## 9.11.1 Circle: GATE CSE 2018 | Question: GA-3



The area of a square is  $d$ . What is the area of the circle which has the diagonal of the square as its diameter?

- A.  $\pi d$       B.  $\pi d^2$       C.  $\frac{1}{4}\pi d^2$       D.  $\frac{1}{2}\pi d$

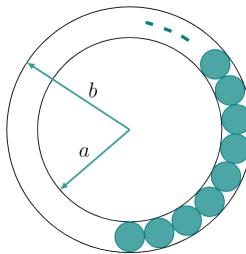
gatecse-2018 quantitative-aptitude geometry circle normal one-mark

[Answer key](#)

## 9.11.2 Circle: GATE CSE 2020 | Question: GA-8



The figure below shows an annular ring with outer and inner radii as  $b$  and  $a$ , respectively. The annular space has been painted in the form of blue colour circles touching the outer and inner periphery of annular space. If maximum  $n$  number of circles can be painted, then the unpainted area available in annular space is \_\_\_\_\_.

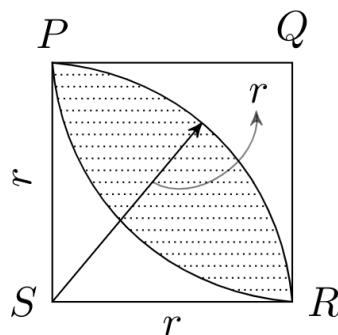


- A.  $\pi[(b^2 - a^2) - \frac{n}{4}(b-a)^2]$   
 C.  $\pi[(b^2 - a^2) + \frac{n}{4}(b-a)^2]$   
 B.  $\pi[(b^2 - a^2) - n(b-a)^2]$   
 D.  $\pi[(b^2 - a^2) + n(b-a)^2]$

gatecse-2020 quantitative-aptitude geometry circle area two-marks

[Answer key](#)

## 9.11.3 Circle: GATE Civil 2021 Set 2 | GA Question: 9



In the figure shown above,  $PQRS$  is a square. The shaded portion is formed by the intersection of sectors of circles with radius equal to the side of the square and centers at  $S$  and  $Q$ .

The probability that any point picked randomly within the square falls in the shaded area is \_\_\_\_\_

- A.  $4 - \frac{\pi}{2}$       B.  $\frac{1}{2}$       C.  $\frac{\pi}{2} - 1$       D.  $\frac{\pi}{4}$

gatcivil-2021-set2 quantitative-aptitude geometry circle

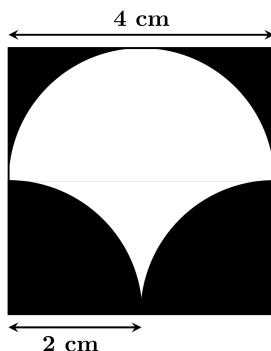
[Answer key](#)

## 9.11.4 Circle: GATE Civil 2023 Set 1 | GA Question: 10



A square of side length 4 cm is given. The boundary of the shaded region is defined by one semi-circle on the top and two circular arcs at the bottom, each of radius 2 cm, as shown.

The area of the shaded region is \_\_\_\_\_ cm<sup>2</sup>.



- A. 8      B. 4      C. 12      D. 10

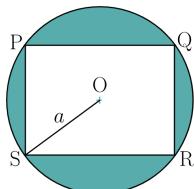
gatecivil-2023-set1 quantitative-aptitude geometry circle

[Answer key](#)



#### 9.11.5 Circle: GATE ECE 2020 | GA Question: 8

A circle with centre O is shown in the figure. A rectangle PQRS of maximum possible area is inscribed in the circle. If the radius of the circle is  $a$ , then the area of the shaded portion is \_\_\_\_\_.



- A.  $\pi a^2 - a^2$       B.  $\pi a^2 - \sqrt{2}a^2$       C.  $\pi a^2 - 2a^2$       D.  $\pi a^2 - 3a^2$

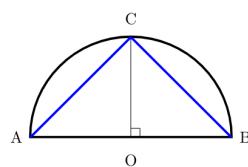
gate2020-ece quantitative-aptitude geometry circle area

[Answer key](#)



#### 9.11.6 Circle: GATE Electrical 2020 | GA Question: 9

Given a semicircle with O as the centre, as shown in the figure, the ratio  $\frac{\overline{AC} + \overline{CB}}{\overline{AB}}$  is \_\_\_\_\_, where  $\overline{AC}$ ,  $\overline{CB}$  and  $\overline{AB}$  are chords.



- A.  $\sqrt{2}$       B.  $\sqrt{3}$       C. 2      D. 3

gate2020-ee quantitative-aptitude geometry circle

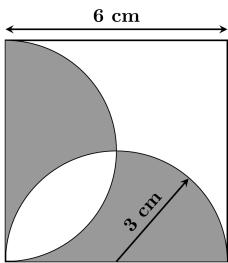
[Answer key](#)



#### 9.11.7 Circle: GATE Electrical 2023 | GA Question: 10

A square with sides of length 6 cm is given. The boundary of the shaded region is defined by two semi-circles whose diameters are the sides of the square, as shown.

The area of the shaded region is \_\_\_\_\_ cm<sup>2</sup>.



- A.  $6\pi$       B. 18      C. 20      D.  $9\pi$

gate2023-ee quantitative-apitude geometry circle

[Answer key](#)

9.12

Clock Time (10)

#### 9.12.1 Clock Time: GATE CSE 2014 Set 2 | Question: GA-10



At what time between 6 a. m. and 7 a. m. will the minute hand and hour hand of a clock make an angle closest to  $60^\circ$ ?

- A. 6 : 22 a.m.      B. 6 : 27 a.m.      C. 6 : 38 a.m.      D. 6 : 45 a.m.

gatecse-2014-set2 quantitative-apitude normal clock-time

[Answer key](#)

#### 9.12.2 Clock Time: GATE Civil 2024 Set 1 | GA Question: 5



On a given day, how many times will the second-hand and the minute-hand of a clock cross each other during the clock time 12 : 05 : 00 hours to 12 : 55 : 00 hours?

- A. 51      B. 49      C. 50      D. 55

gatecivil-2024-set1 quantitative-apitude clock-time

[Answer key](#)

#### 9.12.3 Clock Time: GATE ECE 2020 | GA Question: 7



It is quarter past three in your watch. The angle between the hour hand and the minute hand is \_\_\_\_\_.

- A.  $0^\circ$       B.  $7.5^\circ$       C.  $15^\circ$       D.  $22.5^\circ$

gate2020-ec quantitative-apitude clock-time

[Answer key](#)

#### 9.12.4 Clock Time: GATE Mechanical 2021 Set 2 | GA Question: 3



A digital watch X beeps every 30 seconds while watch Y beeps every 32 seconds. They beeped together at 10 AM.

The immediate next time that they will beep together is \_\_\_\_\_

- A. 10.08 AM      B. 10.42 AM      C. 11.00 AM      D. 10.00 PM

gateme-2021-set2 quantitative-apitude clock-time

[Answer key](#)

#### 9.12.5 Clock Time: GATE Mechanical 2022 Set 1 | GA Question: 10



In a 12-hour clock that runs correctly, how many times do the second, minute, and hour hands of the clock coincide, in a 12-hour duration from 3 PM in a day to 3 AM the next day?

- A. 11      B. 12      C. 144      D. 2

gateme-2022-set1 quantitative-apitude clock-time

[Answer key](#)

### 9.12.6 Clock Time: GATE Mechanical 2023 | GA Question: 4

The minute-hand and second-hand of a clock cross each other \_\_\_\_\_ times between 09 : 15 : 00 AM and 09 : 45 : 00 AM on a day.

- A. 30      B. 15      C. 29      D. 31

gateme-2023 quantitative-apitude clock-time

[Answer key](#)



### 9.12.7 Clock Time: GATE2016 EC-2: GA-8

Two and quarter hours back, when seen in a mirror, the reflection of a wall clock without number markings seemed to show 1 : 30. What is the actual current time shown by the clock?

- A. 8 : 15      B. 11 : 15      C. 12 : 15      D. 12 : 45

gate2016-ec-2 clock-time

[Answer key](#)



### 9.12.8 Clock Time: GATE2018 CE-2: GA-7

A faulty wall clock is known to gain 15 minutes every 24 hours. It is synchronized to the correct time at 9 AM on 11th July. What will be the correct time to the nearest minute when the clock shows 2 PM on 15th July of the same year?

- A. 12 : 45 PM      B. 12 : 58 PM      C. 1 : 00 PM      D. 2 : 00 PM

gate2018-ce-2 general-apitude quantitative-apitude clock-time normal

[Answer key](#)



### 9.12.9 Clock Time: GATE2019 EC: GA-9

Two design consultants, *P* and *Q*, started working from 8 AM for a client. The client budgeted a total of USD 3000 for the consultants. *P* stopped working when the hour hand moved by 210 degrees on the clock. *Q* stopped working when the hour hand moved by 240 degrees. *P* took two tea breaks of 15 minutes each during her shift, but took no lunch break. *Q* took only one lunch break for 20 minutes, but no tea breaks. The market rate for consultants is USD 200 per hour and breaks are not paid. After paying the consultants, the client shall have USD \_\_\_\_\_ remaining in the budget.

- A. 000.00      B. 166.67      C. 300.00      D. 433.33

gate2019-ec general-apitude quantitative-apitude clock-time

[Answer key](#)



### 9.12.10 Clock Time: GATE2019 ME-1: GA-3

A worker noticed that the hour hand on the factory clock had moved by 225 degrees during her stay at the factory. For how long did she stay in the factory?

- A. 3.75 hours      B. 4 hours and 15 mins      C. 8.5 hours      D. 7.5 hours

gate2019-me-1 general-apitude quantitative-apitude clock-time

[Answer key](#)



## 9.13

### Combinatory (12)

#### 9.13.1 Combinatory: GATE CSE 2010 | Question: 65

Given digits 2,2,3,3,3,4,4,4 how many distinct 4 digit numbers greater than 3000 can be formed?

- A. 50      B. 51      C. 52      D. 54

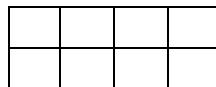
gatecse-2010 quantitative-apitude combinatory normal

[Answer key](#)



### 9.13.2 Combinatory: GATE CSE 2016 Set 2 | Question: GA-09

In a  $2 \times 4$  rectangle grid shown below, each cell is rectangle. How many rectangles can be observed in the grid?



- A. 21      B. 27      C. 30      D. 36

gatecse-2016-set2 quantitative-apitude normal combinatoric

[Answer key](#)



### 9.13.3 Combinatory: GATE CSE 2017 Set 1 | Question: GA-9

Arun, Gulab, Neel and Shweta must choose one shirt each from a pile of four shirts coloured red, pink, blue and white respectively. Arun dislikes the colour red and Shweta dislikes the colour white. Gulab and Neel like all the colours. In how many different ways can they choose the shirts so that no one has a shirt with a colour he or she dislikes?

- A. 21      B. 18      C. 16      D. 14

gatecse-2017-set1 combinatoric quantitative-apitude

[Answer key](#)



### 9.13.4 Combinatory: GATE2011 MN: GA-59

In how many ways 3 scholarships can be awarded to 4 applicants, when each applicant can receive any number of scholarships?

- A. 4      B. 12      C. 64      D. 81

quantitative-apitude gate2011-mn combinatoric

[Answer key](#)



### 9.13.5 Combinatory: GATE2012 AR: GA-5

Ten teams participate in a tournament. Every team plays each of the other teams twice. The total number of matches to be played is

- A. 20      B. 45      C. 60      D. 90

gate2012-ar quantitative-apitude combinatoric

[Answer key](#)



### 9.13.6 Combinatory: GATE2014 EC-4: GA-10

A five digit number is formed using the digits 1, 3, 5, 7 and 9 without repeating any of them. What is the sum of all such possible five digit numbers?

- A. 6666660      B. 6666600      C. 6666666      D. 6666606

gate2014-ec-4 quantitative-apitude normal combinatoric

[Answer key](#)



### 9.13.7 Combinatory: GATE2015 CE-2: GA-8

How many four digit numbers can be formed with the 10 digits  $0, 1, 2, \dots, 9$  if no number can start with 0 and if repetitions are not allowed?

gate2015-ce-2 quantitative-apitude combinatoric

[Answer key](#)



### 9.13.8 Combinatory: GATE2015 ME-3: GA-5

Five teams have to compete in a league, with every team playing every other team exactly once, before going to the next round. How many matches will have to be held to complete the league round of matches?



A. 20

B. 10

C. 8

D. 5

gate2015-me-3 quantitative-aptitude combinatory

Answer key 



### 9.13.9 Combinatory: GATE2017 EC-2: GA-9

The number of 3-digit numbers such that the digit 1 is never to the immediate right of 2 is

A. 781

B. 791

C. 881

D. 891

gate2017-ec-2 quantitative-aptitude combinatory

Answer key 



### 9.13.10 Combinatory: GATE2017 ME-2: GA-8

There are 4 women  $P, Q, R, S$  and 5 men  $V, W, X, Y, Z$  in a group. We are required to form pairs each consisting of one woman and one man.  $P$  is not to be paired with  $Z$ , and  $Y$  must necessarily be paired with someone. In how many ways can 4 such pairs be formed?

A. 74

B. 76

C. 78

D. 80

gate2017-me-2 quantitative-aptitude combinatory

Answer key 



### 9.13.11 Combinatory: GATE2018 CE-2: GA-4

A three-member committee has to be formed from a group of 9 people. How many such distinct committees can be formed?

A. 27

B. 72

C. 81

D. 84

gate2018-ce-2 quantitative-aptitude combinatory

Answer key 



### 9.13.12 Combinatory: GATE2019 EC: GA-4

Five different books ( $P, Q, R, S, T$ ) are to be arranged on a shelf. The books  $R$  and  $S$  are to be arranged first and second, respectively from the right side of the shelf. The number of different orders in which  $P, Q$  and  $T$  may be arranged is \_\_\_\_\_.

A. 2

B. 6

C. 12

D. 120

gate2019-ec quantitative-aptitude combinatory

Answer key 

9.14

## Compound Interest (5)



### 9.14.1 Compound Interest: GATE DS&AI 2024 | GA Question: 8

Person 1 and Person 2 invest in three mutual funds A, B, and C. The amounts they invest in each of these mutual funds are given in the table.

	Mutual fund A	Mutual fund B	Mutual fund C
Person1	10,000	20,000	20,000
Person2	20,000	15,000	15,000

At the end of one year, the total amount that Person 1 gets is ₹500 more than Person 2. The annual rate of return for the mutual funds B and C is 15% each. What is the annual rate of return for the mutual fund A?

A. 7.5%

B. 10%

C. 15%

D. 20%

gate-ds-ai-2024 quantitative-aptitude compound-interest two-marks

Answer key 



#### 9.14.2 Compound Interest: GATE ECE 2021 | GA Question: 1

The current population of a city is 11,02,500 . If it has been increasing at the rate of 5% per annum, what was its population 2 years ago?

- A. 9,92,500      B. 9,95,006      C. 10,00,000      D. 12,51,506

gateec-2021 quantitative-apitude compound-interest

Answer key

#### 9.14.3 Compound Interest: GATE2010 MN: GA-5

A person invest Rs.1000 at 10% annual compound interest for 2 years. At the end of two years, the whole amount is invested at an annual simple interest of 12% for 5 years. The total value of the investment finally is :

- A. 1776      B. 1760      C. 1920      D. 1936

general-apitude quantitative-apitude gate2010-mn compound-interest

Answer key

#### 9.14.4 Compound Interest: GATE2014 AG: GA-5

The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate?

- A. 3 – 4 years      B. 4 – 5 years      C. 5 – 6 years      D. 6 – 7 years

gate2014-ag quantitative-apitude compound-interest normal

Answer key

#### 9.14.5 Compound Interest: GATE2018 EC: GA-6

Leila aspires to buy a car worth *Rs.*10,00,000 after 5 years. What is the minimum amount in Rupees that she should deposit now in a bank which offers 10% annual rate of interest, if the interest was compounded annually?

- A. 5,00,000      B. 6,21,000      C. 6,66,667      D. 7,50,000

gate2018-ec general-apitude quantitative-apitude compound-interest normal

Answer key

### 9.15

#### Conditional Probability (6)

##### 9.15.1 Conditional Probability: GATE CSE 2012 | Question: 63

An automobile plant contracted to buy shock absorbers from two suppliers  $X$  and  $Y$  .  $X$  supplies 60% and  $Y$  supplies 40% of the shock absorbers. All shock absorbers are subjected to a quality test. The ones that pass the quality test are considered reliable. Of  $X$ 's shock absorbers, 96% are reliable. Of  $Y$ 's shock absorbers, 72% are reliable.

The probability that a randomly chosen shock absorber, which is found to be reliable, is made by  $Y$  is

- A. 0.288      B. 0.334      C. 0.667      D. 0.720

gatecse-2012 quantitative-apitude probability normal conditional-probability

Answer key

##### 9.15.2 Conditional Probability: GATE Mechanical 2021 Set 2 | GA Question: 7

A box contains 15 blue balls and 45 black balls. If 2 balls are selected randomly, without replacement, the probability of an outcome in which the first selected is a blue ball and the second selected is a black ball, is \_\_\_\_\_

- A.  $\frac{3}{16}$   
B.  $\frac{45}{236}$   
C.  $\frac{1}{4}$   
D.  $\frac{3}{4}$

[Answer key](#)**9.15.3 Conditional Probability: GATE2013 AE: GA-10**

In a factory, two machines  $M_1$  and  $M_2$  manufacture 60% and 40% of the autocomponents respectively. Out of the total production, 2% of  $M_1$  and 3% of  $M_2$  are found to be defective. If a randomly drawn autocomponent from the combined lot is found defective, what is the probability that it was manufactured by  $M_2$ ?

- A. 0.35      B. 0.45      C. 0.5      D. 0.4

[Answer key](#)**9.15.4 Conditional Probability: GATE2014 AG: GA-10**

10% of the population in a town is  $\text{HIV}^+$ . A new diagnostic kit for  $\text{HIV}$  detection is available; this kit correctly identifies  $\text{HIV}^+$  individuals 95% of the time, and  $\text{HIV}^-$  individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is \_\_\_\_\_.

[Answer key](#)**9.15.5 Conditional Probability: GATE2014 EC-1: GA-10**

You are given three coins: one has heads on both faces, the second has tails on both faces, and the third has a head on one face and a tail on the other. You choose a coin at random and toss it, and it comes up heads. The probability that the other face is tails is

- A.  $\frac{1}{4}$       B.  $\frac{1}{3}$       C.  $\frac{1}{2}$       D.  $\frac{2}{3}$

[Answer key](#)**9.15.6 Conditional Probability: GATE2015 ME-3: GA-10**

A coin is tossed thrice. Let  $X$  be the event that head occurs in each of the first two tosses. Let  $Y$  be the event that a tail occurs on the third toss. Let  $Z$  be the event that two tails occur in three tosses.

Based on the above information, which one of the following statements is TRUE?

- A.  $X$  and  $Y$  are not independent      B.  $Y$  and  $Z$  are dependent  
 C.  $Y$  and  $Z$  are independent      D.  $X$  and  $Z$  are independent

[Answer key](#)**9.16****Cones (1)****9.16.1 Cones: GATE ECE 2021 | GA Question: 8**

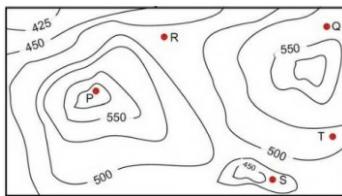
Consider a square sheet of side 1 unit. In the first step, it is cut along the main diagonal to get two triangles. In the next step, one of the cut triangles is revolved about its short edge to form a solid cone. The volume of the resulting cone, in cubic units, is \_\_\_\_\_

- A.  $\frac{\pi}{3}$       B.  $\frac{2\pi}{3}$       C.  $\frac{3\pi}{2}$       D.  $3\pi$

[Answer key](#)**9.17****Contour Plots (4)****9.17.1 Contour Plots: GATE CSE 2017 Set 1 | Question: GA-10**

A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot. If in a flood, the water level rises to

525 m, which of the villages  $P, Q, R, S, T$  get submerged?



A.  $P, Q$

B.  $P, Q, T$

C.  $R, S, T$

D.  $Q, R, S$

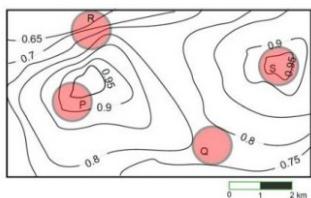
gatecse-2017-set1 general-aptitude quantitative-aptitude data-interpretation normal contour-plots

[Answer key](#)

#### 9.17.2 Contour Plots: GATE CSE 2017 Set 2 | Question: GA-10

An air pressure contour line joins locations in a region having the same atmospheric pressure. The following is an air pressure contour plot of a geographical region. Contour lines are shown at 0.05 bar intervals in this plot.

If the possibility of a thunderstorm is given by how fast air pressure rises or drops over a region, which of the following regions is most likely to have a thunderstorm?



A.  $P$

B.  $Q$

C.  $R$

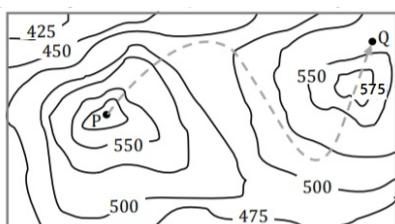
D.  $S$

gatecse-2017-set2 quantitative-aptitude data-interpretation normal contour-plots

[Answer key](#)

#### 9.17.3 Contour Plots: GATE2017 EC-1: GA-10

A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot.



The path from  $P$  to  $Q$  is best described by

A. Up-Down-Up-Down

B. Down-Up-Down-Up

C. Down-Up-Down

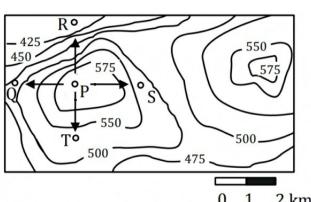
D. Up-Down-Up

gate2017-ec-1 general-aptitude quantitative-aptitude data-interpretation contour-plots

[Answer key](#)

#### 9.17.4 Contour Plots: GATE2017 EC-2: GA-10

A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot.



Which of the following is the steepest path leaving from  $P$ ?

A. P to Q

B. P to R

C. P to S

D. P to T

gate2017-ec-2 general-aptitude quantitative-aptitude data-interpretation contour-plots

Answer key 

9.18

### Cost Market Price (6)



#### 9.18.1 Cost Market Price: GATE 2024 Electrical | GA Question: 4

A shopkeeper buys shirts from a producer and sells them at 20% profit. A customer has to pay ₹ 3,186.00 including 18% taxes, per shirt. At what price did the shopkeeper buy each shirt from the producer?

A. ₹ 2,500.00

B. ₹ 1,975.40

C. ₹ 2,250.00

D. ₹ 2,548.80

gate2024-ee quantitative-aptitude cost-market-price

Answer key 



#### 9.18.2 Cost Market Price: GATE CSE 2011 | Question: 63

The variable cost ( $V$ ) of manufacturing a product varies according to the equation  $V = 4q$ , where  $q$  is the quantity produced. The fixed cost ( $F$ ) of production of same product reduces with  $q$  according to the equation  $F = \frac{100}{q}$ . How many units should be produced to minimize the total cost ( $V + F$ )?

A. 5

B. 4

C. 7

D. 6

gatecse-2011 quantitative-aptitude cost-market-price normal

Answer key 



#### 9.18.3 Cost Market Price: GATE CSE 2012 | Question: 56

The cost function for a product in a firm is given by  $5q^2$ , where  $q$  is the amount of production. The firm can sell the product at a market price of ₹50 per unit. The number of units to be produced by the firm such that the profit is maximized is

A. 5

B. 10

C. 15

D. 25

gatecse-2012 quantitative-aptitude cost-market-price normal

Answer key 



#### 9.18.4 Cost Market Price: GATE CSE 2019 | Question: GA-4

Ten friends planned to share equally the cost of buying a gift for their teacher. When two of them decided not to contribute, each of the other friends had to pay Rs. 150 more. The cost of the gift was Rs. \_\_\_\_\_

A. 666

B. 3000

C. 6000

D. 12000

gatecse-2019 general-aptitude quantitative-aptitude cost-market-price one-mark

Answer key 



#### 9.18.5 Cost Market Price: GATE Electrical 2022 | GA Question: 8

The price of an item is 10% cheaper in an online store S compared to the price at another online store M. Store S charges ₹ 150 for delivery. There are no delivery charges for orders from the store M. A person bought the items from the store S and saved ₹ 100.

What is the price of the item at the online store S (in ₹) if there are no other charges than what is described above?

A. 2500

B. 2250

C. 1750

D. 1500

gate2022-ee quantitative-aptitude cost-market-price

Answer key 



#### 9.18.6 Cost Market Price: GATE2014 AE: GA-5

A foundry has a fixed daily cost of Rs 50,000 whenever it operates and a variable cost of Rs  $800Q$ , where  $Q$  is the daily production in tonnes. What is the cost of production in Rs per tonne for a daily production of 100 tonnes?

**Answer key****9.19****Counting (6)****9.19.1 Counting: GATE Civil 2023 Set 2 | GA Question: 4**

There are 4 red, 5 green, and 6 blue balls inside a box. If  $N$  number of balls are picked simultaneously, what is the smallest value of  $N$  that guarantees there will be at least two balls of the same colour?

One cannot see the colour of the balls until they are picked.

- A. 4      B. 15      C. 5      D. 2

**Answer key****9.19.2 Counting: GATE Electrical 2020 | GA Question: 5**

If P, Q, R, S are four individuals, how many teams of size exceeding one can be formed, with Q as a member?

- A. 5      B. 6      C. 7      D. 8

**Answer key****9.19.3 Counting: GATE Mechanical 2023 | GA Question: 9**

How many pairs of sets (S, T) are possible among the subsets of  $\{1, 2, 3, 4, 5, 6\}$  that satisfy the condition that S is a subset of T?

- A. 729      B. 728      C. 665      D. 664

**Answer key****9.19.4 Counting: GATE2017 EC-1: GA-9**

There are 3 Indians and 3 Chinese in a group of 6 people. How many subgroups of this group can we choose so that every subgroup has at least one Indian?

- A. 56      B. 52      C. 48      D. 44

**Answer key****9.19.5 Counting: GATE2018 CH: GA-8**

To pass a test, a candidate needs to answer at least 2 out of 3 questions correctly. A total of 6,30,000 candidates appeared for the test. Question A was correctly answered by 3,30,000 candidates. Question B was answered correctly by 2,50,000 candidates. Question C was answered correctly by 2,60,000 candidates. Both questions A and B were answered correctly by 1,00,000 candidates. Both questions B and C were answered correctly by 90,000 candidates. Both questions A and C were answered correctly by 80,000 candidates. If the number of students answering all questions correctly is the same as the number answering none, how many candidates failed to clear the test?

- A. 30,000      B. 2,70,000      C. 3,90,000      D. 4,20,000

**Answer key****9.19.6 Counting: GATE2018 EE: GA-6**

An e-mail password must contain three characters. The password has to contain one numeral from 0 to 9, one upper case and one lower case character from the English alphabet. How many distinct passwords are possible?

- A. 6,760      B. 13,520      C. 40,560      D. 1,05,456

[Answer key](#)

9.20

Cube (2)



9.20.1 Cube: GATE CSE 2016 Set 1 | Question: GA05

A cube is built using 64 cubic blocks of side one unit. After it is built, one cubic block is removed from every corner of the cube. The resulting surface area of the body (in square units) after the removal is \_\_\_\_\_.

- a. 56      b. 64      c. 72      d. 96

gatecse-2016-set1 quantitative-aptitude geometry normal cube

[Answer key](#)



9.20.2 Cube: GATE CSE 2021 Set 2 | GA Question: 3

If  $\theta$  is the angle, in degrees, between the longest diagonal of the cube and any one of the edges of the cube, then,  $\cos \theta =$

- A.  $\frac{1}{2}$       B.  $\frac{1}{\sqrt{3}}$       C.  $\frac{1}{\sqrt{2}}$       D.  $\frac{\sqrt{3}}{2}$

gatecse-2021-set2 quantitative-aptitude mensuration cube one-mark

[Answer key](#)

9.21

Currency Notes (1)



9.21.1 Currency Notes: GATE2012 CY: GA-10

Raju has 14 currency notes in his pocket consisting of only Rs. 20 notes and Rs. 10 notes. The total money value of the notes is Rs. 230. The number of Rs. 10 notes that Raju has is

- A. 5      B. 6      C. 9      D. 10

gate2012-cy quantitative-aptitude numerical-computation currency-notes

[Answer key](#)

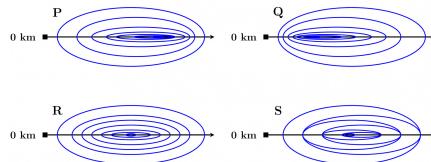
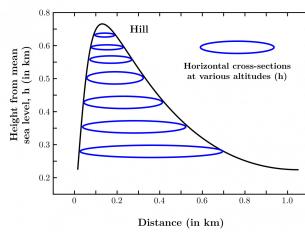
9.22

Curves (2)



9.22.1 Curves: GATE IN 2023 | GA Question: 5

In the given diagram, ovals are marked at different heights ( $h$ ) of a hill. Which one of the following options P, Q, R, and S depicts the top view of the hill?



- A. P      B. Q      C. R      D. S

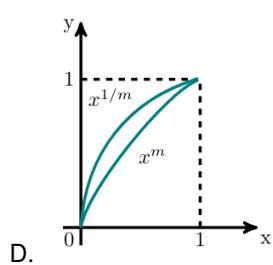
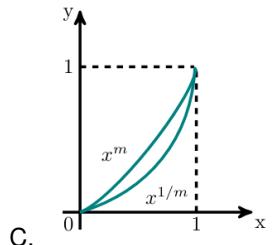
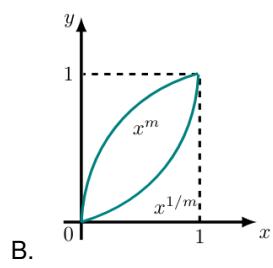
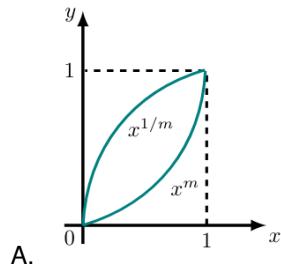
gatein-2023 quantitative-aptitude curves

[Answer key](#)

### 9.22.2 Curves: GATE Mechanical 2020 Set 1 | GA Question: 9



Select the graph that schematically represents BOTH  $y = x^m$  and  $y = x^{1/m}$  properly in the interval  $0 \leq x \leq 1$ , for integer values of  $m$ , where  $m > 1$ .



gateme-2020-set1 quantitative-aptitude functions curves

[Answer key](#)

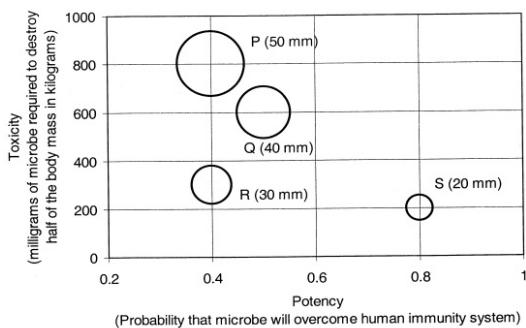
### 9.23

### Data Interpretation (5)



### 9.23.1 Data Interpretation: GATE CSE 2011 | Question: 62

$P, Q, R$  and  $S$  are four types of dangerous microbes recently found in a human habitat. The area of each circle with its diameter printed in brackets represents the growth of a single microbe surviving human immunity system within 24 hours of entering the body. The danger to human beings varies proportionately with the toxicity, potency and growth attributed to a microbe shown in the figure below:



A pharmaceutical company is contemplating the development of a vaccine against the most dangerous microbe. Which microbe should the company target in its first attempt?

- A. *P*      B. *Q*      C. *R*      D. *S*

gatecse-2011 quantitative-apitude data-interpretation normal

[Answer key](#)



### 9.23.2 Data Interpretation: GATE DA 2025 | GA Question: 7

Weight of a person can be expressed as a function of their age. The function usually varies from person to person. Suppose this function is identical for two brothers, and it monotonically increases till the age of 50 years and then it monotonically decreases. Let  $a_1$  and  $a_2$  (in years) denote the ages of the brothers and  $a_1 < a_2$ .

Which one of the following statements is correct about their age on the day when they attain the same weight?

- A.  $a_1 < a_2 < 50$       B.  $a_1 < 50 < a_2$   
 C.  $50 < a_1 < a_2$       D. Either  $a_1 = 50$  or  $a_2 = 50$

gateda-2025 quantitative-apitude data-interpretation two-marks

[Answer key](#)



### 9.23.3 Data Interpretation: GATE2018 CE-1: GA-5

The temperature  $T$  in a room varies as a function of the outside temperature  $T_0$  and the number of persons in the room  $p$ , according to the relation  $T = K(\theta p + T_0)$ , where  $\theta$  and  $K$  are constants. What would be the value of  $\theta$  given the following data?

$T_0$	$p$	$T$
25	2	32.4
30	5	42.0

- A. 0.8      B. 1.0      C. 2.0      D. 10.0

gate2018-ce-1 general-apitude quantitative-apitude data-interpretation

[Answer key](#)



### 9.23.4 Data Interpretation: GATE2018 EC: GA-9

A cab was involved in a hit and run accident at night. You are given the following data about the cabs in the city and the accident.

- i. 85% of cabs in the city are green and the remaining cabs are blue.
- ii. A witness identified the cab involved in the accident as blue.
- iii. It is known that a witness can correctly identify the cab colour only 80% of the time.

Which of the following options is closest to the probability that the accident was caused by a blue cab?

- A. 12%      B. 15%      C. 41%      D. 80%

gate2018-ec general-apitude quantitative-apitude normal data-interpretation

[Answer key](#)



### 9.23.5 Data Interpretation: GATE2019 EC: GA-10

Five people  $P, Q, R, S$  and  $T$  work in a bank.  $P$  and  $Q$  don't like each other but have to share an office till  $T$  gets a promotion and moves to the big office next to the garden.  $R$ , who is currently sharing an office with  $T$  wants to move to the adjacent office with  $S$ , the handsome new intern. Given the floor plan, what is the current location of  $Q, R$  and  $T$ ?

(O=Office, WR=Washroom)

WR	O 1 P, Q	O 2	O 3 R	O 4 S
Manager T		Teller 1	Teller 2	
Garden				

A.

WR	O 1 P, Q	O 2	O 3 R, T	O 4 S
Manager		Teller 1	Teller 2	
Garden				

C.

WR	O 1 P, Q	O 2	O 3 T	O 4 R, S
Manager			Teller 1	Teller 2
Garden				

B.

WR	O 1 P	O 2 Q	O 3 R	O 4 S
Manager			Teller 1	Teller 2
Garden				

D.

gate2019-ec general-aptitude data-interpretation

Answer key

### 9.24

### Digital Image Processing (1)

#### 9.24.1 Digital Image Processing: GATE DA 2025 | GA Question: 3

A  $4 \times 4$  digital image has pixel intensities ( $U$ ) as shown in the figure. The number of pixels with  $U \leq 4$  is:

0	1	0	2
4	7	3	3
5	5	4	4
6	7	3	2

A. 3

B. 8

C. 11

D. 9

gateda-2025 quantitative-aptitude digital-image-processing easy one-mark

Answer key

### 9.25

### Factors (4)

#### 9.25.1 Factors: GATE CSE 2013 | Question: 62

Out of all the 2-digit integers between 1 and 100, a 2-digit number has to be selected at random. What is the probability that the selected number is not divisible by 7 ?

A.  $\left(\frac{13}{90}\right)$

B.  $\left(\frac{12}{90}\right)$

C.  $\left(\frac{78}{90}\right)$

D.  $\left(\frac{77}{90}\right)$

gatecse-2013 quantitative-aptitude easy probability factors

Answer key

#### 9.25.2 Factors: GATE CSE 2018 | Question: GA-4

What would be the smallest natural number which when divided either by 20 or by 42 or by 76 leaves a remainder of 7 in each case?

A. 3047

B. 6047

C. 7987

D. 63847

gatecse-2018 quantitative-aptitude factors one-mark

Answer key

### 9.25.3 Factors: GATE2010 MN: GA-8

Consider the set of integers  $\{1, 2, 3, \dots, 5000\}$ . The number of integers that is divisible by neither 3 nor 4 is :

- A. 1668      B. 2084      C. 2500      D. 2916

general-aptitude quantitative-aptitude gate2010-mn factors

[Answer key](#)



### 9.25.4 Factors: GATE2018 EC: GA-3

If the number 715 ■ 423 is divisible by 3 (■ denotes the missing digit in the thousandths place), then the smallest whole number in the place of ■ is \_\_\_\_\_.

- A. 0      B. 2      C. 5      D. 6

gate2018-ec general-aptitude quantitative-aptitude easy factors

[Answer key](#)



## 9.26

### Fractions (4)

#### 9.26.1 Fractions: GATE CSE 2018 | Question: GA-6

In appreciation of the social improvements completed in a town, a wealthy philanthropist decided to gift *Rs 750* to each male senior citizen in the town and *Rs 1000* to each female senior citizen. Altogether, there were 300 senior citizens eligible for this gift. However, only  $\frac{8}{9}$  th of the eligible men and  $\frac{2}{3}$  rd of the eligible women claimed the gift. How much money (in Rupees) did the philanthropist give away in total?

- A. 1,50,000      B. 2,00,000      C. 1,75,000      D. 1,51,000

gatecse-2018 quantitative-aptitude fractions normal two-marks

[Answer key](#)



#### 9.26.2 Fractions: GATE Civil 2022 Set 2 | GA Question: 3

Both the numerator and the denominator of  $\frac{3}{4}$  are increased by a positive integer,  $x$ , and those of  $\frac{15}{17}$  are decreased by the same integer. This operation results in the same value for both the fractions.

What is the value of  $x$ ?

- A. 1      B. 2      C. 3      D. 4

gatecivil-2022-set2 quantitative-aptitude fractions

[Answer key](#)



#### 9.26.3 Fractions: GATE Civil 2024 Set 1 | GA Question: 3

For positive integers  $p$  and  $q$ , with  $\frac{p}{q} \neq 1$ ,  $\left(\frac{p}{q}\right)^{\frac{p}{q}} = p^{\left(\frac{p}{q}-1\right)}$ . Then,

- A.  $q^p = p^q$       B.  $q^p = p^{2q}$       C.  $\sqrt{q} = \sqrt{p}$       D.  $\sqrt[p]{q} = \sqrt[q]{p}$

gatecivil-2024-set1 quantitative-aptitude fractions

[Answer key](#)



#### 9.26.4 Fractions: GATE2016 EC-1: GA-9

If  $q^{-a} = \frac{1}{r}$  and  $r^{-b} = \frac{1}{s}$  and  $s^{-c} = \frac{1}{q}$ , the value of  $abc$  is \_\_\_\_\_.

- A.  $(rqs)^{-1}$       B. 0      C. 1      D.  $r + q + s$

gate2016-ec-1 quantitative-aptitude fractions

[Answer key](#)



### 9.27.1 Functions: GATE CSE 2015 Set 2 | Question: GA-9



If  $p, q, r, s$  are distinct integers such that:

$$f(p, q, r, s) = \max(p, q, r, s)$$

$$g(p, q, r, s) = \min(p, q, r, s)$$

$$h(p, q, r, s) = \text{remainder of } \frac{(p \times q)}{(r \times s)} \text{ if } (p \times q) > (r \times s)$$

or remainder of  $\frac{(r \times s)}{(p \times q)}$  if  $(r \times s) > (p \times q)$

Also a function  $fgh(p, q, r, s) = f(p, q, r, s) \times g(p, q, r, s) \times h(p, q, r, s)$

Also the same operations are valid with two variable functions of the form  $f(p, q)$

What is the value of  $fg(h(2, 5, 7, 3), 4, 6, 8)$ ?

gatecse-2015-set2 functions normal numerical-answers

Answer key

### 9.27.2 Functions: GATE CSE 2015 Set 3 | Question: GA-5



A function  $f(x)$  is linear and has a value of 29 at  $x = -2$  and 39 at  $x = 3$ . Find its value at  $x = 5$ .

A. 59

B. 45

C. 43

D. 35

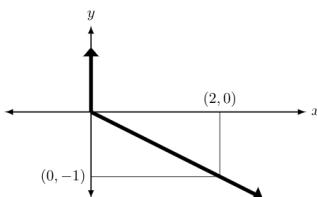
gatecse-2015-set3 quantitative-apitude normal functions

Answer key

### 9.27.3 Functions: GATE CSE 2015 Set 3 | Question: GA-8



Choose the most appropriate equation for the function drawn as thick line, in the plot below.



A.  $x = y - |y|$

B.  $x = -(y - |y|)$

C.  $x = y + |y|$

D.  $x = -(y + |y|)$

gatecse-2015-set3 quantitative-apitude normal functions

Answer key

### 9.27.4 Functions: GATE CSE 2023 | GA Question: 7



Consider two functions of time ( $t$ ),

$$f(t) = 0.01t^2$$
$$g(t) = 4t$$

where  $0 < t < \infty$ .

Now consider the following two statements:

- For some  $t > 0, g(t) > f(t)$ .
- There exists a  $T$ , such that  $f(t) > g(t)$  for all  $t > T$ .

Which one of the following options is TRUE?

A. only (i) is correct

C. both (i) and (ii) are correct

B. only (ii) is correct

D. neither (i) nor (ii) is correct

gatecse-2023 quantitative-apitude functions two-marks

Answer key

### 9.27.5 Functions: GATE CSE 2023 | GA Question: 9

$f(x)$  and  $g(y)$  are functions of  $x$  and  $y$ , respectively, and  $f(x) = g(y)$  for all values of  $x$  and  $y$ . Which one of the following options is necessarily TRUE for a  $x$  and  $y$ ?

- A.  $f(x) = 0$  and  $g(y) = 0$
- B.  $f(x) = g(y) = \text{constant}$
- C.  $f(x) \neq \text{constant}$  and  $g(y) \neq \text{constant}$
- D.  $f(x) + g(y) = f(x) - g(y)$

gatecse-2023 quantitative-aptitude functions two-marks

Answer key 

### 9.27.6 Functions: GATE Civil 2020 Set 2 | GA Question: 5

If  $f(x) = x^2$  for each  $x \in (-\infty, \infty)$ , then  $\frac{f(f(f(x)))}{f(x)}$  is equal to \_\_\_\_\_.

- A.  $f(x)$
- B.  $(f(x))^2$
- C.  $(f(x))^3$
- D.  $(f(x))^4$

gate2020-ce-2 quantitative-aptitude functions

Answer key 

### 9.27.7 Functions: GATE Civil 2021 Set 1 | GA Question: 9

A function,  $\lambda$ , is defined by

$$\lambda(p, q) = \begin{cases} (p - q)^2, & \text{if } p \geq q, \\ p + q, & \text{if } p < q. \end{cases}$$

The value of the expression  $\frac{\lambda(-(-3+2), (-2+3))}{(-(-2+1))}$  is:

- A.  $-1$
- B.  $0$
- C.  $\frac{16}{3}$
- D.  $16$

gatecivil-2021-set1 quantitative-aptitude functions easy

Answer key 

### 9.27.8 Functions: GATE ECE 2020 | GA Question: 5

A superadditive function  $f(\cdot)$  satisfies the following property

$$f(x_1 + x_2) \geq f(x_1) + f(x_2)$$

Which of the following functions is a superadditive function for  $x > 1$ ?

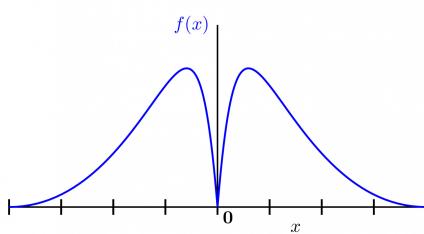
- A.  $e^x$
- B.  $\sqrt{x}$
- C.  $1/x$
- D.  $e^{-x}$

gate2020-ec quantitative-aptitude functions

Answer key 

### 9.27.9 Functions: GATE ECE 2023 | GA Question: 7

Which one of the following options represents the given graph?



- A.  $f(x) = x^2 2^{-|x|}$       B.  $f(x) = x 2^{-|x|}$       C.  $f(x) = |x| 2^{-x}$       D.  $f(x) = x 2^{-x}$

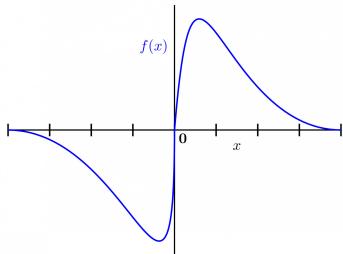
gateece-2023 quantitative-aptitude functions

[Answer key](#)

### 9.27.10 Functions: GATE Electrical 2023 | GA Question: 7



Which one of the following options represents the given graph?



- A.  $f(x) = x^2 2^{-|x|}$       B.  $f(x) = x 2^{-|x|}$   
 C.  $f(x) = |x| 2^{-x}$       D.  $f(x) = x 2^{-x}$

gate2023-ee quantitative-aptitude functions

[Answer key](#)

### 9.27.11 Functions: GATE IN 2023 | GA Question: 7



Ankita has to climb 5 stairs starting at the ground, while respecting the following rules:

1. At any stage, Ankita can move either one or two stairs up.
2. At any stage, Ankita cannot move to a lower step.

Let  $F(N)$  denote the number of possible ways in which Ankita can reach the  $N^{\text{th}}$  stair. For example,  $F(1) = 1, F(2) = 2, F(3) = 3$ .

The value of  $F(5)$  is \_\_\_\_\_.

- A. 8      B. 7      C. 6      D. 5

gatein-2023 quantitative-aptitude functions

[Answer key](#)

### 9.27.12 Functions: GATE Mechanical 2020 Set 1 | GA Question: 5



Define  $[x]$  as the greatest integer less than or equal to  $x$ , for each  $x \in (-\infty, \infty)$ . If  $y = [x]$ , then area under  $y$  for  $x \in [1, 4]$  is \_\_\_\_\_.

- A. 1      B. 3      C. 4      D. 6

gateme-2020-set1 quantitative-aptitude functions

[Answer key](#)

### 9.27.13 Functions: GATE Mechanical 2022 Set 2 | GA Question: 8



Consider the following for non-zero positive integers,  $p$  and  $q$ .

$$f(p, q) = \frac{p \times p \times p \times \dots \times p = p^q}{q \text{ terms}}; f(p, 1) = p$$

$$g(p, q) = p^{p^{p^{p^{\dots^{p^{(up to q terms)}}}}}}; g(p, 1) = p$$

Which one of the following options is correct based on the above?

- A.  $f(2, 2) = g(2, 2)$   
C.  $g(2, 1) \neq f(2, 1)$

- B.  $f(g(2, 2), 2) < f(2, g(2, 2))$   
D.  $f(3, 2) > g(3, 2)$

gate2022-set2 quantitative-aptitude functions

Answer key 

#### 9.27.14 Functions: GATE2010 MN: GA-10



Given the following four functions  $f_1(n) = n^{100}$ ,  $f_2(n) = (1.2)^n$ ,  $f_3(n) = 2^{n/2}$ ,  $f_4(n) = 3^{n/3}$  which function will have the largest value for sufficiently large values of  $n$  (*i.e.*  $n \rightarrow \infty$ )?

- A.  $f_4$

- B.  $f_3$

- C.  $f_2$

- D.  $f_1$

general-aptitude quantitative-aptitude gate2010-mn functions

Answer key 

#### 9.27.15 Functions: GATE2012 AR: GA-7



Let  $f(x) = x - [x]$ , where  $x \geq 0$  and  $[x]$  is the greatest integer not larger than  $x$ . Then  $f(x)$  is a

- A. monotonically increasing function
- B. monotonically decreasing function
- C. linearly increasing function between two integers
- D. linearly decreasing function between two integers

gate2012-ar quantitative-aptitude functions normal

Answer key 

#### 9.27.16 Functions: GATE2015 EC-3: GA-5



If  $x > y > 1$ , which of the following must be true?

- i.  $\ln x > \ln y$
- ii.  $e^x > e^y$
- iii.  $y^x > x^y$
- iv.  $\cos x > \cos y$

- A. (i) and (ii)

- B. (i) and (iii)

- C. (iii) and (iv)

- D. (ii) and (iv)

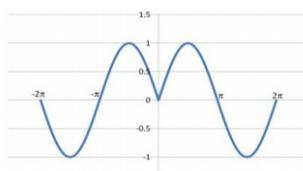
gate2015-ec-3 general-aptitude quantitative-aptitude functions

Answer key 

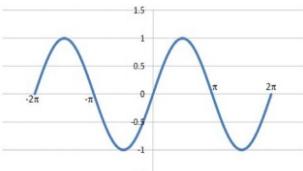
#### 9.27.17 Functions: GATE2016 ME-2: GA-10



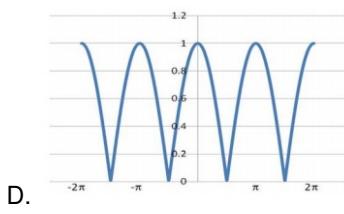
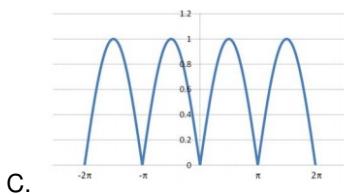
Which of the following curves represents the function  $y = \ln(|e^{|\sin(|x|)|}|)$  for  $|x| < 2\pi$ ? Here,  $x$  represents the abscissa and  $y$  represents the ordinate.



A.



B.



gate2016-me-2 functions quantitative-aptitude

[Answer key](#)



### 9.27.18 Functions: GATE2018 EE: GA-5

Functions  $F(a,b)$  and  $G(a,b)$  are defined as follows:

$F(a,b) = (a - b)^2$  and  $G(a,b) = |a - b|$ , where  $|x|$  represents the absolute value of  $x$ .

What would be the value of  $G(F(1,3),G(1,3))$ ?

A. 2

B. 4

C. 6

D. 36

gate2018-ee general-aptitude quantitative-aptitude easy functions

[Answer key](#)



### 9.28

### Geometry (29)

#### 9.28.1 Geometry: GATE 2024 Electrical | GA Question: 10

A surveyor has to measure the horizontal distance from her position to a distant reference point C. Using her position as the center, a 200 m horizontal line segment is drawn with the two endpoints A and B. Points A, B, and C are not collinear. Each of the angles  $\angle CAB$  and  $\angle CBA$  are measured as  $87.8^\circ$ . The distance (in m) of the reference point C from her position is nearest to

A. 2603

B. 2606

C. 2306

D. 2063

gate2024-ee quantitative-aptitude geometry

[Answer key](#)

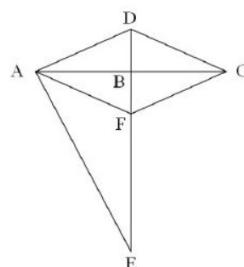


#### 9.28.2 Geometry: GATE 2024 Electrical | GA Question: 7

In the following figure,

$$CD = 5 \text{ cm}, BE = 10 \text{ cm}, AE = 12 \text{ cm}, \\ \angle DAB = \angle DCB, \text{ and } \angle DAE = \angle DBC = 90^\circ$$

Points AFCD create a rhombus.



The length of BF (in cm) is

A. 3

B. 2

C. 4

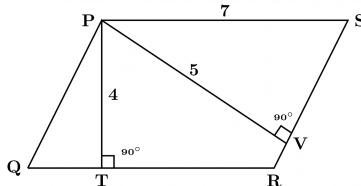
D. 6

gate2024-ee quantitative-aptitude geometry

Answer key 

### 9.28.3 Geometry: GATE CH 2023 | GA Question: 3

In the given figure, PQRS is a parallelogram with PS = 7 cm, PT = 4 cm and PV = 5 cm. What is the length of RS in cm? (The diagram is representative.) 



A.  $\frac{20}{7}$

B.  $\frac{28}{5}$

C.  $\frac{9}{2}$

D.  $\frac{35}{4}$

gatetech-2023 quantitative-aptitude geometry

Answer key 

### 9.28.4 Geometry: GATE CSE 2014 Set 1 | Question: GA-10

When a point inside of a tetrahedron (a solid with four triangular surfaces) is connected by straight lines to its corners, how many (new) internal planes are created with these lines? 

gatecse-2014-set1 quantitative-aptitude geometry combinatory normal numerical-answers

Answer key 

### 9.28.5 Geometry: GATE CSE 2024 | Set 1 | GA Question: 7

A rectangular paper sheet of dimensions  $54 \text{ cm} \times 4 \text{ cm}$  is taken. The two longer edges of the sheet are joined together to create a cylindrical tube. A cube whose surface area is equal to the area of the sheet is also taken.

Then, the ratio of the volume of the cylindrical tube to the volume of the cube is

A.  $1/\pi$

B.  $2/\pi$

C.  $3/\pi$

D.  $4/\pi$

gatecse2024-set1 quantitative-aptitude geometry two-marks

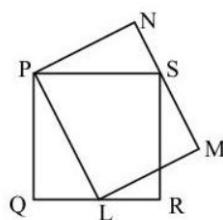
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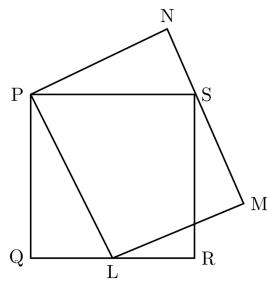
### 9.28.6 Geometry: GATE CSE 2025 | Set 2 | GA Question: 9

In the Given figure, PQRS is a square of side 2 cm and PLMN is a rectangle. The corner L of the rectangle is on the side QR. Side MN of the rectangle passes through the corner S of the square. 

What is the area (in  $\text{cm}^2$ ) of the rectangle PLMN?

Note: The figure shown is representative.



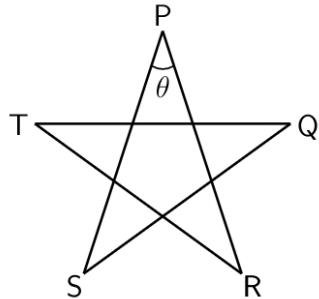


- A.  $2\sqrt{2}$       B. 2      C. 8      D. 4

gatecse2025-set2 quantitative-aptitude geometry two-marks

[Answer key](#)

#### 9.28.7 Geometry: GATE Civil 2021 Set 1 | GA Question: 8



Five line segments of equal lengths, PR, PS, QS, QT and RT are used to form a star as shown in the figure above. The value of  $\theta$ , in degrees, is \_\_\_\_\_

- A. 36      B. 45      C. 72      D. 108

gatecivil-2021-set1 quantitative-aptitude geometry

[Answer key](#)

#### 9.28.8 Geometry: GATE Civil 2024 Set 1 | GA Question: 10



During a half-moon phase, the Earth-Moon-Sun form a right triangle. If the Moon-Earth-Sun angle at this half-moon phase is measured to be  $89.85^\circ$ , the ratio of the Earth-Sun and Earth-Moon distances is closest to

- A. 328      B. 382      C. 238      D. 283

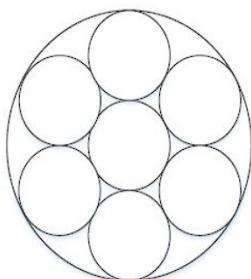
gatecivil-2024-set1 quantitative-aptitude geometry

[Answer key](#)

#### 9.28.9 Geometry: GATE Civil 2024 Set 2 | GA Question: 7



Seven identical cylindrical chalk-sticks are fitted tightly in a cylindrical container. The figure below shows the arrangement of the chalk-sticks inside the cylinder.



The length of the container is equal to the length of the chalk-sticks. The ratio of the occupied space to the empty space of the container is

- A. 5/2      B. 7/2      C. 9/2      D. 3

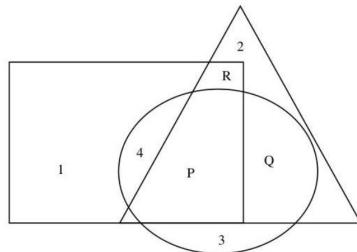
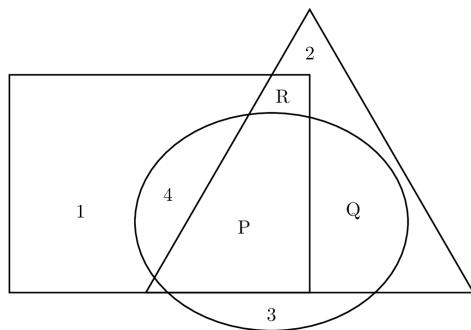
gatecivil-2024-set2 quantitative-aptitude geometry

**Answer key**



#### 9.28.10 Geometry: GATE DA 2025 | GA Question: 4

In the given figure, the numbers associated with the rectangle, triangle, and ellipse are 1, 2, and 3, respectively. Which one among the given options is the most appropriate combination of P, Q, and R ?



- A.  $P = 6; Q = 5; R = 3$   
 C.  $P = 3; Q = 6; R = 6$
- B.  $P = 5; Q = 6; R = 3$   
 D.  $P = 5; Q = 3; R = 6$

gateda-2025 quantitative-aptitude geometry one-mark

**Answer key**

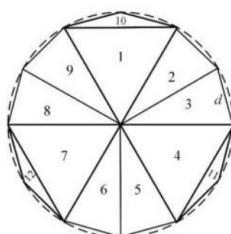


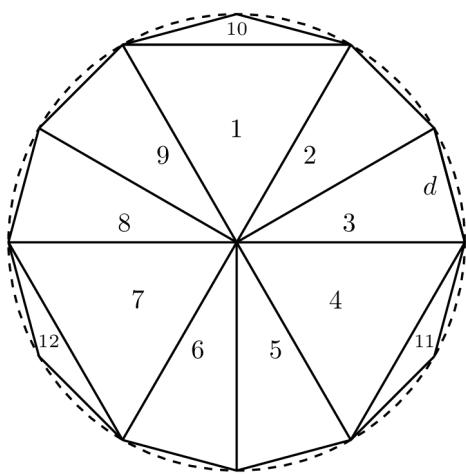
#### 9.28.11 Geometry: GATE DA 2025 | GA Question: 8

A regular dodecagon (12-sided regular polygon) is inscribed in a circle of radius  $r$  cm as shown in the figure. The side of the dodecagon is  $d$  cm. All the triangles (numbered 1 to 12) in the figure are used to form squares of side  $r$  cm and each numbered triangle is used only once to form a square.

The number of squares that can be formed and the number of triangles required to form each square, respectively, are:

Note: The figure shown is representative.





A. 3;4

B. 4;3

C. 3;3

D. 3;2

gateda-2025 quantitative-aptitude geometry two-marks

[Answer key](#)



#### 9.28.12 Geometry: GATE ECE 2022 | GA Question: 3

A trapezium has vertices marked as P, Q, R and S (in that order anticlockwise). The side PQ is parallel to side SR.

Further, it is given that,  $PQ = 11 \text{ cm}$ ,  $QR = 4 \text{ cm}$ ,  $RS = 6 \text{ cm}$  and  $SP = 3 \text{ cm}$ .

What is the shortest distance between PQ and SR (in cm)?

A. 1.80

B. 2.40

C. 4.20

D. 5.76

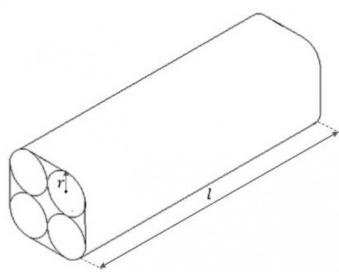
gateece-2022 quantitative-aptitude geometry

[Answer key](#)



#### 9.28.13 Geometry: GATE ECE 2024 | GA Question: 7

Four identical cylindrical chalk-sticks, each of radius  $r = 0.5 \text{ cm}$  and length  $l = 10 \text{ cm}$ , are bound tightly together using a duct tape as shown in the following figure.



The width of the duct tape is equal to the length of the chalk-stick. The area (in  $\text{cm}^2$ ) of the duct tape required to wrap the bundle of chalk-sticks once, is

A.  $20(4 + \pi)$

B.  $20(8 + \pi)$

C.  $10(8 + \pi)$

D.  $10(4 + \pi)$

gateece-2024 quantitative-aptitude geometry

[Answer key](#)



#### 9.28.14 Geometry: GATE Mechanical 2022 Set 1 | GA Question: 7

A rhombus is formed by joining the midpoints of the sides of a unit square.

What is the diameter of the largest circle that can be inscribed within the rhombus?

A.  $\frac{1}{\sqrt{2}}$

B.  $\frac{1}{2\sqrt{2}}$

C.  $\sqrt{2}$

D.  $2\sqrt{2}$

gateme-2022-set1 quantitative-aptitude geometry

Answer key 



### 9.28.15 Geometry: GATE2015 EC-3: GA-8

From a circular sheet of paper of radius 30 cm, a sector of 10% area is removed. If the remaining part is used to make a conical surface, then the ratio of the radius and height of the cone is \_\_\_\_\_

gate2015-ec-3 geometry quantitative-aptitude normal

Answer key 



### 9.28.16 Geometry: GATE2016 CE-2: GA-9

A square pyramid has a base perimeter  $x$ , and the slant height is half of the perimeter. What is the lateral surface area of the pyramid

A.  $x^2$

B.  $0.75x^2$

C.  $0.50x^2$

D.  $0.25x^2$

gate2016-ce-2 geometry quantitative-aptitude

Answer key 



### 9.28.17 Geometry: GATE2016 EC-2: GA-10

A wire of length 340 mm is to be cut into two parts. One of the parts is to be made into a square and the other into a rectangle where sides are in the ratio of 1 : 2. What is the length of the side of the square (in mm) such that the combined area of the square and the rectangle is a **MINIMUM**?

A. 30

B. 40

C. 120

D. 180

gate2016-ec-2 geometry quantitative-aptitude

Answer key 



### 9.28.18 Geometry: GATE2016 ME-2: GA-5

A window is made up of a square portion and an equilateral triangle portion above it. The base of the triangular portion coincides with the upper side of the square. If the perimeter of the window is 6 m, the area of the window in  $m^2$  is \_\_\_\_\_.

A. 1.43

B. 2.06

C. 2.68

D. 2.88

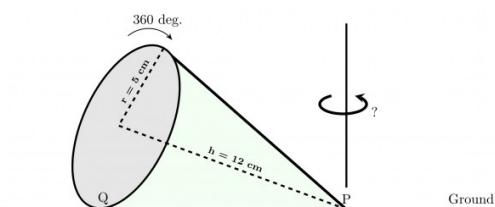
gate2016-me-2 quantitative-aptitude geometry

Answer key 



### 9.28.19 Geometry: GATE2017 ME-1: GA-3

A right-angled cone (with base radius 5 cm and height 12 cm), as shown in the figure below, is rolled on the ground keeping the point  $P$  fixed until the point  $Q$  (at the base of the cone, as shown) touches the ground again.



By what angle (in radians) about  $P$  does the cone travel?

A.  $\frac{5\pi}{12}$

B.  $\frac{5\pi}{24}$

C.  $\frac{24\pi}{5}$

D.  $\frac{10\pi}{13}$

gate2017-me-1 general-aptitude quantitative-aptitude geometry

Answer key 

### 9.28.20 Geometry: GATE2018 CE-1: GA-4

Tower  $A$  is  $90\text{ m}$  tall and tower  $B$  is  $140\text{ m}$  tall. They are  $100\text{ m}$  apart. A horizontal skywalk connects the floors at  $70\text{ m}$  in both the towers. If a taut rope connects the top of tower  $A$  to the bottom tower  $B$ , at what distance (in meters) from tower  $A$  will the rope intersect the skywalk?

gate2018-ce-1 general-aptitude quantitative-aptitude geometry numerical-answers

Answer key 



### 9.28.21 Geometry: GATE2018 CH: GA-5

Arrange the following three-dimensional objects in the descending order of their volumes:

- i. A cuboid with dimensions  $10\text{ cm}$ ,  $8\text{ cm}$  and  $6\text{ cm}$
- ii. A cube of side  $8\text{ cm}$
- iii. A cylinder with base radius  $7\text{ cm}$  and height  $7\text{ cm}$
- iv. A sphere of radius  $7\text{ cm}$

- A. i), ii), iii), iv)
- B. ii), i), iv), iii)
- C. iii), ii), i), iv)
- D. iv), iii), ii), i)

gate2018-ch quantitative-aptitude normal geometry

Answer key 



### 9.28.22 Geometry: GATE2018 CH: GA-7

A set of 4 parallel lines intersect with another set of 5 parallel lines. How many parallelograms are formed?

- A. 20
- B. 48
- C. 60
- D. 72

gate2018-ch general-aptitude quantitative-aptitude easy geometry

Answer key 



### 9.28.23 Geometry: GATE2018 EC: GA-5

A  $1.5\text{m}$  tall person is standing at a distance of  $3\text{m}$  from a lamp post. The light from the lamp at the top of the post casts her shadow. The length of the shadow is twice her height. What is the height of the lamp post in meters?

- A. 1.5
- B. 3
- C. 4.5
- D. 6

gate2018-ec general-aptitude quantitative-aptitude normal geometry

Answer key 



### 9.28.24 Geometry: GATE2018 ME-1: GA-4

A rectangle becomes a square when its length and breadth are reduced by  $10\text{ m}$  and  $5\text{ m}$ , respectively. During this process, the rectangle loses  $650\text{ m}^2$  of area. What is the area of the original rectangle in square meters?

- A. 1125
- B. 2250
- C. 2924
- D. 4500

gate2018-me-1 general-aptitude quantitative-aptitude geometry

Answer key 



### 9.28.25 Geometry: GATE2018 ME-2: GA-4

The perimeters of a circle, a square and an equilateral triangle are equal. Which one of the following statements is true?

- A. The circle has the largest area
- B. The square has the largest area
- C. The equilateral triangle has the largest area
- D. All the three shapes have the same area

gate2018-me-2 general-aptitude quantitative-aptitude geometry easy

Answer key 



### 9.28.26 Geometry: GATE2018 ME-2: GA-7



A wire would enclose an area of  $1936 m^2$ , if it is bent to a square. The wire is cut into two pieces. The longer piece is thrice as long as the shorter piece. The long and the short pieces are bent into a square and a circle, respectively. Which of the following choices is closest to the sum of the areas enclosed by the two pieces in square meters?

- A. 1096      B. 1111      C. 1243      D. 2486

gate2018-me-2 general-aptitude quantitative-aptitude geometry

[Answer key](#)

### 9.28.27 Geometry: GATE2019 CE-1: GA-3



On a horizontal ground, the base of a straight ladder is 6 m away from the base of a vertical pole. The ladder makes an angle of  $45^\circ$  to the horizontal. If the ladder is resting at a point located at one-fifth of the height of the pole from the bottom, the height of the pole is \_\_\_\_\_ meters.

- A. 15      B. 25      C. 30      D. 35

gate2019-ce-1 general-aptitude quantitative-aptitude geometry

[Answer key](#)

### 9.28.28 Geometry: GATE2019 CE-2: GA-3



Suresh wanted to lay a new carpet in his new mansion with an area of  $70 \times 55$  sq.mts. However an area of 550 sq. mts. had to be left out for flower pots. If the cost carpet is Rs.50 sq. mts. how much money (in Rs.) will be spent by Suresh for the carpet now?

- A. Rs.1,65,000      B. Rs.1,92,500      C. Rs.2,75,000      D. Rs.1,27,500

gate2019-ce-2 general-aptitude quantitative-aptitude geometry

[Answer key](#)

### 9.28.29 Geometry: GATE2019 CE-2: GA-4



A retaining wall with measurements  $30\text{ m} \times 12\text{ m} \times 6\text{ m}$  was constructed with bricks of dimensions  $8\text{ cm} \times 6\text{ cm} \times 6\text{ cm}$ . If 60% of the wall consists of bricks, the number of bricks used for the construction is \_\_\_\_\_ lakhs.

- A. 30      B. 40      C. 45      D. 75

gate2019-ce-2 general-aptitude quantitative-aptitude geometry

[Answer key](#)

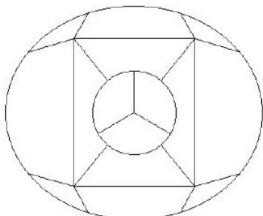
### 9.29

### Graph Coloring (1)



#### 9.29.1 Graph Coloring: GATE DS&AI 2024 | GA Question: 2

The 15 parts of the given figure are to be painted such that no two adjacent parts with shared boundaries (excluding corners) have the same color. The minimum number of colors required is



- A. 4      B. 3      C. 5      D. 6

gate-ds-ai-2024 quantitative-aptitude graph-coloring one-mark

[Answer key](#)

### 9.30

### Inequality (4)



### 9.30.1 Inequality: GATE CH 2022 | GA Question: 8



Consider the following inequalities.

- I.  $3p - q < 4$
- II.  $3q - p < 12$

Which one of the following expressions below satisfies the above two inequalities?

- A.  $p + q < 8$
- B.  $p + q = 8$
- C.  $8 \leq p + q < 16$
- D.  $p + q \geq 16$

gatech-2022 quantitative-aptitude inequality

[Answer key](#)

### 9.30.2 Inequality: GATE ECE 2022 | GA Question: 7



Consider the following inequalities.

- A.  $2x - 1 > 7$
- B.  $2x - 9 < 1$

Which one of the following expressions below satisfies the above two inequalities?

- A.  $x \leq -4$
- B.  $-4 < x \leq 4$
- C.  $4 < x < 5$
- D.  $x \geq 5$

gateece-2022 quantitative-aptitude inequality

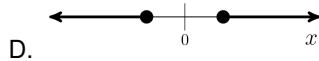
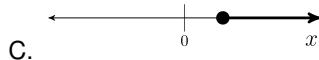
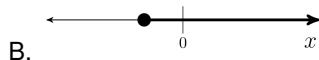
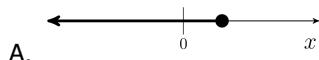
[Answer key](#)

### 9.30.3 Inequality: GATE Mechanical 2022 Set 2 | GA Question: 2



Which one of the following is a representation (not to scale and in bold) of all values of  $x$  satisfying the inequality

$$2 - 5x \leq -\frac{6x - 5}{3}$$
 on the real number line?



gateme-2022-set2 quantitative-aptitude inequality

[Answer key](#)

### 9.30.4 Inequality: GATE Mechanical 2023 | GA Question: 7



Consider the following inequalities

$$\begin{aligned} p^2 - 4q &< 4 \\ 3p + 2q &< 6 \end{aligned}$$

where  $p$  and  $q$  are positive integers.

The value of  $(p + q)$  is \_\_\_\_\_.

- A. 2
- B. 1
- C. 3
- D. 4

gateme-2023 quantitative-aptitude inequality

[Answer key](#)

### 9.31.1 LCM HCF: GATE Electrical 2022 | GA Question: 3

Three bells  $P$ ,  $Q$  and  $R$  are rung periodically in a school.  $P$  is rung every 20 minutes;  $Q$  is rung every 30 minutes and  $R$  is rung every 50 minutes.

If all the three bells are rung at 12 : 00 PM, when will the three bells ring together again the next time?

- A. 5 : 00 PM      B. 5 : 30 PM      C. 6 : 00 PM      D. 6 : 30 PM

gate2022-ee quantitative-aptitude lcm-hcf

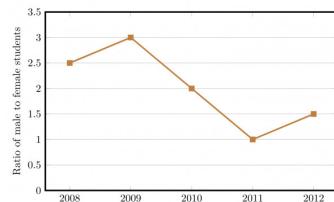
[Answer key](#)

9.32

### Line Graph (12)

#### 9.32.1 Line Graph: GATE CSE 2014 Set 2 | Question: GA-9

The ratio of male to female students in a college for five years is plotted in the following line graph. If the number of female students doubled in 2009, by what percent did the number of male students increase in 2009?

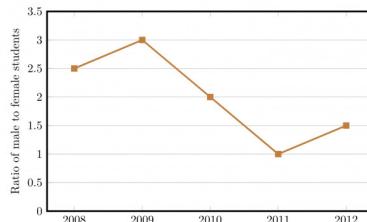


gatecse-2014-set2 quantitative-aptitude data-interpretation numerical-answers normal line-graph

[Answer key](#)

#### 9.32.2 Line Graph: GATE CSE 2014 Set 3 | Question: GA-9

The ratio of male to female students in a college for five years is plotted in the following line graph. If the number of female students in 2011 and 2012 is equal, what is the ratio of male students in 2012 to male students in 2011?

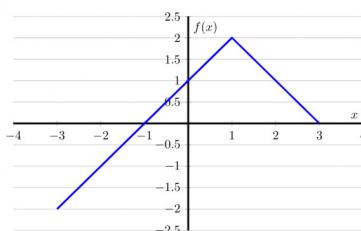


- A. 1 : 1      B. 2 : 1      C. 1.5 : 1      D. 2.5 : 1

gatecse-2014-set3 quantitative-aptitude data-interpretation normal line-graph

[Answer key](#)

#### 9.32.3 Line Graph: GATE CSE 2016 Set 2 | Question: GA-10



- A.  $f(x) = 1 - |x - 1|$   
B.  $f(x) = 1 + |x - 1|$   
C.  $f(x) = 2 - |x - 1|$   
D.  $f(x) = 2 + |x - 1|$

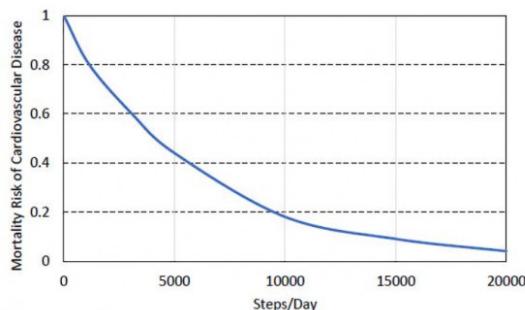
gatecse-2016-set2 quantitative-aptitude data-interpretation normal line-graph

[Answer key](#)

#### 9.32.4 Line Graph: GATE Civil 2024 Set 2 | GA Question: 8



The plot below shows the relationship between the mortality risk of cardiovascular disease and the number of steps a person walks per day. Based on the data, which one of the following options is true?



- A. The risk reduction on increasing the steps/day from 0 to 10000 is less than the risk reduction on increasing the steps/day from 10000 to 20000.
- B. The risk reduction on increasing the steps/day from 0 to 5000 is less than the risk reduction on increasing the steps/day from 15000 to 20000.
- C. For any 5000 increment in steps/day the largest risk reduction occurs on going from 0 to 5000.
- D. For any 5000 increment in steps/day the largest risk reduction occurs on going from 15000 to 20000.

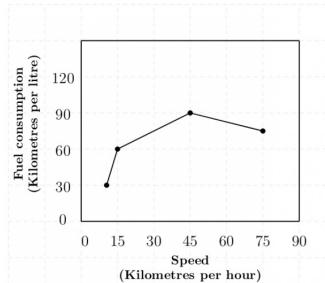
gatecivil-2024-set2 line-graph quantitative-apitude data-interpretation

Answer key

#### 9.32.5 Line Graph: GATE2011 AG: GA-9



The fuel consumed by a motorcycle during a journey while traveling at various speeds is indicated in the graph below.



The distances covered during four laps of the journey are listed in the table below

Lap	Distance (kilometres)	Average Speed (kilometres per hour)
P	15	15
Q	75	45
R	40	75
S	10	10

From the given data, we can conclude that the fuel consumed per kilometre was least during the lap

- A. P
- B. Q
- C. R
- D. S

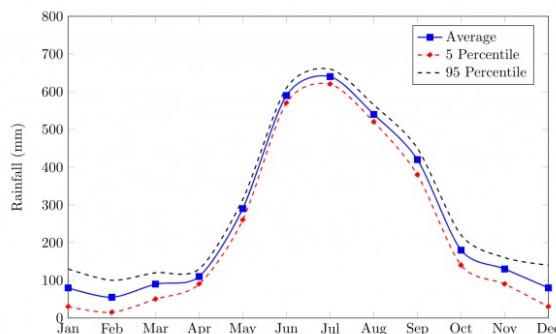
general-apitude quantitative-apitude gate2011-ag data-interpretation line-graph

Answer key

#### 9.32.6 Line Graph: GATE2014 AE: GA-10



The monthly rainfall chart based on 50 years of rainfall in Agra is shown in the following figure.



Which of the following are true? (k percentile is the value such that k percent of the data fall below that value)

- i. On average, it rains more in July than in December
- ii. Every year, the amount of rainfall in August is more than that in January
- iii. July rainfall can be estimated with better confidence than February rainfall
- iv. In August, there is at least 500 mm of rainfall

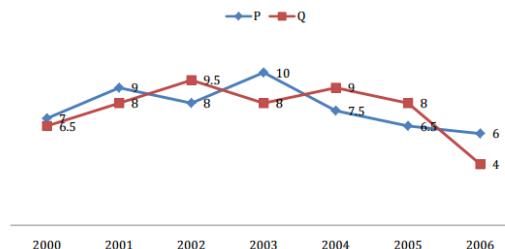
- A. (i) and (ii)      B. (i) and (iii)      C. (ii) and (iii)      D. (iii) and (iv)

gate2014-ae quantitative-aptitude data-interpretation line-graph

[Answer key](#)

### 9.32.7 Line Graph: GATE2016 CE-2: GA-6

Two finance companies,  $P$  and  $Q$ , declared fixed annual rates of interest on the amounts invested with them. The rates of interest offered by these companies may differ from year to year. Year-wise annual rates of interest offered by these companies are shown by the line graph provided below.



If the amounts invested in the companies,  $P$  and  $Q$ , in 2006 are in the ratio  $8 : 9$ , then the amounts received after one year as interests from companies  $P$  and  $Q$  would be in the ratio:

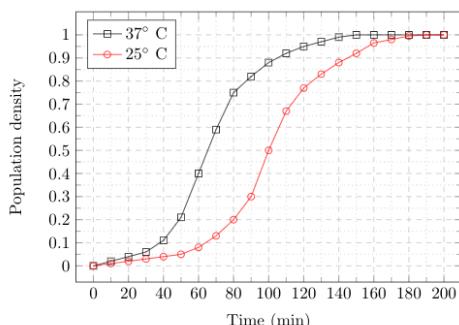
- A.  $2 : 3$       B.  $3 : 4$       C.  $6 : 7$       D.  $4 : 3$

gate2016-ce-2 data-interpretation quantitative-aptitude line-graph

[Answer key](#)

### 9.32.8 Line Graph: GATE2017 ME-1: GA-10

The growth of bacteria (lactobacillus) in milk leads to curd formation. A minimum bacterial population density of 0.8 (in suitable units) is needed to form curd. In the graph below, the population density of lactobacillus in 1 litre of milk is plotted as a function of time, at two different temperatures,  $25^{\circ}\text{C}$  and  $37^{\circ}\text{C}$ .



Consider the following statements based on the data shown above:

- i. The growth in bacterial population stops earlier at  $37^{\circ}\text{C}$  as compared to  $25^{\circ}\text{C}$
- ii. The time taken for curd formation at  $25^{\circ}\text{C}$  is twice the time taken at  $37^{\circ}\text{C}$

Which one of the following options is correct?

- A. Only i      B. Only ii      C. Both i and ii      D. Neither i nor ii

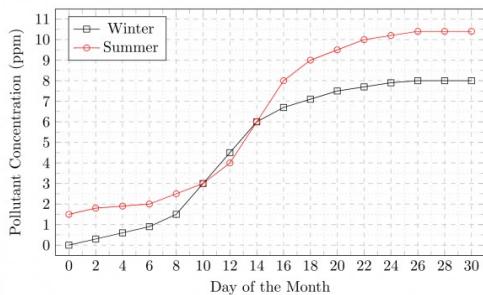
gate2017-me-1 general-aptitude quantitative-aptitude data-interpretation line-graph

[Answer key](#)



### 9.32.9 Line Graph: GATE2017 ME-2: GA-10

In the graph below, the concentration of a particular pollutant in a lake is plotted over (alternate) days of a month in winter (average temperature  $10^{\circ}\text{C}$ ) and a month in summer (average temperature  $30^{\circ}\text{C}$ ).



Consider the following statements based on the data shown above:

- i. Over the given months, the difference between the maximum and the minimum pollutant concentrations is the same in both winter and summer
- ii. There are at least four days in the summer month such that the pollutant concentrations on those days are within 1 ppm of the pollutant concentrations on the corresponding days in the winter month.

Which one of the following options is correct?

- A. Only i      B. Only ii      C. Both i and ii      D. Neither i nor ii

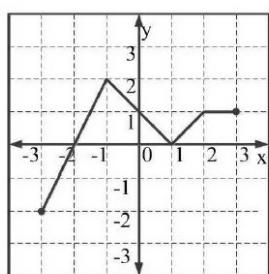
gate2017-me-2 general-aptitude quantitative-aptitude data-interpretation line-graph

[Answer key](#)



### 9.32.10 Line Graph: GATE2018 CE-1: GA-8

Which of the following function(s) is an accurate description of the graph for the range(s) indicated?



- i.  $y = 2x + 4$  for  $-3 \leq x \leq -1$
- ii.  $y = |x - 1|$  for  $-1 \leq x \leq 2$
- iii.  $y = ||x| - 1|$  for  $-1 \leq x \leq 2$
- iv.  $y = 1$  for  $2 \leq x \leq 3$

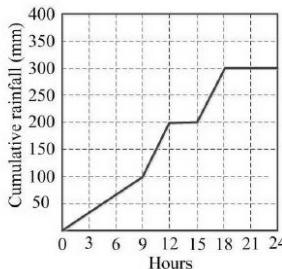
- A. i, ii and iii only      B. i, ii and iv only      C. i and iv only      D. ii and iv only

gate2018-ce-1 general-aptitude quantitative-aptitude line-graph

[Answer key](#)

### 9.32.11 Line Graph: GATE2018 CE-2: GA-8

The annual average rainfall in a tropical city is 1000 mm. On a particular rainy day (24-hour period), the cumulative rainfall experienced by the city is shown in the graph. Over the 24-hour period, 50% of the rainfall falling on a rooftop, which had an obstruction-free area of  $50\text{ m}^2$ , was harvested into a tank. What is the total volume of water collected in the tank liters?



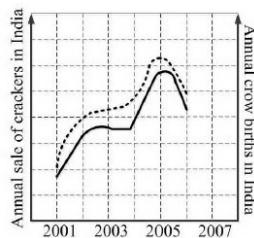
- A. 25,000      B. 18,750      C. 7,500      D. 3.125

gate2018-ce-2 general-aptitude quantitative-aptitude data-interpretation line-graph

[Answer key](#)

### 9.32.12 Line Graph: GATE2018 CH: GA-10

In a detailed study of annual crow births in India, it was found that there was relatively no growth during the period 2002 to 2004 and a sudden spike from 2004 to 2005. In another unrelated study, it was found that the revenue from cracker sales in India which remained fairly flat from 2002 to 2004, saw a sudden spike in 2005 before declining again in 2006. The solid line in the graph below refers to annual sale of crackers and the dashed line refers to the annual crow births in India. Choose the most appropriate inference from the above data.



- A. There is a strong correlation between crow birth and cracker sales.  
B. Cracker usage increases crow birth rate.  
C. If cracker sale declines, crow birth will decline.  
D. Increased birth rate of crows will cause an increase in the sale of crackers.

gate2018-ch general-aptitude quantitative-aptitude data-interpretation line-graph

[Answer key](#)

## 9.33

### Lines (1)

#### 9.33.1 Lines: GATE Civil 2022 Set 2 | GA Question: 8

Consider the following equations of straight lines:

$$\text{Line L1 : } 2x - 3y = 5$$

$$\text{Line L2 : } 3x + 2y = 8$$

$$\text{Line L3 : } 4x - 6y = 5$$

$$\text{Line L4 : } 6x - 9y = 6$$

Which one among the following is the correct statement?

- A. L1 is parallel to L2 and L1 is perpendicular to L3  
B. L2 is parallel to L4 and L2 is perpendicular to L1  
C. L3 is perpendicular to L4 and L3 is parallel to L2  
D. L4 is perpendicular to L2 and L4 is parallel to L3

**Answer key****9.34****Logarithms (14)****9.34.1 Logarithms: GATE CSE 2011 | Question: 57**

If  $\log(P) = (1/2)\log(Q) = (1/3)\log(R)$ , then which of the following options is **TRUE**?

- A.  $P^2 = Q^3R^2$       B.  $Q^2 = PR$       C.  $Q^2 = R^3P$       D.  $R = P^2Q^2$

**Answer key****9.34.2 Logarithms: GATE CSE 2018 | Question: GA-7**

If  $pqr \neq 0$  and  $p^{-x} = \frac{1}{q}, q^{-y} = \frac{1}{r}, r^{-z} = \frac{1}{p}$ , what is the value of the product  $xyz$ ?

- A.  $-1$       B.  $\frac{1}{pqr}$       C.  $1$       D.  $pqr$

**Answer key****9.34.3 Logarithms: GATE CSE 2024 | Set 1 | GA Question: 5**

For positive non-zero real variables  $p$  and  $q$ , if

$$\log(p^2 + q^2) = \log p + \log q + 2\log 3,$$

then, the value of  $\frac{p^4+q^4}{p^2q^2}$  is

- A. 79      B. 81      C. 9      D. 83

**Answer key****9.34.4 Logarithms: GATE CSE 2024 | Set 2 | GA Question: 4**

For positive non-zero real variables  $x$  and  $y$ , if

$$\ln\left(\frac{x+y}{2}\right) = \frac{1}{2}[\ln(x) + \ln(y)]$$

then, the value of  $\frac{x}{y} + \frac{y}{x}$  is

- A. 1      B. 1/2      C. 2      D. 4

**Answer key****9.34.5 Logarithms: GATE Civil 2023 Set 1 | GA Question: 9**

Let  $a = 30!$ ,  $b = 50!$ , and  $c = 100!$ . Consider the following numbers:

$$\log_a c, \quad \log_c a, \quad \log_b a, \quad \log_a b$$

Which one of the following inequalities is **CORRECT**?

- A.  $\log_c a < \log_b a < \log_a b < \log_a c$   
 B.  $\log_c a < \log_a b < \log_b a < \log_b c$   
 C.  $\log_c a < \log_b a < \log_a c < \log_a b$   
 D.  $\log_b a < \log_c a < \log_a b < \log_a c$

[Answer key](#)

### 9.34.6 Logarithms: GATE Civil 2023 Set 2 | GA Question: 9



If  $x$  satisfies the equation  $4^{8^x} = 256$ , then  $x$  is equal to \_\_\_\_\_.

A.  $\frac{1}{2}$

B.  $\log_{16} 8$

C.  $\frac{2}{3}$

D.  $\log_4 8$

gatecivil-2023-set2 quantitative-apitude logarithms

[Answer key](#)

### 9.34.7 Logarithms: GATE ECE 2024 | GA Question: 4



For a real number  $x > 1$ ,

$$\frac{1}{\log_2 x} + \frac{1}{\log_3 x} + \frac{1}{\log_4 x} = 1$$

The value of  $x$  is

A. 4

B. 12

C. 24

D. 36

gateece-2024 logarithms quantitative-apitude

[Answer key](#)

### 9.34.8 Logarithms: GATE2012 AR: GA-6



A value of  $x$  that satisfies the equation  $\log x + \log(x-7) = \log(x+11) + \log 2$  is

A. 1

B. 2

C. 7

D. 11

gate2012-ar quantitative-apitude logarithms

[Answer key](#)

### 9.34.9 Logarithms: GATE2015 EC-1: GA-5



If  $\log_x (\frac{5}{7}) = -\frac{1}{3}$ , then the value of  $x$  is

A.  $343/125$

B.  $25/343$

C.  $-25/49$

D.  $-49/25$

gate2015-ec-1 general-apitude numerical-methods logarithms

[Answer key](#)

### 9.34.10 Logarithms: GATE2015 EC-3: GA-9



$\log \tan 1^\circ + \log \tan 2^\circ + \dots + \log \tan 89^\circ$  is ...

A. 1

B.  $1/\sqrt{2}$

C. 0

D. -1

gate2015-ec-3 quantitative-apitude logarithms

[Answer key](#)

### 9.34.11 Logarithms: GATE2018 CE-2: GA-5



For non-negative integers,  $a, b, c$ , what would be the value of  $a + b + c$  if  $\log a + \log b + \log c = 0$ ?

A. 3

B. 1

C. 0

D. -1

gate2018-ce-2 general-apitude quantitative-apitude logarithms

[Answer key](#)

### 9.34.12 Logarithms: GATE2018 CE-2: GA-9



Given that  $\frac{\log P}{y-z} = \frac{\log Q}{z-x} = \frac{\log R}{x-y} = 10$  for  $x \neq y \neq z$ , what is the value of the product  $PQR$ ?

A. 0

B. 1

C.  $xyz$

D.  $10^{xyz}$

gate2018-ce-2 general-apitude quantitative-apitude logarithms

[Answer key](#)

### 9.34.13 Logarithms: GATE2018 ME-1: GA-6



For integers,  $a$ ,  $b$ , and  $c$ , what would be the minimum and maximum values respectively of  $a+b+c$  if  $\log|a| + \log|b| + \log|c| = 0$ ?

- A. -3 and 3      B. -1 and 1      C. -1 and 3      D. 1 and 3

gate2018-me-1 general-aptitude quantitative-aptitude logarithms

[Answer key](#)

### 9.34.14 Logarithms: GATE2018 ME-2: GA-5



The value of the expression  $\frac{1}{1 + \log_u vw} + \frac{1}{1 + \log_v uw} + \frac{1}{1 + \log_w uv}$  is \_\_\_\_\_

- A. -1      B. 0      C. 1      D. 3

gate2018-me-2 general-aptitude quantitative-aptitude logarithms

[Answer key](#)

## 9.35

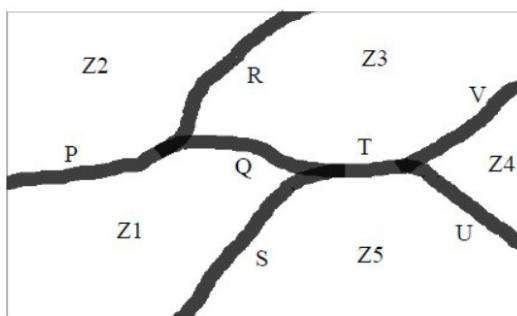
### Maps (1)

#### 9.35.1 Maps: GATE CSE 2025 | Set 2 | GA Question: 10



The diagram below shows a river system consisting of 7 segments, marked P, Q, R, S, T, U, and V. It splits the land into 5 zones, marked Z1, Z2, Z3, Z4, and Z5. We need to connect these zones using the latest number of bridges. Out of the following options, which one is correct?

Note: The figure shown is representative.



- A. Bridges on P, Q and T  
C. Bridges on Q, R, T and V

- B. Bridges on P, Q, S and T  
D. Bridges on P, Q, S, U and V

gatecse2025-set2 quantitative-aptitude maps two-marks

[Answer key](#)

## 9.36

### Maxima Minima (4)

#### 9.36.1 Maxima Minima: GATE CSE 2012 | Question: 62



A political party orders an arch for the entrance to the ground in which the annual convention is being held. The profile of the arch follows the equation  $y = 2x - 0.1x^2$  where  $y$  is the height of the arch in meters. The maximum possible height of the arch is

- A. 8 meters      B. 10 meters      C. 12 meters      D. 14 meters

gatecse-2012 quantitative-aptitude normal maxima-minima

[Answer key](#)

### 9.36.2 Maxima Minima: GATE CSE 2017 Set 2 | Question: GA-9



The number of roots of  $e^x + 0.5x^2 - 2 = 0$  in the range  $[-5, 5]$  is

- A. 0      B. 1      C. 2      D. 3

gatecse-2017-set2 quantitative-apitude normal maxima-minima calculus

[Answer key](#)

### 9.36.3 Maxima Minima: GATE2010 TF: GA-5



Consider the function  $f(x) = \max(7 - x, x + 3)$ . In which range does  $f$  take its minimum value?

- A.  $-6 \leq x < -2$       B.  $-2 \leq x < 2$   
C.  $2 \leq x < 6$       D.  $6 \leq x < 10$

general-apitude quantitative-apitude gate2010-tf maxima-minima functions

[Answer key](#)

### 9.36.4 Maxima Minima: GATE2013 CE: GA-6



$X$  and  $Y$  are two positive real numbers such that  $2X + Y \leq 6$  and  $X + 2Y \leq 8$ . For which of the following values of

$(X, Y)$  the function  $f(X, Y) = 3X + 6Y$  will give maximum value ?

- A.  $\left(\frac{4}{3}, \frac{10}{3}\right)$       B.  $\left(\frac{8}{3}, \frac{20}{3}\right)$       C.  $\left(\frac{8}{3}, \frac{10}{3}\right)$       D.  $\left(\frac{4}{3}, \frac{20}{3}\right)$

gate2013-ce quantitative-apitude maxima-minima

[Answer key](#)

## 9.37

### Mensuration (1)



#### 9.37.1 Mensuration: GATE DA 2025 | GA Question: 5

A rectangle has a length  $L$  and a width  $W$ , where  $L > W$ . If the width,  $W$ , is increased by 10%, which one of the following statements is correct for all values of  $L$  and  $W$ ?

- A. Perimeter increases by 10%.      B. Length of the diagonals increases by 10%.  
C. Area increases by 10%.      D. The rectangle becomes a square.

gateda-2025 quantitative-apitude mensuration one-mark

[Answer key](#)

## 9.38

### Modular Arithmetic (2)



#### 9.38.1 Modular Arithmetic: GATE Electrical 2023 | GA Question: 9

The digit in the unit's place of the product  $3^{999} \times 7^{1000}$  is \_\_\_\_\_.

- A. 7      B. 1      C. 3      D. 9

gate2023-ee quantitative-apitude modular-arithmetic

[Answer key](#)

#### 9.38.2 Modular Arithmetic: GATE2012 CY: GA-1



If  $(1.001)^{1259} = 3.52$  and  $(1.001)^{2062} = 7.85$ , then  $(1.001)^{3321} =$

- A. 2.23      B. 4.33      C. 11.37      D. 27.64

gate2012-cy quantitative-apitude modular-arithmetic

[Answer key](#)

## 9.39

### Number Series (10)



#### 9.39.1 Number Series: GATE CSE 2013 | Question: 61

Find the sum of the expression

$$\frac{1}{\sqrt{1}+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \dots + \frac{1}{\sqrt{80}+\sqrt{81}}$$

A. 7

B. 8

C. 9

D. 10

gatecse-2013 quantitative-apitude normal number-series

[Answer key](#)

### 9.39.2 Number Series: GATE CSE 2014 Set 2 | Question: GA-5



The value of  $\sqrt{12 + \sqrt{12 + \sqrt{12 + \dots}}}$  is

A. 3.464

B. 3.932

C. 4.000

D. 4.444

gatecse-2014-set2 quantitative-apitude easy number-series

[Answer key](#)

### 9.39.3 Number Series: GATE CSE 2014 Set 3 | Question: GA-4



Which number does not belong in the series below?

2, 5, 10, 17, 26, 37, 50, 64

A. 17

B. 37

C. 64

D. 26

gatecse-2014-set3 quantitative-apitude number-series easy

[Answer key](#)

### 9.39.4 Number Series: GATE2010 TF: GA-7



Consider the series  $\frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{8} + \frac{1}{9} - \frac{1}{16} + \frac{1}{32} + \frac{1}{27} - \frac{1}{64} + \dots$ . The sum of the infinite series above is:

A.  $\infty$

B.  $\frac{5}{6}$

C.  $\frac{1}{2}$

D. 0

general-apitude quantitative-apitude gate2010-tf number-series

[Answer key](#)

### 9.39.5 Number Series: GATE2013 EE: GA-10



Find the sum to ' $n$ ' terms of the series  $10 + 84 + 734 + \dots$

A.  $\frac{9(9^n+1)}{10} + 1$

B.  $\frac{9(9^n-1)}{8} + 1$

C.  $\frac{9(9^n-1)}{8} + n$

D.  $\frac{9(9^n-1)}{8} + n^2$

gate2013-ee quantitative-apitude number-series

[Answer key](#)

### 9.39.6 Number Series: GATE2014 EC-1: GA-5



What is the next number in the series?

12    35    81    173    357    \_\_\_\_\_.

gate2014-ec-1 number-series quantitative-apitude numerical-answers

[Answer key](#)

### 9.39.7 Number Series: GATE2014 EC-2: GA-5



Fill in the missing number in the series.

2    3    6    15    \_\_\_\_\_ 157.5    630

gate2014-ec-2 number-series quantitative-apitude numerical-answers

[Answer key](#)

### 9.39.8 Number Series: GATE2014 EC-3: GA-4



The next term in the series 81, 54, 36, 24, ... is \_\_\_\_\_.

**Answer key****9.39.9 Number Series: GATE2018 CE-1: GA-9**

Consider a sequence of numbers  $a_1, a_2, a_3, \dots, a_n$  where  $a_n = \frac{1}{n} - \frac{1}{n+2}$ , for each integer  $n > 0$ . What is the sum of the first 50 terms?

- A.  $(1 + \frac{1}{2}) - \frac{1}{50}$   
 C.  $(1 + \frac{1}{2}) - (\frac{1}{51} + \frac{1}{52})$   
 B.  $(1 + \frac{1}{2}) + \frac{1}{50}$   
 D.  $1 - (\frac{1}{51} + \frac{1}{52})$

**Answer key****9.39.10 Number Series: GATE2018 EC: GA-4**

What is the value of  $1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \frac{1}{256} + \dots$ ?

- A. 2  
 B.  $\frac{7}{4}$   
 C.  $\frac{3}{2}$   
 D.  $\frac{4}{3}$

**Answer key****9.40****Number System (7)****9.40.1 Number System: GATE 2024 Electrical | GA Question: 3**

The decimal number system uses the characters  $0, 1, 2, \dots, 8, 9$ , and the octal number system uses the characters  $0, 1, 2, \dots, 6, 7$ .

For example, the decimal number  $12 (= 1 \times 10^1 + 2 \times 10^0)$  is expressed as  $14 (= 1 \times 8^1 + 4 \times 8^0)$  in the octal number system.

The decimal number 108 in the octal number system is

- A. 168  
 B. 108  
 C. 150  
 D. 154

**Answer key****9.40.2 Number System: GATE CSE 2014 Set 3 | Question: GA-10**

Consider the equation:  $(7526)_8 - (Y)_8 = (4364)_8$ , where  $(X)_N$  stands for  $X$  to the base  $N$ . Find  $Y$ .

- A. 1634  
 B. 1737  
 C. 3142  
 D. 3162

**Answer key****9.40.3 Number System: GATE CSE 2017 Set 2 | Question: GA-8**

$X$  is a 30 digit number starting with the digit 4 followed by the digit 7. Then the number  $X^3$  will have

- A. 90 digits  
 B. 91 digits  
 C. 92 digits  
 D. 93 digits

**Answer key****9.40.4 Number System: GATE Civil 2020 Set 1 | GA Question: 5**

The sum of two positive numbers is 100. After subtracting 5 from each number, the product of the resulting numbers is 0. One of the original numbers is \_\_\_\_\_.

- A. 80  
 B. 85  
 C. 90  
 D. 95

[Answer key](#)

#### 9.40.5 Number System: GATE2010 MN: GA-9



A positive integer  $m$  in base 10 when represented in base 2 has the representation  $p$  and in base 3 has the representation  $q$ . We get  $p - q = 990$  where the subtraction is done in base 10. Which of the following is necessarily true?

- A.  $m \geq 14$       B.  $9 \leq m \leq 13$       C.  $6 \leq m \leq 8$       D.  $m < 6$

general-aptitude quantitative-aptitude gate2010-mn number-system

[Answer key](#)

#### 9.40.6 Number System: GATE2016 CE-2: GA-5



The sum of the digits of a two digit number is 12. If the new number formed by reversing the digits is greater than the original number by 54, find the original number.

- A. 39      B. 57      C. 66      D. 93

gate2016-ce-2 quantitative-aptitude number-system

[Answer key](#)

#### 9.40.7 Number System: GATE2018 ME-1: GA-5



A number consists of two digits. The sum of the digits is 9. If 45 is subtracted from the number, its digits are interchanged. What is the number?

- A. 63      B. 72      C. 81      D. 90

gate2018-me-1 general-aptitude quantitative-aptitude number-system

[Answer key](#)

9.41

### Number Theory (6)

#### 9.41.1 Number Theory: GATE ECE 2023 | GA Question: 3



What is the smallest number with distinct digits whose digits add up to 45?

- A. 123555789      B. 123457869      C. 123456789      D. 99999

gateece-2023 quantitative-aptitude number-theory

[Answer key](#)

#### 9.41.2 Number Theory: GATE Electrical 2021 | GA Question: 4



Which one of the following numbers is exactly divisible by  $(11^{13} + 1)$ ?

- A.  $11^{26} + 1$       B.  $11^{33} + 1$       C.  $11^{39} - 1$       D.  $11^{52} - 1$

gateee-2021 quantitative-aptitude number-system number-theory

[Answer key](#)

#### 9.41.3 Number Theory: GATE IN 2023 | GA Question: 3



A 'frabjous' number is defined as a 3 digit number with all digits odd, and no two adjacent digits being the same. For example, 137 is a frabjous number, while 133 is not. How many such frabjous numbers exist?

- A. 125      B. 720      C. 60      D. 80

gatein-2023 quantitative-aptitude number-theory

[Answer key](#)

#### 9.41.4 Number Theory: GATE2012 AE: GA-8



If a prime number on division by 4 gives a remainder of 1, then that number can be expressed as

- A. sum of squares of two natural numbers  
B. sum of cubes of two natural numbers

- C. sum of square roots of two natural numbers  
 D. sum of cube roots of two natural numbers

gate2012-ae number-theory quantitative-aptitude

[Answer key](#)



#### 9.41.5 Number Theory: GATE2016 ME-2: GA-9

The binary operation  $\square$  is defined as  $a \square b = ab + (a + b)$ , where  $a$  and  $b$  are any two real numbers. The value of the identity element of this operation, defined as the number  $x$  such that  $a \square x = a$ , for any  $a$ , is

- A. 0      B. 1      C. 2      D. 10

gate2016-me-2 quantitative-aptitude number-theory easy

[Answer key](#)



#### 9.41.6 Number Theory: GATE2017 ME-2: GA-3

If  $a$  and  $b$  are integers and  $a - b$  is even, which of the following must always be even?

- A.  $ab$       B.  $a^2 + b^2 + 1$       C.  $a^2 + b + 1$       D.  $ab - b$

gate2017-me-2 general-aptitude quantitative-aptitude number-theory

[Answer key](#)

9.42

### Numerical Computation (14)



#### 9.42.1 Numerical Computation: GATE CSE 2014 Set 1 | Question: GA-4

If  $\left(z + \frac{1}{z}\right)^2 = 98$ , compute  $\left(z^2 + \frac{1}{z^2}\right)$ .

gatecse-2014-set1 quantitative-aptitude easy numerical-answers numerical-computation

[Answer key](#)



#### 9.42.2 Numerical Computation: GATE CSE 2014 Set 2 | Question: GA-4

What is the average of all multiples of 10 from 2 to 198?

- A. 90      B. 100      C. 110      D. 120

gatecse-2014-set2 quantitative-aptitude easy numerical-computation factors

[Answer key](#)



#### 9.42.3 Numerical Computation: GATE CSE 2017 Set 1 | Question: GA-4

Find the smallest number  $y$  such that  $y \times 162$  is a perfect cube.

- A. 24      B. 27      C. 32      D. 36

gatecse-2017-set1 general-aptitude quantitative-aptitude numerical-computation

[Answer key](#)



#### 9.42.4 Numerical Computation: GATE CSE 2017 Set 2 | Question: GA-4

A test has twenty questions worth 100 marks in total. There are two types of questions. Multiple choice questions are worth 3 marks each and essay questions are worth 11 marks each. How many multiple choice questions does the exam have?

- A. 12      B. 15      C. 18      D. 19

gatecse-2017-set2 quantitative-aptitude numerical-computation

[Answer key](#)



#### 9.42.5 Numerical Computation: GATE Chemical 2020 | GA Question: 9

For a matrix  $M = [m_{ij}]$ ;  $i, j = 1, 2, 3, 4$ , the diagonal elements are all zero and  $m_{ij} = -m_{ji}$ . The minimum number of elements required to fully specify the matrix is \_\_\_\_\_

- A. 0      B. 6      C. 12      D. 16

gate2020-ch quantitative-apitude numerical-computation matrix

[Answer key](#)



#### 9.42.6 Numerical Computation: GATE2010 TF: GA-10

A student is answering a multiple choice examination with 65 questions with a marking scheme as follows: i) 1 marks for each correct answer ,ii)  $-\frac{1}{4}$  for a wrong answer ,iii)  $-\frac{1}{8}$  for a question that has not been attempted. If the student gets 37 marks in the test then the least possible number of questions the student has NOT answered is:

- A. 6      B. 5      C. 7      D. 4

general-apitude quantitative-apitude gate2010-tf numerical-computation

[Answer key](#)



#### 9.42.7 Numerical Computation: GATE2013 CE: GA-1

A number is as much greater than 75 as it is smaller than 117. The number is:

- A. 91      B. 93      C. 89      D. 96

gate2013-ce quantitative-apitude numerical-computation

[Answer key](#)



#### 9.42.8 Numerical Computation: GATE2014 EC-2: GA-8

The sum of eight consecutive odd numbers is 656. The average of four consecutive even numbers is 87. What is the sum of the smallest odd number and second largest even number?

gate2014-ec-2 quantitative-apitude numerical-answers numerical-computation

[Answer key](#)



#### 9.42.9 Numerical Computation: GATE2014 EC-4: GA-4

Let  $f(x, y) = x^n y^m = P$ . If  $x$  is doubled and  $y$  is halved, the new value of  $f$  is

- A.  $2^{n-m} P$       B.  $2^{m-n} P$       C.  $2(n-m)P$       D.  $2(m-n)P$

gate2014-ec-4 quantitative-apitude easy numerical-computation

[Answer key](#)



#### 9.42.10 Numerical Computation: GATE2017 ME-1: GA-7

What is the sum of the missing digits in the subtraction problem below?

$$\begin{array}{r} 5 \\ - 4 \quad 8 \\ \hline \end{array}$$

1 1 1 1

- A. 8      B. 10  
C. 11      D. Cannot be determined.

gate2017-me-1 general-apitude quantitative-apitude numerical-computation

[Answer key](#)



#### 9.42.11 Numerical Computation: GATE2018 ME-2: GA-9

A house has a number which need to be identified. The following three statements are given that can help in identifying the house number?

- i. If the house number is a multiple of 3, then it is a number from 50 to 59.



- ii. If the house number is NOT a multiple of 4, then it is a number from 60 to 69.  
 iii. If the house number is NOT a multiple of 6, then it is a number from 70 to 79.

What is the house number?

- A. 54      B. 65      C. 66      D. 76

gate2018-me-2 general-aptitude quantitative-aptitude numerical-computation

[Answer key](#)



#### 9.42.12 Numerical Computation: GATE2019 EE: GA-9

Given two sets  $X = \{1, 2, 3\}$  and  $Y = \{2, 3, 4\}$ , we construct a set  $Z$  of all possible fractions where the numerators belong to set  $X$  and the denominators belong to set  $Y$ . The product of elements having minimum and maximum values in the set  $Z$  is \_\_\_\_\_.

- A. 1/12      B. 1/8      C. 1/6      D. 3/8

gate2019-ee general-aptitude quantitative-aptitude numerical-computation

[Answer key](#)



#### 9.42.13 Numerical Computation: GATE2019 ME-1: GA-4

The sum and product of two integers are 26 and 165 respectively. The difference between these two integers is \_\_\_\_\_

- A. 2      B. 3      C. 4      D. 6

gate2019-me-1 general-aptitude quantitative-aptitude numerical-computation

[Answer key](#)



#### 9.42.14 Numerical Computation: GATE2019 ME-2: GA-4

The product of three integers  $X$ ,  $Y$  and  $Z$  is 192.  $Z$  is equal to 4 and  $P$  is equal to the average of  $X$  and  $Y$ . What is the minimum possible value of  $P$ ?

- A. 6      B. 7      C. 8      D. 9.5

gate2019-me-2 general-aptitude quantitative-aptitude numerical-computation

[Answer key](#)

### 9.43

### Percentage (21)



#### 9.43.1 Percentage: GATE CSE 2014 Set 1 | Question: GA-8

Round-trip tickets to a tourist destination are eligible for a discount of 10% on the total fare. In addition, groups of 4 or more get a discount of 5% on the total fare. If the one way single person fare is Rs 100, a group of 5 tourists purchasing round-trip tickets will be charged Rs \_\_\_\_\_

gatecse-2014-set1 quantitative-aptitude easy numerical-answers percentage

[Answer key](#)



#### 9.43.2 Percentage: GATE CSE 2014 Set 3 | Question: GA-8

The Gross Domestic Product (*GDP*) in Rupees grew at 7% during 2012 – 2013. For international comparison, the *GDP* is compared in US Dollars (*USD*) after conversion based on the market exchange rate. During the period 2012 – 2013 the exchange rate for the *USD* increased from Rs. 50/*USD* to Rs.60/*USD*. India's GDP in USD during the period 2012 – 2013

- A. increased by 5%  
 C. decreased by 20%  
 B. decreased by 13%  
 D. decreased by 11%

gatecse-2014-set3 quantitative-aptitude normal percentage

[Answer key](#)



#### 9.43.3 Percentage: GATE CSE 2024 | Set 1 | GA Question: 4

The number of coins of ₹1, ₹5, and ₹10 denominations that a person has are in the ratio 5 : 3 : 13. Of the total



amount, the percentage of money in ₹5 coins is

- A. 21%      B.  $14\frac{2}{7}\%$       C. 10%      D. 30%

gatecse2024-set1 quantitative-aptitude percentage one-mark

Answer key 

#### 9.43.4 Percentage: GATE Civil 2024 Set 2 | GA Question: 3

A student was supposed to **multiply** a positive real number  $p$  with another positive real number  $q$ . Instead, the student **divided**  $p$  by  $q$ . If the percentage error in the student's answer is 80%, the value of  $q$  is

- A. 5      B.  $\sqrt{2}$       C. 2      D.  $\sqrt{5}$

gatcivil-2024-set2 quantitative-aptitude percentage

Answer key 

#### 9.43.5 Percentage: GATE Mechanical 2020 Set 2 | GA Question: 5

There are five levels  $\{P, Q, R, S, T\}$  in a linear supply chain before a product reaches customers, as shown in the figure.



At each of the five levels, the price of the product is increased by 25%. If the product is produced at level  $P$  at the cost of Rs. 120 per unit, what is the price paid (in rupees) by the customers?

- A. 187.50      B. 234.38      C. 292.96      D. 366.21

gateme-2020-set2 quantitative-aptitude percentage

Answer key 

#### 9.43.6 Percentage: GATE2011 AG: GA-4

There are two candidates  $P$  and  $Q$  in an election. During the campaign, 40% of the voters promised to vote for  $P$ , and rest for  $Q$ . However, on the day of election 15% of the voters went back on their promise to vote for  $P$  and instead voted for  $Q$ . 25% of the voters went back on their promise to vote for  $Q$  and instead voted for  $P$ . Suppose,  $P$  lost by 2 votes, then what was the total number of voters?

- A. 100      B. 110      C. 90      D. 95

general-aptitude quantitative-aptitude gate2011-ag percentage

Answer key 

#### 9.43.7 Percentage: GATE2012 AE: GA-7

The total runs scored by four cricketers  $P, Q, R$  and  $S$  in years 2009 and 2010 are given in the following table;

Player	2009	2010
P	802	1008
Q	765	912
R	429	619
S	501	701

The player with the lowest percentage increase in total runs is

- A.  $P$       B.  $Q$       C.  $R$       D.  $S$

gate2012-ae quantitative-aptitude percentage

Answer key 

#### 9.43.8 Percentage: GATE2012 CY: GA-8

The data given in the following table summarizes the monthly budget of an average household.

Category	Amount (Rs.)
Food	4000
Rent	2000
Savings	1500
Other expenses	1800
Clothing	1200

The approximate percentage of the monthly budget **NOT** spent on savings is

- A. 10%      B. 14%      C. 81%      D. 86%

gate2012-cy quantitative-aptitude percentage

[Answer key](#)



#### 9.43.9 Percentage: GATE2013 EE: GA-2

In the summer of 2012, in New Delhi, the mean temperature of Monday to Wednesday was  $41^{\circ}\text{C}$  and of Tuesday to Thursday was  $43^{\circ}\text{C}$ . If the temperature on Thursday was 15% higher than that of Monday, then the temperature in  $^{\circ}\text{C}$  on Thursday was

- A. 40      B. 43      C. 46      D. 49

gate2013-ee quantitative-aptitude percentage

[Answer key](#)



#### 9.43.10 Percentage: GATE2014 AE: GA-9

One percent of the people of country  $X$  are taller than 6 ft. Two percent of the people of country  $Y$  are taller than 6 ft. There are thrice as many people in country  $X$  as in country  $Y$ . Taking both countries together, what is the percentage of people taller than 6 ft?

- A. 3.0      B. 2.5      C. 1.5      D. 1.25

gate2014-ae percentage quantitative-aptitude

[Answer key](#)



#### 9.43.11 Percentage: GATE2014 EC-4: GA-8

Industrial consumption of power doubled from 2000 – 2001 to 2010 – 2011. Find the annual rate of increase in percent assuming it to be uniform over the years.

- A. 5.6      B. 7.2      C. 10.0      D. 12.2

gate2014-ec-4 percentage normal quantitative-aptitude

[Answer key](#)



#### 9.43.12 Percentage: GATE2015 CE-2: GA-7

The given question is followed by two statements; select the most appropriate option that solves the question.

Capacity of a solution tank  $A$  is 70% of the capacity of tank  $B$ . How many gallons of solution are in tank  $A$  and tank  $B$ ?

Statements:

- I. Tank  $A$  is 80% full and tank  $B$  is 40% full.
- II. Tank  $A$  if full contains 14,000 gallons of solution.



- A. Statement I alone is sufficient.
- B. Statement II alone is sufficient.
- C. Either statement I or II alone is sufficient.
- D. Both the statements I and II together are sufficient.

**Answer key****9.43.13 Percentage: GATE2016 CE-2: GA-4** $(x\% \text{ of } y) + (y\% \text{ of } x)$  is equivalent to \_\_\_\_\_.

- A. 2% of  $xy$       B. 2% of  $(xy/100)$       C.  $xy\%$  of 100      D. 100% of  $xy$

**Answer key****9.43.14 Percentage: GATE2016 EC-1: GA-4**

In a huge pile of apples and oranges, both ripe and unripe mixed together, 15% are unripe fruits. Of the unripe fruits, 45% are apples. Of the ripe ones, 60% are oranges. If the pile contains a total of 5692000 fruits, how many of them are apples?

- A. 2029198      B. 2467482      C. 2789080      D. 3577422

**Answer key****9.43.15 Percentage: GATE2017 CE-1: GA-4**

If the radius of a right circular cone is increased by 50%, its volume increases by

- A. 75%      B. 100%      C. 125%      D. 237.5%

**Answer key****9.43.16 Percentage: GATE2017 EC-1: GA-3**

In the summer, water consumption is known to decrease overall by 25%. A Water Board official states that in the summer household consumption decreases by 20%, while other consumption increases by 70%. Which of the following statement is correct?

- A. The ratio of household to other consumption is 8/17  
 B. The ratio of household to other consumption is 1/17  
 C. The ratio of household to other consumption is 17/8  
 D. There are errors in the official's statement.

**Answer key****9.43.17 Percentage: GATE2018 EE: GA-9**

A designer uses marbles of four different colours for his designs. The cost of each marble is the same, irrespective of the colour. The table below shows the percentage of marbles of each colour used in the current design. The cost of each marble increased by 25%. Therefore, the designer decided to reduce equal numbers of marbles of each colour to keep the total cost unchanged. What is the percentage of blue marbles in the new design?

Blue	Black	Red	Yellow
40%	25%	20%	15%

- A. 35.75      B. 40.25      C. 43.75      D. 46.25

**Answer key****9.43.18 Percentage: GATE2019 CE-2: GA-7**

Population of state  $X$  increased by  $x\%$  and the population of state  $Y$  increased by  $y\%$  from 2001 to 2011. Assume that  $x$  is greater than  $y$ . Let  $P$  be the ratio of the population of state  $X$  to state  $Y$  in a given year. The

percentage increase in  $P$  from 2001 to 2011 is \_\_\_\_\_

- A.  $\frac{x}{y}$       B.  $x - y$       C.  $\frac{100(x-y)}{100+x}$       D.  $\frac{100(x-y)}{100+y}$

gate2019-ce-2 general-aptitude quantitative-aptitude percentage

Answer key 

#### 9.43.19 Percentage: GATE2019 IN: GA-3

The radius as well as the height of a circular cone increases by 10%. The percentage increase in its volume is \_\_\_\_\_.  
\_\_\_\_\_.

- A. 17.1      B. 21.0      C. 33.1      D. 72.8

gate2019-in general-aptitude quantitative-aptitude geometry percentage

Answer key 

#### 9.43.20 Percentage: GATE2019 IN: GA-7

In a country of 1400 million population, 70% own mobile phones. Among the mobile phone owners, only 294 million access the Internet. Among these Internet users, only half buy goods from e-commerce portals. What is the percentage of these buyers in the country?

- A. 10.50      B. 14.70      C. 15.00      D. 50.00

gate2019-in general-aptitude quantitative-aptitude percentage

Answer key 

#### 9.43.21 Percentage: GATE2019 ME-2: GA-6

Fiscal deficit was 4% of the GDP in 2015 and that increased to 5% in 2016. If the GDP increased by 10% from 2015 to 2016, the percentage increase in the actual fiscal deficit is \_\_\_\_\_

- A. 37.50      B. 35.70      C. 25.00      D. 10.00

gate2019-me-2 general-aptitude quantitative-aptitude percentage

Answer key 

### 9.44

#### Permutation and Combination (4)

##### 9.44.1 Permutation and Combination: GATE CSE 2024 | Set 2 | GA Question: 2

Two wizards try to create a spell using all the four elements, *water*, *air*, *fire*, and *earth*. For this, they decide to mix all these elements in all possible orders. They also decide to work independently. After trying all possible combination of elements, they conclude that the spell does not work.

How many attempts does each wizard make before coming to this conclusion, independently?

- A. 24      B. 48      C. 16      D. 12

gatecse2024-set2 quantitative-aptitude permutation-and-combination one-mark

Answer key 

##### 9.44.2 Permutation and Combination: GATE CSE 2025 | Set 1 | GA Question: 10

A shop has 4 distinct flavors of ice-cream. One can purchase any number of scoops of any flavor. The order in which the scoops are purchased is inconsequential. If one wants to purchase 3 scoops of ice-cream, in how many ways can one make that purchase?

- A. 4      B. 20      C. 24      D. 48

gatecse2025-set1 quantitative-aptitude permutation-and-combination two-marks

Answer key 

##### 9.44.3 Permutation and Combination: GATE Civil 2024 Set 1 | GA Question: 7

Three distinct sets of indistinguishable twins are to be seated at a circular table that has 8 identical chairs. Unique seating arrangements are defined by the relative positions of the people.

How many unique seating arrangements are possible such that each person is sitting next to their twin?

- A. 12      B. 14      C. 10      D. 28

gatecivil-2024-set1 quantitative-apitude permutation-and-combination

[Answer key](#)



#### 9.44.4 Permutation and Combination: GATE DS&AI 2024 | GA Question: 3

How many 4-digit positive integers divisible by 3 can be formed using only the digits {1,3,4,6,7}, such that no digit appears more than once in a number?

- A. 24      B. 48      C. 72      D. 12

gate-ds-ai-2024 quantitative-apitude permutation-and-combination one-mark

[Answer key](#)



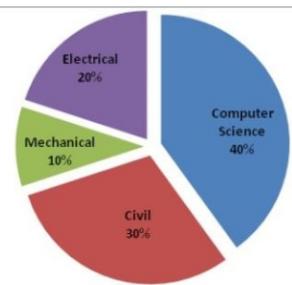
9.45

#### Pie Chart (16)

##### 9.45.1 Pie Chart: GATE CSE 2015 Set 1 | Question: GA-9



The pie chart below has the breakup of the number of students from different departments in an engineering college for the year 2012. The proportion of male to female students in each department is 5 : 4. There are 40 males in Electrical Engineering. What is the difference between the numbers of female students in the civil department and the female students in the Mechanical department?



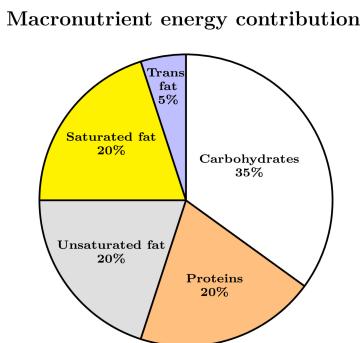
gatecse-2015-set1 quantitative-apitude data-interpretation numerical-answers pie-chart

[Answer key](#)



##### 9.45.2 Pie Chart: GATE CSE 2024 | Set 1 | GA Question: 8

The pie chart presents the percentage contribution of different macronutrients to a typical 2,000 kcal diet of a person.



The typical energy density (kcal/g) of these macronutrients is given in the table.

Macronutrient	Energy density (kcal/g)
Carbohydrates	4
Proteins	4
Unsaturated fat	9
Saturated fat	9

Trans fat	9
-----------	---

The total fat (all three types), in grams, this person consumes is

- A. 44.4      B. 77.8      C. 100      D. 3,600

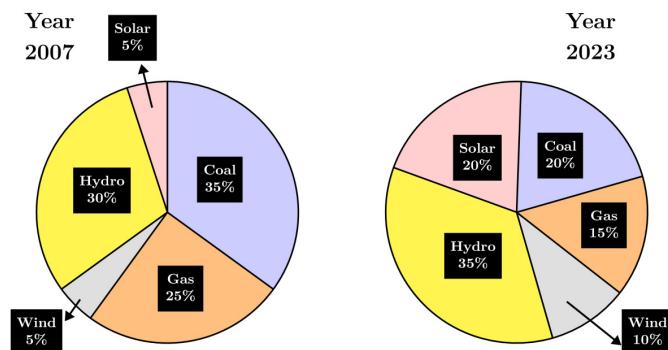
gatecse2024-set1 quantitative-aptitude pie-chart two-marks

Answer key 

#### 9.45.3 Pie Chart: GATE CSE 2024 | Set 2 | GA Question: 8



The pie charts depict the shares of various power generation technologies in the total electricity generation of a country for the years 2007 and 2023.



The renewable sources of electricity generation consist of Hydro, Solar and Wind. Assuming that the total electricity generated remains the same from 2007 to 2023, what is the percentage increase in the share of the renewable sources of electricity generation over this period?

- A. 25%      B. 50%      C. 77.5%      D. 62.5%

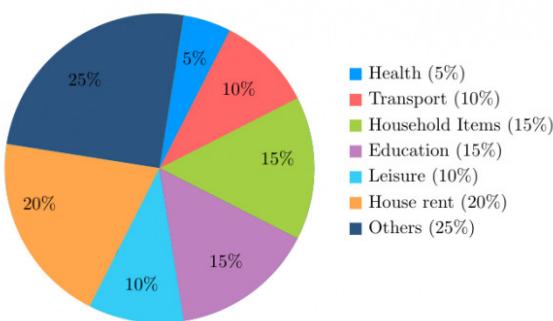
gatecse2024-set2 quantitative-aptitude pie-chart two-marks

Answer key 

#### 9.45.4 Pie Chart: GATE Civil 2020 Set 1 | GA Question: 10



The total expenditure of a family, on different activities in a month, is shown in the pie-chart. The extra money spent on education as compared to transport (in percent) is \_\_\_\_\_.



- A. 5      B. 33.3      C. 50      D. 100

gate2020-ce-1 quantitative-aptitude data-interpretation pie-chart

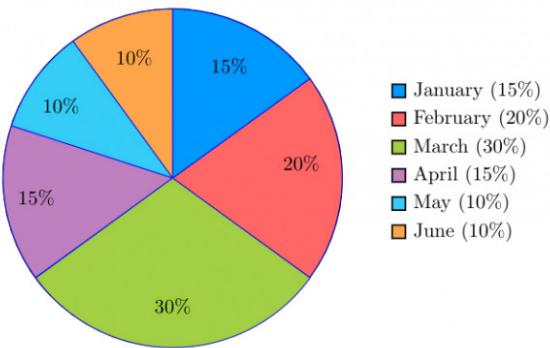
Answer key 

#### 9.45.5 Pie Chart: GATE Civil 2020 Set 2 | GA Question: 10



The monthly distribution of 9 Watt LED bulbs sold by two firms  $X$  and  $Y$  from January to June 2018 is shown in the pie-chart and the corresponding table. If the total number of LED bulbs sold by the two firms during April-June 2018 is 50000, then the number of LED bulbs sold by the firm  $Y$  during April-June 2018 is \_\_\_\_\_.

Percentage of 9 Watt LED bulbs sold by the firms  $X$  and  $Y$  from January 2018 to June, 2018



Month	Ratio of LED bulbs sold by two firms ( $X : Y$ )
January	7 : 8
February	2 : 3
March	2 : 1
April	3 : 2
May	1 : 4
June	9 : 11

- A. 11250      B. 9750      C. 8750      D. 8250

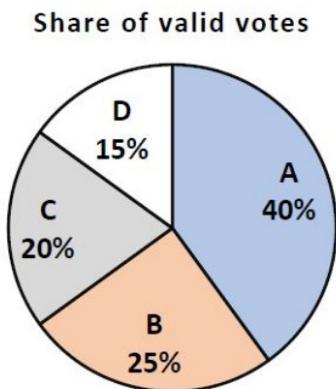
gate2020-ce-2 quantitative-aptitude data-interpretation pie-chart

[Answer key](#)



#### 9.45.6 Pie Chart: GATE DS&AI 2024 | GA Question: 5

In an election, the share of valid votes received by the four candidates A, B, C, and D is represented by the pie chart shown. The total number of votes cast in the election were 1,15,000, out of which 5,000 were invalid.



Based on the data provided, the total number of valid votes received by the candidates B and C is

- A. 45,000      B. 49,500      C. 51,750      D. 54,000

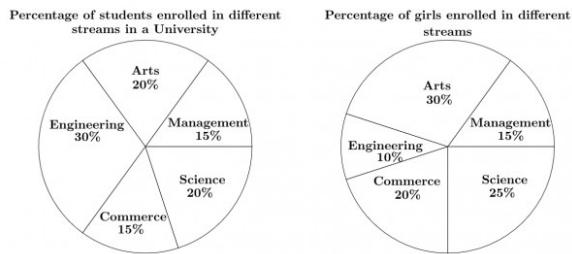
gate-ds-ai-2024 quantitative-aptitude pie-chart one-mark

[Answer key](#)



#### 9.45.7 Pie Chart: GATE Mechanical 2020 Set 2 | GA Question: 10

The two pie-charts given below show the data of total students and only girls registered in different streams in a university. If the total number of students registered in the university is 5000, and the total number of the registered girls is 1500; then, the ratio of boys enrolled in Arts to the girls enrolled in Management is \_\_\_\_\_



A. 2 : 1

B. 9 : 22

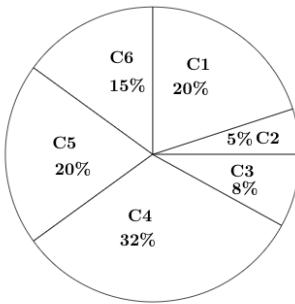
C. 11 : 9

D. 22 : 9

gateme-2020-set2 quantitative-aptitude data-interpretation pie-chart

[Answer key](#)

#### 9.45.8 Pie Chart: GATE Mechanical 2021 Set 1 | GA Question: 9



Company	Ratio
C1	3 : 2
C2	1 : 4
C3	5 : 3
C4	2 : 3
C5	9 : 1
C6	3 : 4

The distribution of employees at the rank of executives, across different companies  $C_1, C_2, \dots, C_6$  is presented in the chart given above. The ratio of executives with a management degree to those without a management degree in each of these companies is provided in the table above. The total number of executives across all companies is 10,000.

The total number of management degree holders among the executives in companies  $C_2$  and  $C_5$  together is \_\_\_\_\_.

A. 225

B. 600

C. 1900

D. 2500

gateme-2021-set1 quantitative-aptitude data-interpretation pie-chart

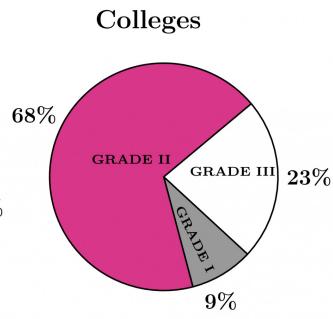
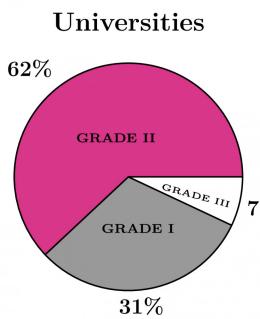
[Answer key](#)

#### 9.45.9 Pie Chart: GATE Mechanical 2023 | GA Question: 3



A certain country has 504 universities and 25951 colleges. These are categorised into Grades I, II, and III as shown in the given pie charts.

What is the percentage, correct to one decimal place, of higher education institutions (colleges and universities) that fall into Grade III?



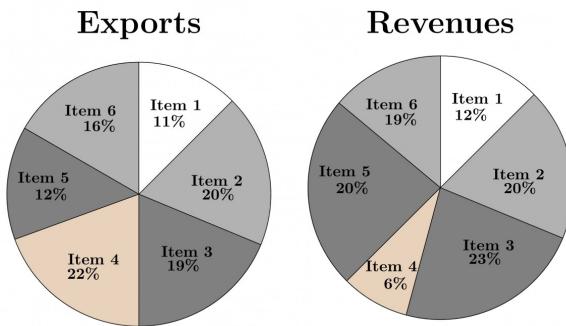
- A. 22.7      B. 23.7      C. 15.0      D. 66.8

gateme-2023 quantitative-aptitude pie-chart

[Answer key](#)

#### 9.45.10 Pie Chart: GATE2014 AG: GA-8

The total exports and revenues from the exports of a country are given in the two pie charts below. The pie chart for exports shows the quantity of each item as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 5 lakh tonnes and the total revenues are 250 crore rupees. What is the ratio of the revenue generated through export of Item 1 per kilogram to the revenue generated through export of Item 4 per kilogram?



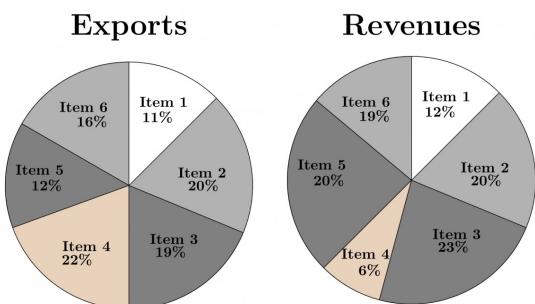
- A. 1 : 2      B. 2 : 1      C. 1 : 4      D. 4 : 1

gate2014-ag quantitative-aptitude data-interpretation pie-chart ratio-proportion normal

[Answer key](#)

#### 9.45.11 Pie Chart: GATE2014 EC-2: GA-9

The total exports and revenues from the exports of a country are given in the two charts shown below. The pie chart for exports shows the quantity of each item exported as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 500 thousand tonnes and the total revenues are 250 crore rupees. Which item among the following has generated the maximum revenue per kg?



- A. Item 2      B. Item 3      C. Item 6      D. Item 5

gate2014-ec-2 quantitative-aptitude data-interpretation pie-chart normal

[Answer key](#)

#### 9.45.12 Pie Chart: GATE2014 EC-3: GA-7



The multi-level hierarchical pie chart shows the population of animals in a reserve forest. The correct conclusions from this information are:



- (i) Butterflies are birds
- (ii) There are more tigers in this forest than red ants
- (iii) All reptiles in this forest are either snakes or crocodiles
- (iv) Elephants are the largest mammals in this forest

A. (i) and (ii) only  
C. (i), (iii) and (iv) only

B. (i), (ii), (iii) and (iv)  
D. (i), (ii) and (iii) only

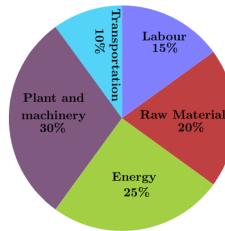
gate2014-ec-3 quantitative-apitude data-interpretation pie-chart normal

[Answer key](#)

#### 9.45.13 Pie Chart: GATE2014 EC-3: GA-9



A firm producing air purifiers sold 200 units in 2012. The following pie chart presents the share of raw material, labour, energy, plant & machinery, and transportation costs in the total manufacturing cost of the firm in 2012. The expenditure on labour in 2012 is Rs.4,50,000. In 2013, the raw material expenses increased by 30% and all other expenses increased by 20%. If the company registered a profit of Rs.10 lakhs in 2012, at what price (in Rs) was each air purifier sold?



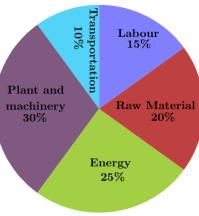
gate2014-ec-3 quantitative-apitude data-interpretation pie-chart numerical-answers

[Answer key](#)

#### 9.45.14 Pie Chart: GATE2014 EC-4: GA-9



A firm producing air purifiers sold 200 units in 2012. The following pie chart presents the share of raw material, labour, energy, plant & machinery, and transportation costs in the total manufacturing cost of the firm in 2012. The expenditure on labour in 2012 is Rs. 4,50,000. In 2013, the raw material expenses increased by 30% and all other expenses increased by 20%. What is the percentage increase in total cost for the company in 2013?



gate2014-ec-4 quantitative-apitude data-interpretation pie-chart numerical-answers

[Answer key](#)

#### 9.45.15 Pie Chart: GATE2017 EC-1: GA-4

40% of deaths on city roads may be attributed to drunken driving. The number of degrees needed to represent this as a slice of a pie chart is

- A. 120      B. 144      C. 160      D. 212

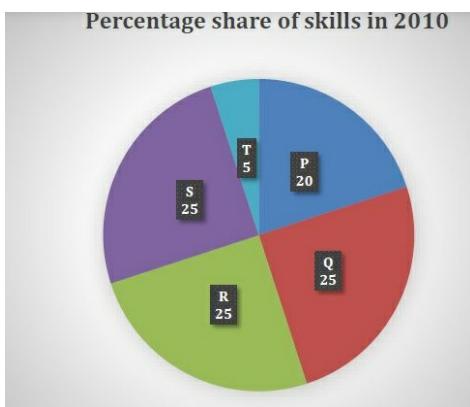
gate2017-ec-1 general-apitude quantitative-apitude percentage pie-chart

[Answer key](#)



#### 9.45.16 Pie Chart: GATE2019 ME-1: GA-9

A firm hires employees at five different skill levels P, Q, R, S, T. The shares of employment at these skills levels of total employment in 2010 is given in the pie chart as shown. There were a total of 600 employees in 2010 and the total employment increased by 15% from 2010 to 2016. The total employment at skill levels P, Q and R remained unchanged during this period. If the employment at skill level S increased by 40% from 2010 to 2016, how many employees were there at skill level T in 2016?



- A. 30      B. 35      C. 60      D. 72

gate2019-me-1 general-apitude quantitative-apitude data-interpretation pie-chart

[Answer key](#)



### 9.46

### Polynomials (4)

#### 9.46.1 Polynomials: GATE CH 2023 | GA Question: 9



The coefficient of  $x^4$  in the polynomial  $(x - 1)^3(x - 2)^3$  is equal to \_\_\_\_\_.

- A. 33      B. -3      C. 30      D. 21

gattech-2023 quantitative-apitude polynomials

[Answer key](#)

#### 9.46.2 Polynomials: GATE CSE 2016 Set 1 | Question: GA09



If  $f(x) = 2x^7 + 3x - 5$ , which of the following is a factor of  $f(x)$ ?

- A.  $(x^3 + 8)$       B.  $(x - 1)$       C.  $(2x - 5)$       D.  $(x + 1)$

**Answer key****9.46.3 Polynomials: GATE2018 CH: GA-9**

If  $x^2 + x - 1 = 0$  what is the value of  $x^4 + \frac{1}{x^4}$ ?

- A. 1      B. 5      C. 7      D. 9

**Answer key****9.46.4 Polynomials: GATE2018 EE: GA-3**

The three roots of the equation  $f(x) = 0$  are  $x = \{-2, 0, 3\}$ . What are the three values of  $x$  for which  $f(x-3) = 0$ ?

- A.  $-5, -3, 0$       B.  $-2, 0, 3$       C.  $0, 6, 8$       D.  $1, 3, 6$

**Answer key****9.47****Powers (1)****9.47.1 Powers: GATE DA 2025 | GA Question: 9**

If a real variable  $x$  satisfies  $3^{x^2} = 27 \times 9^x$ , then the value of  $\frac{2^{x^2}}{(2^x)^2}$  is:

- A.  $2^{-1}$       B.  $2^0$       C.  $2^3$       D.  $2^{15}$

**Answer key****9.48****Prime Numbers (1)****9.48.1 Prime Numbers: GATE CSE 2025 | Set 2 | GA Question: 5**

Let  $p_1$  and  $p_2$  denote two arbitrary prime numbers. Which one of the following statements is correct for all values of  $p_1$  and  $p_2$ ?

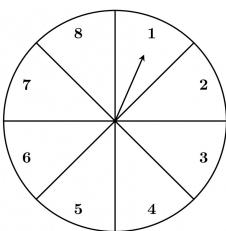
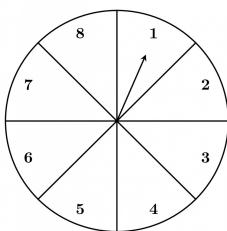
- A.  $p_1 + p_2$  not a prime number      B.  $p_1 p_2$  is not a prime number  
 C.  $p_1 + p_2 + 1$  is a prime number      D.  $p_1 p_2 + 1$  is a prime number

**Answer key****9.49****Probability (29)****9.49.1 Probability: GATE CH 2022 | GA Question: 7**

A game consists of spinning an arrow around a stationary disk as shown below. When the arrow comes to rest, there are eight equally likely outcomes. It could come to rest in any one of the sectors numbered 1, 2, 3, 4, 5, 6, 7 or 8 as shown.

Two such disks are used in a game where their arrows are independently spun.

What is the probability that the sum of the numbers on the resulting sectors upon spinning the two disks is equal to 8 after the arrows come to rest?



- A.  $\frac{1}{16}$   
 B.  $\frac{3}{64}$   
 C.  $\frac{3}{32}$   
 D.  $\frac{7}{64}$

gatech-2022 quantitative-apitude probability

[Answer key](#)

#### 9.49.2 Probability: GATE CSE 2015 Set 1 | Question: GA-10

The probabilities that a student passes in mathematics, physics and chemistry are  $m, p$  and  $c$  respectively. Of these subjects, the student has 75% chance of passing in at least one, a 50% chance of passing in at least two and a 40% chance of passing in exactly two. Following relations are drawn in  $m, p, c$ :

- I.  $p + m + c = 27/20$   
 II.  $p + m + c = 13/20$   
 III.  $(p) \times (m) \times (c) = 1/10$

- A. Only relation I is true.  
 C. Relations II and III are true.  
 B. Only relation II is true.  
 D. Relations I and III are true.

gatecse-2015-set1 quantitative-apitude probability

[Answer key](#)



#### 9.49.3 Probability: GATE CSE 2015 Set 1 | Question: GA-3

Given Set  $A = \{2, 3, 4, 5\}$  and Set  $B = \{11, 12, 13, 14, 15\}$ , two numbers are randomly selected, one from each set. What is the probability that the sum of the two numbers equals 16?

- A. 0.20      B. 0.25      C. 0.30      D. 0.33

gatecse-2015-set1 quantitative-apitude probability normal

[Answer key](#)



#### 9.49.4 Probability: GATE CSE 2017 Set 1 | Question: GA-5

The probability that a  $k$ -digit number does NOT contain the digits 0, 5, or 9 is

- A.  $0.3^k$       B.  $0.6^k$       C.  $0.7^k$       D.  $0.9^k$

gatecse-2017-set1 general-apitude quantitative-apitude probability easy

[Answer key](#)



#### 9.49.5 Probability: GATE CSE 2017 Set 2 | Question: GA-5

There are 3 red socks, 4 green socks and 3 blue socks. You choose 2 socks. The probability that they are of the same colour is

- A.  $\frac{1}{5}$       B.  $\frac{7}{30}$       C.  $\frac{1}{4}$       D.  $\frac{4}{15}$

gatecse-2017-set2 quantitative-apitude probability



[Answer key](#)

#### 9.49.6 Probability: GATE CSE 2018 | Question: GA-10



A six sided unbiased die with four green faces and two red faces is rolled seven times. Which of the following combinations is the most likely outcome of the experiment?

- A. Three green faces and four red faces.
- B. Four green faces and three red faces.
- C. Five green faces and two red faces.
- D. Six green faces and one red face

gatecse-2018 quantitative-apitude probability normal two-marks

[Answer key](#)

#### 9.49.7 Probability: GATE CSE 2021 Set 1 | GA Question: 8



There are five bags each containing identical sets of ten distinct chocolates. One chocolate is picked from each bag.

The probability that at least two chocolates are identical is \_\_\_\_\_

- A. 0.3024
- B. 0.4235
- C. 0.6976
- D. 0.8125

gatecse-2021-set1 quantitative-apitude probability two-marks

[Answer key](#)

#### 9.49.8 Probability: GATE CSE 2022 | GA Question: 8



A box contains five balls of same size and shape. Three of them are green coloured balls and two of them are orange coloured balls. Balls are drawn from the box one at a time. If a green ball is drawn, it is not replaced. If an orange ball is drawn, it is replaced with another orange ball.

First ball is drawn. What is the probability of getting an orange ball in the next draw?

- A.  $\frac{1}{2}$
- B.  $\frac{8}{25}$
- C.  $\frac{19}{50}$
- D.  $\frac{23}{50}$

gatecse-2022 quantitative-apitude probability two-marks

[Answer key](#)

#### 9.49.9 Probability: GATE CSE 2025 | Set 1 | GA Question: 8



A fair six-faced dice, with the faces labelled '1', '2', '3', '4', '5', and '6', is rolled thrice. What is the probability of rolling '6' exactly once?

- A.  $\frac{75}{216}$
- B.  $\frac{1}{6}$
- C.  $\frac{1}{18}$
- D.  $\frac{25}{216}$

gatecse2025-set1 quantitative-apitude probability easy two-marks

[Answer key](#)

#### 9.49.10 Probability: GATE Civil 2021 Set 2 | GA Question: 3



Two identical cube shaped dice each with faces numbered 1 to 6 are rolled simultaneously. The probability that an even number is rolled out on each dice is:

- A.  $\frac{1}{36}$
- B.  $\frac{1}{12}$
- C.  $\frac{1}{8}$
- D.  $\frac{1}{4}$

gatecivil-2021-set2 quantitative-apitude probability

[Answer key](#)

#### 9.49.11 Probability: GATE DS&AI 2024 | GA Question: 7



The probability of a boy or a girl being born is  $1/2$ . For a family having only three children, what is the probability of having two girls and one boy?

- A.  $3/8$
- B.  $1/8$
- C.  $1/4$
- D.  $1/2$

gate-ds-ai-2024 quantitative-apitude probability two-marks

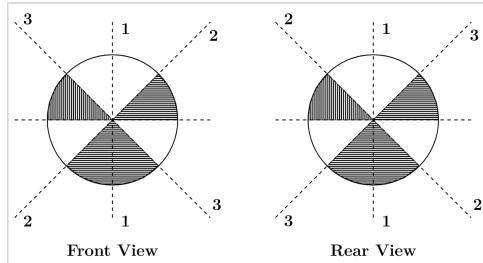
[Answer key](#)

#### 9.49.12 Probability: GATE Electrical 2022 | GA Question: 5



The figure below shows the front and rear view of a disc, which is shaded with identical patterns. The disc is flipped once with respect to any one of the fixed axes 1 – 1, 2 – 2 or 3 – 3 chosen uniformly at random.

What is the probability that the disc DOES NOT retain the same front and rear views after the flipping operation?



- A. 0      B.  $\frac{1}{3}$       C.  $\frac{2}{3}$       D. 1

gate2022-ee quantitative-aptitude probability

Answer key

#### 9.49.13 Probability: GATE Electrical 2022 | GA Question: 7



There are two identical dice with a single letter on each of the faces. The following six letters: Q, R, S, T, U and V, one on each of the faces. Any of the six outcomes are equally likely.

The two dice are thrown once independently at random.

What is the probability that the outcomes on the dice were composed only of any combination of the following possible outcomes: Q, U and V?

- A.  $\frac{1}{4}$       B.  $\frac{3}{4}$       C.  $\frac{1}{6}$       D.  $\frac{5}{36}$

gate2022-ee quantitative-aptitude probability

Answer key

#### 9.49.14 Probability: GATE Electrical 2023 | GA Question: 3



Given a fair six-faced dice where the faces are labelled '1', '2', '3', '4', '5', and '6', what is the probability of getting a '1' on the first roll of the dice and a '4' on the second roll?

- A.  $\frac{1}{36}$       B.  $\frac{1}{6}$   
C.  $\frac{5}{6}$       D.  $\frac{1}{3}$

gate2023-ee quantitative-aptitude probability

Answer key

#### 9.49.15 Probability: GATE Mechanical 2024 | GA Question: 5



Take two long dice (rectangular parallelepiped), each having four rectangular faces labelled as 2, 3, 5, and 7. If thrown, the long dice cannot land on the square faces and has  $1/4$  probability of landing on any of the four rectangular faces. The label on the top face of the dice is the score of the throw.

If thrown together, what is the probability of getting the sum of the two long dice scores greater than 11?

- A. 3/8      B. 1/8      C. 1/16      D. 3/16

gateme-2024 quantitative-aptitude probability

Answer key

#### 9.49.16 Probability: GATE2012 AE: GA-6



Two policemen, A and B, fire once each at the same time at an escaping convict. The probability that A hits the convict is three times the probability that B hits the convict. If the probability of the convict not getting injured is 0.5, the probability that B hits the convict is

- A. 0.14      B. 0.22      C. 0.33      D. 0.40

gate2012-ae quantitative-aptitude probability

[Answer key](#)

### 9.49.17 Probability: GATE2012 AR: GA-9



A smuggler has 10 capsules in which five are filled with narcotic drugs and the rest contain the original medicine. All the 10 capsules are mixed in a single box, from which the customs officials picked two capsules at random and tested for the presence of narcotic drugs. The probability that the smuggler will be caught is

- A. 0.50      B. 0.67      C. 0.78      D. 0.82

gate2012-ar quantitative-aptitude probability

[Answer key](#)

### 9.49.18 Probability: GATE2012 CY: GA-7



*A* and *B* are friends. They decide to meet between 1:00 pm and 2:00 pm on a given day. There is a condition that whoever arrives first will not wait for the other for more than 15 minutes. The probability that they will meet on that day is

- A. 1/4      B. 1/16      C. 7/16      D. 9/16

gate2012-cy quantitative-aptitude probability

[Answer key](#)

### 9.49.19 Probability: GATE2013 EE: GA-6



What is the chance that a leap year, selected at random, will contain 53 Saturdays?

- A. 2/7      B. 3/7      C. 1/7      D. 5/7

gate2013-ee quantitative-aptitude probability

[Answer key](#)

### 9.49.20 Probability: GATE2014 AG: GA-4



In any given year, the probability of an earthquake greater than Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is \_\_\_\_\_ years.

gate2014-ag quantitative-aptitude probability numerical-answers normal

[Answer key](#)

### 9.49.21 Probability: GATE2014 EC-2: GA-4



A regular die has six sides with numbers 1 to 6 marked on its sides. If a very large number of throws show the following frequencies of occurrence: 1 → 0.167; 2 → 0.167; 3 → 0.152; 4 → 0.166; 5 → 0.168; 6 → 0.180. We call this die:

- A. Irregular      B. Biased      C. Gaussian      D. Insufficient

gate2014-ec-2 quantitative-aptitude probability normal

[Answer key](#)

### 9.49.22 Probability: GATE2014 EC-3: GA-10



A batch of one hundred bulbs is inspected by testing four randomly chosen bulbs. The batch is rejected if even one of the bulbs is defective. A batch typically has five defective bulbs. The probability that the current batch is accepted is \_\_\_\_\_.

gate2014-ec-3 quantitative-aptitude probability numerical-answers normal

[Answer key](#)

### 9.49.23 Probability: GATE2015 CE-2: GA-5



Four cards are randomly selected from a pack of 52 cards. If the first two cards are kings, what is the probability that the third card is a king?

- A. 4/52      B. 2/50      C.  $(1/52) \times (1/52)$       D.  $(1/52) \times (1/51) \times (1/50)$

**Answer key****9.49.24 Probability: GATE2015 EC-2: GA- 5**

Ram and Ramesh appeared in an interview for two vacancies in the same department. The probability of Ram's selection is  $1/6$  and that of Ramesh is  $1/8$ . What is the probability that only one of them will be selected?

- A.  $47/48$       B.  $1/4$       C.  $13/48$       D.  $35/48$

**Answer key****9.49.25 Probability: GATE2016 EC-1: GA-6**

A person moving through a tuberculosis prone zone has a 50% probability of becoming infected. However, only 30% of infected people develop the disease. What percentage of people moving through a tuberculosis prone zone remains infected but does not show symptoms of disease?

- A. 15      B. 33      C. 35      D. 37

**Answer key****9.49.26 Probability: GATE2017 CE-2: GA-5**

Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the top faces of the dice is a perfect square is

- A.  $\frac{1}{9}$       B.  $\frac{2}{9}$       C.  $\frac{1}{3}$       D.  $\frac{4}{9}$

**Answer key****9.49.27 Probability: GATE2017 ME-2: GA-4**

A couple has 2 children. The probability that both children are boys if the older one is a boy is

- A.  $1/4$       B.  $1/3$       C.  $1/2$       D. 1

**Answer key****9.49.28 Probability: GATE2018 EE: GA-8**

A class of twelve children has two more boys than girls. A group of three children are randomly picked from this class to accompany the teacher on a field trip. What is the probability that the group accompanying the teacher contains more girls than boys?

- A. 0      B.  $\frac{325}{864}$       C.  $\frac{525}{864}$       D.  $\frac{5}{12}$

**Answer key****9.49.29 Probability: GATE2018 ME-2: GA-10**

An unbiased coin is tossed six times in a row and four different such trials are conducted. One trial implies six tosses of the coin. If H stands for head and T stands for tail, the following are the observations from the four trials.

1. HTHTHT
2. TTHHHT
3. HTTHHT
4. HHHT\_\_

Which statement describing the last two coin tosses of the fourth trial has the highest probability of being correct?

- A. Two T will occur.  
B. One H and one T will occur.  
C. Two H will occur.  
D. One H will be followed by one T.

**Answer key****9.50****Probability Density Function (1)****9.50.1 Probability Density Function: GATE Electrical 2021 | GA Question: 8**

Let  $X$  be a continuous random variable denoting the temperature measured. The range of temperature is  $[0, 100]$  degree Celsius and let the probability density function of  $X$  be  $f(x) = 0.01$  for  $0 \leq X \leq 100$ .

The mean of  $X$  is \_\_\_\_\_

- A. 2.5      B. 5.0      C. 25.0      D. 50.0

**Answer key****9.51****Profit Loss (6)****9.51.1 Profit Loss: GATE CSE 2021 Set 1 | GA Question: 7**

<b>Items</b>	<b>Cost ₹)</b>	<b>Profit %</b>	<b>Marked Price ₹)</b>
$P$	5,400	---	5,860
$Q$	---	25	10,000

Details of prices of two items  $P$  and  $Q$  are presented in the above table. The ratio of cost of item  $P$  to cost of item  $Q$  is 3 : 4. Discount is calculated as the difference between the marked price and the selling price. The profit percentage is calculated as the ratio of the difference between selling price and cost, to the cost

$$(\text{Profit \%}) = \frac{\text{Selling price} - \text{Cost}}{\text{Cost}} \times 100$$

The discount on item  $Q$ , as a percentage of its marked price, is \_\_\_\_\_

- A. 25      B. 12.5      C. 10      D. 5

**Answer key****9.51.2 Profit Loss: GATE CSE 2024 | Set 2 | GA Question: 7**

A person sold two different items at the same price. He made 10% profit in one item, and 10% loss in the other item. In selling these two items, the person made a total of

- A. 1% profit      B. 2% profit      C. 1% loss      D. 2% loss

**Answer key****9.51.3 Profit Loss: GATE Civil 2022 Set 1 | GA Question: 7**

$P$  invested ₹5000 per month for 6 months of a year and  $Q$  invested ₹ $x$  per month for 8 months of the year in a partnership business. The profit is shared in proportion to the total investment made in that year.

If at the end of that investment year,  $Q$  receives  $\frac{4}{9}$  of the total profit, what is the value of  $x$  (in ₹)?

- A. 2500      B. 3000      C. 4687      D. 8437

**Answer key****9.51.4 Profit Loss: GATE2013 CE: GA-9**

A firm is selling its product at Rs. 60 per unit. The total cost of production is Rs. 100 and firm is earning total profit of Rs. 500. Later, the total cost increased by 30%. By what percentage the price should be increased to

maintained the same profit level.

- A. 5      B. 10      C. 15      D. 30

quantitative-apitude gate2013-ce profit-loss

[Answer key](#)



#### 9.51.5 Profit Loss: GATE2018 CE-1: GA-6

A fruit seller sold a basket of fruits at 12.5% loss. Had he sold it for Rs. 108 more, he would have made a 10% gain. What is the loss in Rupees incurred by the fruit seller?

- A. 48      B. 52      C. 60      D. 108

gate2018-ce-1 general-apitude quantitative-apitude profit-loss

[Answer key](#)



#### 9.51.6 Profit Loss: GATE2019 ME-1: GA-7

A person divided an amount of Rs. 100,000 into two parts and invested in two different schemes. In one he got 10% profit and in the other he got 12%. If the profit percentages are interchanged with these investments he would have got Rs. 120 less. Find the ratio between his investments in the two schemes.

- A. 9 : 16      B. 11 : 14      C. 37 : 63      D. 47 : 53

gate2019-me-1 general-apitude quantitative-apitude ratio-proportion profit-loss

[Answer key](#)

### 9.52

#### Quadratic Equations (11)



##### 9.52.1 Quadratic Equations: GATE CSE 2014 Set 1 | Question: GA-5

The roots of  $ax^2 + bx + c = 0$  are real and positive.  $a, b$  and  $c$  are real. Then  $ax^2 + b|x| + c = 0$  has

- A. no roots      B. 2 real roots      C. 3 real roots      D. 4 real roots

gatecse-2014-set1 quantitative-apitude quadratic-equations normal

[Answer key](#)



##### 9.52.2 Quadratic Equations: GATE CSE 2016 Set 2 | Question: GA-05

In a quadratic function, the value of the product of the roots ( $\alpha, \beta$ ) is 4. Find the value of

$$\frac{\alpha^n + \beta^n}{\alpha^{-n} + \beta^{-n}}$$

- A.  $n^4$       B.  $4^n$       C.  $2^{2n-1}$       D.  $4^{n-1}$

gatecse-2016-set2 quantitative-apitude quadratic-equations normal

[Answer key](#)



##### 9.52.3 Quadratic Equations: GATE CSE 2021 Set 2 | GA Question: 4

If  $\left(x - \frac{1}{2}\right)^2 - \left(x - \frac{3}{2}\right)^2 = x + 2$ , then the value of  $x$  is:

- A. 2      B. 4      C. 6      D. 8

gatecse-2021-set2 quantitative-apitude quadratic-equations one-mark

[Answer key](#)



##### 9.52.4 Quadratic Equations: GATE CSE 2022 | GA Question: 3

Let  $r$  be a root of the equation  $x^2 + 2x + 6 = 0$ .

Then the value of the expression  $(r+2)(r+3)(r+4)(r+5)$  is

- A. 51      B. -51      C. 126      D. -126



**Answer key****9.52.5 Quadratic Equations: GATE ECE 2020 | GA Question: 9**

$a, b, c$  are real numbers. The quadratic equation  $ax^2 - bx + c = 0$  has equal roots, which is  $\beta$ , then

- A.  $\beta = b/a$
- B.  $\beta^2 = ac$
- C.  $\beta^3 = bc/(2a^2)$
- D.  $\beta^2 \neq 4ac$

**Answer key****9.52.6 Quadratic Equations: GATE2011 MN: GA-62**

A student attempted to solve a quadratic equation in  $x$  twice. However, in the first attempt, he incorrectly wrote the constant term and ended up with the roots as  $(4, 3)$ . In the second attempt, he incorrectly wrote down the coefficient of  $x$  and got the roots as  $(3, 2)$ . Based on the above information, the roots of the correct quadratic equation are

- A.  $(-3, 4)$
- B.  $(3, -4)$
- C.  $(6, 1)$
- D.  $(4, 2)$

**Answer key****9.52.7 Quadratic Equations: GATE2013 EE: GA-8**

The set of values of  $p$  for which the roots of the equation  $3x^2 + 2x + p(p-1) = 0$  are of opposite sign is

- A.  $(-\infty, 0)$
- B.  $(0, 1)$
- C.  $(1, \infty)$
- D.  $(0, \infty)$

**Answer key****9.52.8 Quadratic Equations: GATE2015 EC-2: GA-9**

if  $a^2 + b^2 + c^2 = 1$  then  $ab + bc + ac$  lies in the interval

- A.  $[1, 2/3]$
- B.  $[-1/2, 1]$
- C.  $[-1, 1/2]$
- D.  $[2, -4]$

**Answer key****9.52.9 Quadratic Equations: GATE2016 EC-2: GA-4**

Given  $(9 \text{ inches})^{\frac{1}{2}} = (0.25 \text{ yards})^{\frac{1}{2}}$ , which one of the following statements is TRUE?

- A.  $3 \text{ inches} = 0.5 \text{ yards}$
- B.  $9 \text{ inches} = 1.5 \text{ yards}$
- C.  $9 \text{ inches} = 0.25 \text{ yards}$
- D.  $81 \text{ inches} = 0.0625 \text{ yards}$

**Answer key****9.52.10 Quadratic Equations: GATE2018 EE: GA-4**

For what values of  $k$  given below is  $\frac{(k+2)^2}{(k-3)}$  an integer?

- A. 4, 8, 18
- B. 4, 10, 16
- C. 4, 8, 28
- D. 8, 26, 28

**Answer key****9.52.11 Quadratic Equations: GATE2018 ME-1: GA-7**

Given that  $a$  and  $b$  are integers and  $a + a^2b^3$  is odd, which of the following statements is correct?

- A.  $a$  and  $b$  are both odd  
C.  $a$  is even and  $b$  is odd

- B.  $a$  and  $b$  are both even  
D.  $a$  is odd and  $b$  is even

gate2018-me-1 general-aptitude quantitative-aptitude quadratic-equations system-of-equations

[Answer key](#)

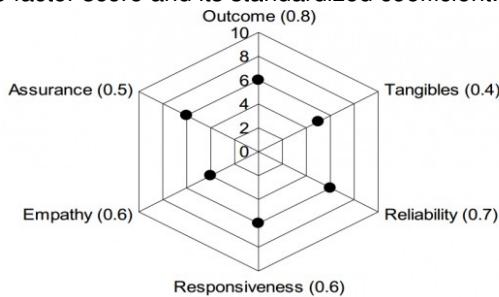
9.53

### Radar Chart (1)

#### 9.53.1 Radar Chart: GATE2011 GG: GA-9



The quality of services delivered by a company consists of six factors as shown below in the radar diagram. The dots in the figure indicate the score for each factor on a scale of 0 to 10. The standardized coefficient for each factor is given in the parentheses. The contribution of each factor to the overall service quality is directly proportional to the factor score and its standardized coefficient.



The lowest contribution among all the above factors to the overall quality of services delivered by the company is

- A. 10%      B. 20%      C. 24%      D. 40%

gate2011-gg difficult quantitative-aptitude data-interpretation radar-chart

[Answer key](#)

9.54

### Ratio Proportion (26)

#### 9.54.1 Ratio Proportion: GATE 2024 Electrical | GA Question: 5



If, for non-zero real variables  $x, y$ , and real parameter  $a > 1$ ,

$$x : y = (a+1) : (a-1),$$

then, the ratio  $(x^2 - y^2) : (x^2 + y^2)$  is

- A.  $2a : (a^2 + 1)$       B.  $a : (a^2 + 1)$       C.  $2a : (a^2 - 1)$       D.  $a : (a^2 - 1)$

gate2024-ee quantitative-aptitude ratio-proportion

[Answer key](#)

#### 9.54.2 Ratio Proportion: GATE CSE 2016 Set 1 | Question: GA10



In a process, the number of cycles to failure decreases exponentially with an increase in load. At a load of 80 units, it takes 100 cycles for failure. When the load is halved, it takes 10000 cycles for failure. The load for which the failure will happen in 5000 cycles is \_\_\_\_\_.

- A. 40.00      B. 46.02      C. 60.01      D. 92.02

gatecse-2016-set1 quantitative-aptitude ratio-proportion normal

[Answer key](#)

#### 9.54.3 Ratio Proportion: GATE CSE 2018 | Question: GA-8



In a party, 60% of the invited guests are male and 40% are female. If 80% of the invited guests attended the party and if all the invited female guests attended, what would be the ratio of males to females among the attendees in the party?

- A. 2:3      B. 1:1      C. 3:2      D. 2:1

**Answer key****9.54.4 Ratio Proportion: GATE CSE 2021 Set 1 | GA Question: 1**

The ratio of boys to girls in a class is 7 to 3.

Among the options below, an acceptable value for the total number of students in the class is:

- A. 21      B. 37      C. 50      D. 73

**Answer key****9.54.5 Ratio Proportion: GATE CSE 2021 Set 2 | GA Question: 8**

The number of students in three classes is in the ratio 3 : 13 : 6. If 18 students are added to each class, the ratio changes to 15 : 35 : 21.

The total number of students in all the three classes in the beginning was:

- A. 22      B. 66      C. 88      D. 110

**Answer key****9.54.6 Ratio Proportion: GATE CSE 2024 | Set 1 | GA Question: 2**If two distinct non-zero real variables  $x$  and  $y$  are such that  $(x + y)$  is proportional to  $(x - y)$  then the value of  $\frac{x}{y}$ 

- |   |   |
|---|---|
| A. depends on $xy$<br>C. depends only on $y$ and not on $x$ | B. depends only on $x$ and not on $y$<br>D. is a constant |
|---|---|

**Answer key****9.54.7 Ratio Proportion: GATE Civil 2020 Set 2 | GA Question: 8**

The ratio of 'the sum of the odd positive integers from 1 to 100' to 'the sum of the even positive integers from 150 to 200' is \_\_\_\_\_.

- A. 45 : 95      B. 1 : 2      C. 50 : 91      D. 1 : 1

**Answer key****9.54.8 Ratio Proportion: GATE Civil 2022 Set 1 | GA Question: 3**

If

$$p : q = 1 : 2$$

$$q : r = 4 : 3$$

$$r : s = 4 : 5$$

and  $u$  is 50% more than  $s$ , what is the ratio  $p : u$ ?

- A. 2 : 15      B. 16 : 15      C. 1 : 5      D. 16 : 45

**Answer key****9.54.9 Ratio Proportion: GATE Civil 2022 Set 2 | GA Question: 2**

$$x : y : z = \frac{1}{2} : \frac{1}{3} : \frac{1}{4}.$$

What is the value of  $\frac{x+z-y}{y}$ ?

- A. 0.75      B. 1.25      C. 2.25      D. 3.25

[Answer key](#)

#### 9.54.10 Ratio Proportion: GATE Civil 2022 Set 2 | GA Question: 7



In a partnership business, the monthly investment by three friends for the first six months is in the ratio  $3 : 4 : 5$ . After six months, they had to increase their monthly investments by  $10\%$ ,  $15\%$ , and  $20\%$ , respectively, of their initial monthly investment. The new investment ratio was kept constant for the next six months.

What is the ratio of their shares in the total profit (in the same order) at the end of the year such that the share is proportional to their individual total investment over the year?

- A.  $22 : 23 : 24$       B.  $22 : 33 : 50$       C.  $33 : 46 : 60$       D.  $63 : 86 : 110$

gatecivil-2022-set2 quantitative-aptitude ratio-proportion

[Answer key](#)

#### 9.54.11 Ratio Proportion: GATE Civil 2024 Set 2 | GA Question: 5



The ratio of the number of girls to boys in class VIII is the same as the ratio of the number of boys to girls in class IX. The total number of students (boys and girls) in classes VIII and IX is 450 and 360, respectively. If the number of girls in classes VIII and IX is the same, then the number of girls in each class is

- A. 150      B. 200      C. 250      D. 175

gatecivil-2024-set2 quantitative-aptitude ratio-proportion

[Answer key](#)

#### 9.54.12 Ratio Proportion: GATE ECE 2022 | GA Question: 2



A sum of money is to be distributed among P, Q, R, and S in the proportion  $5 : 2 : 4 : 3$ , respectively.

If R gets ₹ 1000 more than S, what is the share of Q (in ₹)?

- A. 500      B. 1000      C. 1500      D. 2000

gateece-2022 quantitative-aptitude ratio-proportion

[Answer key](#)

#### 9.54.13 Ratio Proportion: GATE ECE 2024 | GA Question: 3



Five years ago, the ratio of Aman's age to his father's age was  $1 : 4$ , and five years from now, the ratio will be  $2 : 5$ . What was his father's age when Aman was born?

- A. 28 years      B. 30 years      C. 35 years      D. 32 years

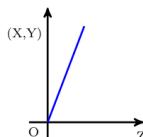
gateece-2024 quantitative-aptitude ratio-proportion

[Answer key](#)

#### 9.54.14 Ratio Proportion: GATE Mechanical 2020 Set 2 | GA Question: 9



An engineer measures THREE quantities,  $X$ ,  $Y$  and  $Z$  in an experiment. She finds that they follow a relationship that is represented in the figure below: (the product of  $X$  and  $Y$  linearly varies with  $Z$ )



Then, which of the following statements is FALSE?

- A. For fixed  $Z$ ;  $X$  is proportional to  $Y$   
 C. For fixed  $X$ ;  $Z$  is proportional to  $Y$
- B. For fixed  $Y$ ;  $X$  is proportional to  $Z$   
 D.  $XY/Z$  is constant

gateme-2020-set2 quantitative-aptitude ratio-proportion

[Answer key](#)

#### 9.54.15 Ratio Proportion: GATE Mechanical 2021 Set 1 | GA Question: 8



The number of hens, ducks and goats in farm  $P$  are 65, 91 and 169, respectively. The total number of hens, ducks

and goats in a nearby farm  $Q$  is 416. The ratio of hens : ducks : goats in farm  $Q$  is 5 : 14 : 13. All the hens, ducks and goats are sent from farm  $Q$  to farm  $P$ .

The new ratio of hens : ducks : goats in farm  $P$  is \_\_\_\_\_

- A. 5 : 7 : 13      B. 5 : 14 : 13      C. 10 : 21 : 26      D. 21 : 10 : 26

gateme-2021-set1 quantitative-aptitude ratio-proportion

Answer key 



#### 9.54.16 Ratio Proportion: GATE Mechanical 2024 | GA Question: 4

The real variables  $x, y, z$ , and the real constants  $p, q, r$  satisfy

$$\frac{x}{pq - r^2} = \frac{y}{qr - p^2} = \frac{z}{rp - q^2}$$

Given that the denominators are non-zero, the value of  $px + qy + rz$  is

- A. 0      B. 1      C.  $pqr$       D.  $p^2 + q^2 + r^2$

gateme-2024 quantitative-aptitude ratio-proportion

Answer key 



#### 9.54.17 Ratio Proportion: GATE2011 AG: GA-8

Three friends,  $R, S$  and  $T$  shared toffee from a bowl.  $R$  took  $\frac{1}{3}$ <sup>rd</sup> of the toffees, but returned four to the bowl.  $S$  took  $\frac{1}{4}$ <sup>th</sup> of what was left but returned three toffees to the bowl.  $T$  took half of the remainder but returned two back into the bowl. If the bowl had 17 toffees left, how many toffees were originally there in the bowl?

- A. 38      B. 31      C. 48      D. 41

general-aptitude quantitative-aptitude gate2011-ag ratio-proportion

Answer key 



#### 9.54.18 Ratio Proportion: GATE2011 GG: GA-4

If  $m$  students require a total of  $m$  pages of stationery in  $m$  days, then 100 students will require 100 pages of stationery in

- A. 100 days      B.  $m/100$  days      C.  $100/m$  days      D.  $m$  days

gate2011-gg quantitative-aptitude ratio-proportion

Answer key 



#### 9.54.19 Ratio Proportion: GATE2013 AE: GA-1

If  $3 \leq X \leq 5$  and  $8 \leq Y \leq 11$  then which of the following options is TRUE?

- A.  $\left( \frac{3}{5} \leq \frac{X}{Y} \leq \frac{8}{5} \right)$       B.  $\left( \frac{3}{11} \leq \frac{X}{Y} \leq \frac{5}{8} \right)$   
C.  $\left( \frac{3}{11} \leq \frac{X}{Y} \leq \frac{8}{5} \right)$       D.  $\left( \frac{3}{5} \leq \frac{X}{Y} \leq \frac{8}{11} \right)$

gate2013-ae quantitative-aptitude ratio-proportion normal

Answer key 



#### 9.54.20 Ratio Proportion: GATE2014 AE: GA-8

The smallest angle of a triangle is equal to two thirds of the smallest angle of a quadrilateral. The ratio between the angles of the quadrilateral is 3 : 4 : 5 : 6. The largest angle of the triangle is twice its smallest angle. What is the sum, in degrees, of the second largest angle of the triangle and the largest angle of the quadrilateral?

gate2014-ae quantitative-aptitude ratio-proportion numerical-answers

Answer key 

### 9.54.21 Ratio Proportion: GATE2015 EC-1: GA-9

A cube of side 3 units is formed using a set of smaller cubes of side 1 unit. Find the proportion of the number of faces of the smaller cubes visible to those which are NOT visible.

- A. 1 : 4      B. 1 : 3      C. 1 : 2      D. 2 : 3

gate2015-ec-1 general-aptitude quantitative-aptitude geometry ratio-proportion

Answer key 



### 9.54.22 Ratio Proportion: GATE2017 CE-2: GA-4

What is the value of  $x$  when  $81 \times \left(\frac{16}{25}\right)^{x+2} \div \left(\frac{3}{5}\right)^{2x+4} = 144$ ?

- A. 1      B. -1  
C. -2      D. Can not be determined

gate2017-ce-2 ratio-proportion quantitative-aptitude



Answer key 

### 9.54.23 Ratio Proportion: GATE2018 CE-1: GA-7

The price of a wire made of a super alloy material is proportional to the square of its length. The price of  $10m$  length of the wire is Rs. 1600. What would be the total price (in Rs.) of two wires of length  $4m$  and  $6m$ ?

- A. 768      B. 832      C. 1440      D. 1600

gate2018-ce-1 general-aptitude quantitative-aptitude ratio-proportion

Answer key 



### 9.54.24 Ratio Proportion: GATE2018 CE-2: GA-6

In manufacturing industries, loss is usually taken to be proportional to the square of the deviation from a target. If the loss is Rs. 4900 for a deviation of 7 units, what would be the loss in Rupees for a deviation of 4 units from the target?

- A. 400      B. 1200      C. 1600      D. 2800

gate2018-ce-2 general-aptitude quantitative-aptitude ratio-proportion

Answer key 



### 9.54.25 Ratio Proportion: GATE2018 EC: GA-7

Two alloys  $A$  and  $B$  contain gold and copper in the ratios of  $2 : 3$  and  $3 : 7$  by mass, respectively. Equal masses of alloys  $A$  and  $B$  are melted to make an alloy  $C$ . The ratio of gold to copper in alloy  $C$  is \_\_\_\_\_.

- A. 5 : 10      B. 7 : 13      C. 6 : 11      D. 9 : 13

gate2018-ec general-aptitude quantitative-aptitude normal ratio-proportion

Answer key 



### 9.54.26 Ratio Proportion: GATE2019 EE: GA-7

The ratio of the number of boys and girls who participated in an examination is  $4 : 3$ . The total percentage of candidates who passed the examination is 80 and the percentage of girls who passed the exam is 90. The percentage of boys who passed is \_\_\_\_\_.

- A. 55.50      B. 72.50      C. 80.50      D. 90.00

gate2019-ee general-aptitude quantitative-aptitude ratio-proportion percentage

Answer key 



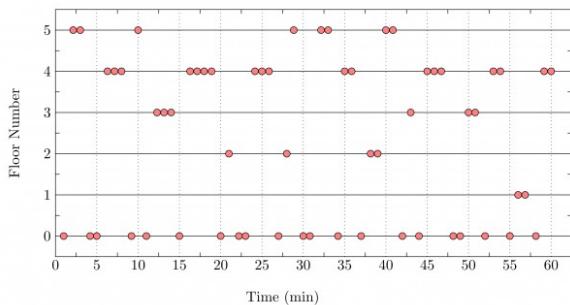
## 9.55

### Scatter Plot (1)

#### 9.55.1 Scatter Plot: GATE2017 CE-2: GA-10

The points in the graph below represent the halts of a lift for a durations of 1 minute, over a period of 1 hour.





Which of the following statements are correct?

- i. The elevator moves directly from any non-ground floor to another non-ground floor over the one hour period.
- ii. The elevator stays on the fourth floor for the longest duration over the one hour period.

- A. Only i      B. Only ii      C. Both i and ii      D. Neither i nor ii

gate2017-ce-2 data-interpretation scatter-plot

[Answer key](#)

## 9.56

## Seating Arrangement (4)

### 9.56.1 Seating Arrangement: GATE Civil 2021 Set 1 | GA Question: 5



Four persons P, Q, R and S are to be seated in a row, all facing the same direction, but not necessarily in the same order. P and R cannot sit adjacent to each other. S should be seated to the right of Q. The number of distinct seating arrangements possible is:

- A. 2      B. 4      C. 6      D. 8

gatecivil-2021-set1 quantitative-apitude permutation-and-combination seating-arrangement

[Answer key](#)



### 9.56.2 Seating Arrangement: GATE Civil 2021 Set 2 | GA Question: 5



Four persons P, Q, R and S are to be seated in a row. R should not be seated at the second position from the left end of the row. The number of distinct seating arrangements possible is:

- A. 6      B. 9      C. 18      D. 24

gatecivil-2021-set2 quantitative-apitude permutation-and-combination seating-arrangement

[Answer key](#)



### 9.56.3 Seating Arrangement: GATE Mechanical 2021 Set 1 | GA Question: 10



Five persons P, Q, R, S and T are sitting in a row not necessarily in the same order. Q and R are separated by one person, and S should not be seated adjacent to Q.

The number of distinct seating arrangements possible is:

- A. 4      B. 8      C. 10      D. 16

gateme-2021-set1 quantitative-apitude permutation-and-combination seating-arrangement

[Answer key](#)



### 9.56.4 Seating Arrangement: GATE Mechanical 2021 Set 2 | GA Question: 1



Five persons P, Q, R, S and T are to be seated in a row, all facing the same direction, but not necessarily in the same order. P and T cannot be seated at either end of the row. P should not be seated adjacent to S. R is to be seated at the second position from the left end of the row. The number of distinct seating arrangements possible is:

- A. 2      B. 3      C. 4      D. 5

gateme-2021-set2 quantitative-apitude permutation-and-combination seating-arrangement

[Answer key](#)

## 9.57

## Sequence Series (10)

### 9.57.1 Sequence Series: GATE CSE 2012 | Question: 65



Given the sequence of terms, AD CG FK JP, the next term is

- A. OV      B. OW      C. PV      D. PW

gatecse-2012 quantitative-apitude sequence-series easy

[Answer key](#)

### 9.57.2 Sequence Series: GATE CSE 2018 | Question: GA-5



What is the missing number in the following sequence?

$$2, 12, 60, 240, 720, 1440, \underline{\hspace{1cm}}, 0$$

- A. 2880      B. 1440      C. 720      D. 0

gatecse-2018 quantitative-apitude sequence-series easy one-mark

[Answer key](#)

### 9.57.3 Sequence Series: GATE CSE 2023 | GA Question: 3



A series of natural numbers  $F_1, F_2, F_3, F_4, F_5, F_6, F_7, \dots$  obeys  $F_{n+1} = F_n + F_{n-1}$  for all integers  $n \geq 2$ .

If  $F_6 = 37$ , and  $F_7 = 60$ , then what is  $F_1$ ?

- A. 4      B. 5      C. 8      D. 9

gatecse-2023 quantitative-apitude sequence-series one-mark

[Answer key](#)

### 9.57.4 Sequence Series: GATE DS&AI 2024 | GA Question: 4



The sum of the following infinite series is

$$2 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{8} + \frac{1}{9} + \frac{1}{16} + \frac{1}{27} + \dots$$

- A. 11/3      B. 7/2      C. 13/4      D. 9/2

gate-ds-ai-2024 quantitative-apitude sequence-series one-mark

[Answer key](#)

### 9.57.5 Sequence Series: GATE Mechanical 2024 | GA Question: 3



In the following series, identify the number that needs to be changed to form the Fibonacci series.

1, 1, 2, 3, 6, 8, 13, 21, ...

- A. 8      B. 21      C. 6      D. 13

gateme-2024 quantitative-apitude sequence-series

[Answer key](#)

### 9.57.6 Sequence Series: GATE2014 EC-4: GA-5



In a sequence of 12 consecutive odd numbers, the sum of the first 5 numbers is 425. What is the sum of the last 5 numbers in the sequence?

gate2014-ec-4 quantitative-apitude sequence-series normal numerical-answers

[Answer key](#)

### 9.57.7 Sequence Series: GATE2014 EC-4: GA-6



Find the next term in the sequence: 13M, 17Q, 19S, \_\_\_\_\_.

- A. 21W      B. 21V      C. 23W      D. 23V

gate2014-ec-4 quantitative-apitude sequence-series normal

[Answer key](#)

### 9.57.8 Sequence Series: GATE2016 ME-2: GA-8



Find the missing sequence in the letter series.  $B, FH, LNP, \underline{\hspace{2cm}}$ .

- A. SUWY      B. TUVW      C. TVXZ      D. TWXZ

gate2016-me-2 sequence-series quantitative-aptitude

[Answer key](#)

### 9.57.9 Sequence Series: GATE2019 EE: GA-3



The missing number in the given sequence  $343, 1331, \underline{\hspace{2cm}}, 4913$  is

- A. 3375      B. 2744      C. 2197      D. 4096

gate2019-ee general-aptitude quantitative-aptitude sequence-series

[Answer key](#)

### 9.57.10 Sequence Series: GATE2019 ME-2: GA-3



If IMHO=JNIP; IDK=JEL; and SO=TP, then IDC=\_\_\_\_\_

- A. JDE      B. JED      C. JDC      D. JCD

gate2019-me-2 general-aptitude quantitative-aptitude sequence-series easy

[Answer key](#)

**9.58**

**Set Theory (1)**

### 9.58.1 Set Theory: GATE Mechanical 2024 | GA Question: 7



How many combinations of non-null sets A, B, C are possible from the subsets of  $\{2, 3, 5\}$  satisfying the conditions: (i) A is a subset of B, and (ii) B is a subset of C?

- A. 28      B. 27      C. 18      D. 19

gateme-2024 quantitative-aptitude set-theory

[Answer key](#)

**9.59**

**Speed Time Distance (19)**

### 9.59.1 Speed Time Distance: GATE CSE 2013 | Question: 64



A tourist covers half of his journey by train at  $60 \text{ km/h}$ , half of the remainder by bus at  $30 \text{ km/h}$  and the rest by cycle at  $10 \text{ km/h}$ . The average speed of the tourist in  $\text{km/h}$  during his entire journey is

- A. 36      B. 30      C. 24      D. 18

gatecse-2013 quantitative-aptitude easy speed-time-distance

[Answer key](#)

### 9.59.2 Speed Time Distance: GATE CSE 2019 | Question: GA-3



Two cars start from the same location and go in the same direction. The speed of the first car is  $50 \text{ km/h}$  and the speed of the second car is  $60 \text{ km/h}$ . The number of hours it takes for the distance between the two cars to be  $20 \text{ km}$  is \_\_\_\_\_.

- A. 1      B. 2      C. 3      D. 6

gatecse-2019 general-aptitude quantitative-aptitude speed-time-distance one-mark

[Answer key](#)

### 9.59.3 Speed Time Distance: GATE Chemical 2020 | GA Question: 8



The distance between Delhi and Agra is  $233 \text{ km}$ . A car  $P$  started travelling from Delhi to Agra and another car  $Q$  started from Agra to Delhi along the same road 1 hour after the car  $P$  started. The two cars crossed each other  $75$  minutes after the car  $Q$  started. Both cars were travelling at constant speed. The speed of car  $P$  was  $10 \text{ km/hr}$  more than

the speed of car  $Q$ . How many kilometers the car  $Q$  had travelled when the cars crossed each other?

- A. 66.6      B. 75.2      C. 88.2      D. 116.5

gate2020-ch quantitative-apitude speed-time-distance

[Answer key](#)



#### 9.59.4 Speed Time Distance: GATE Civil 2023 Set 2 | GA Question: 10

Consider a spherical globe rotating about an axis passing through its poles. There are three points  $P, Q$ , and  $R$  situated respectively on the equator, the north pole, and midway between the equator and the north pole in the northern hemisphere. Let  $P, Q$ , and  $R$  move with speeds  $v_P, v_Q$ , and  $v_R$ , respectively.

Which one of the following options is CORRECT?

- A.  $v_P < v_R < v_Q$       B.  $v_P < v_Q < v_R$   
C.  $v_P > v_R > v_Q$       D.  $v_P = v_R \neq v_Q$

gatecivil-2023-set2 quantitative-apitude speed-time-distance

[Answer key](#)



#### 9.59.5 Speed Time Distance: GATE Electrical 2022 | GA Question: 2

In a 500 m race,  $P$  and  $Q$  have speeds in the ratio of 3 : 4.  $Q$  starts the race when  $P$  has already covered 140 m.

What is the distance between  $P$  and  $Q$  (in m) when  $P$  wins the race?

- A. 20      B. 40      C. 60      D. 140

gate2022-ee quantitative-apitude speed-time-distance

[Answer key](#)



#### 9.59.6 Speed Time Distance: GATE Mechanical 2022 Set 1 | GA Question: 3

A person travelled 80 km in 6 hours. If the person travelled the first part with a uniform speed of 10 kmph and the remaining part with a uniform speed of 18 kmph.

What percentage of the total distance is travelled at a uniform speed of 10 kmph?

- A. 28.25      B. 37.25      C. 43.75      D. 50.00

gateme-2022-set1 quantitative-apitude speed-time-distance

[Answer key](#)



#### 9.59.7 Speed Time Distance: GATE2013 AE: GA-6

Velocity of an object fired directly in upward direction is given by  $V = 80 - 32t$ , where  $t$  (time) is in seconds. When will the velocity be between 32 m/sec and 64 m/sec?

- A.  $\left(1, \frac{3}{2}\right)$   
B.  $\left(\frac{1}{2}, 1\right)$   
C.  $\left(\frac{1}{2}, \frac{3}{2}\right)$   
D.  $(1, 3)$

gate2013-ae quantitative-apitude speed-time-distance

[Answer key](#)



#### 9.59.8 Speed Time Distance: GATE2013 EE: GA-9

A car travels 8 km in the first quarter of an hour, 6 km in the second quarter and 16 km in the third quarter. The average speed of the car in km per hour over the entire journey is

- A. 30      B. 36      C. 40      D. 24

gate2013-ee speed-time-distance quantitative-apitude

[Answer key](#)



#### 9.59.9 Speed Time Distance: GATE2014 EC-1: GA-8

A train that is 280 metres long, travelling at a uniform speed, crosses a platform in 60 seconds and passes a man standing on the platform in 20 seconds. What is the length of the platform in metres?

**Answer key****9.59.10 Speed Time Distance: GATE2014 EC-2: GA-10**

It takes 30 minutes to empty a half-full tank by draining it at a constant rate. It is decided to simultaneously pump water into the half-full tank while draining it. What is the rate at which water has to be pumped in so that it gets fully filled in 10 minutes?

- A. 4 times the draining rate
- B. 3 times the draining rate
- C. 2.5 times the draining rate
- D. 2 times the draining rate

**Answer key****9.59.11 Speed Time Distance: GATE2014 EC-3: GA-8**

A man can row at 8 km per hour in still water. If it takes him thrice as long to row upstream, as to row downstream, then find the stream velocity in km per hour.

**Answer key****9.59.12 Speed Time Distance: GATE2015 EC-2: GA- 8**

A tiger is 50 leaps of its own behind a deer. The tiger takes 5 leaps per minute to the deer's 4. If the tiger and the deer cover 8 meter and 5 meter per leap respectively, what distance in meters will the tiger have to run before it catches the deer?

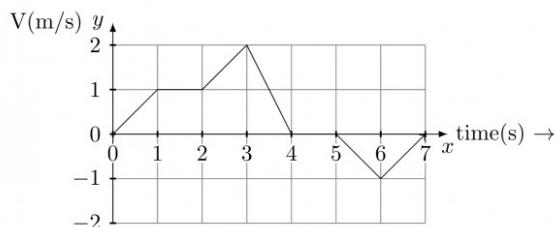
**Answer key****9.59.13 Speed Time Distance: GATE2016 EC-3: GA-5**

It takes 10 s and 15 s, respectively, for two trains travelling at different constant speeds to completely pass a telegraph post. The length of the first train is 120 m and that of the second train is 150 m. The magnitude of the difference in the speeds of the two trains (in  $m/s$ ) is \_\_\_\_\_.

- A. 2.0
- B. 10.0
- C. 12.0
- D. 22.0

**Answer key****9.59.14 Speed Time Distance: GATE2016 EC-3: GA-6**

The velocity  $V$  of a vehicle along a straight line is measured in  $m/s$  and plotted as shown with respect to time in seconds. At the end of the 7 seconds, how much will the odometer reading increase by (in m)?



- A. 0
- B. 3
- C. 4
- D. 5

**Answer key****9.59.15 Speed Time Distance: GATE2017 CE-2: GA-9**

Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walk is



A. 1

B. 4

C. 5

D. 6

gate2017-ce-2 speed-time-distance quantitative-apitude

Answer key



### 9.59.16 Speed Time Distance: GATE2017 EC-1: GA-8

Trucks (10 m long) and cars (5 m long) go on a single lane bridge. There must be a gap of at least 20 m after each truck and a gap of at least 15 m after each car. Trucks and cars travel at a speed of 36 km/h. If cars and trucks go alternately, what is the maximum number of vehicles that can use the bridge in one hour?

A. 1440

B. 1200

C. 720

D. 600

gate2017-ec-1 general-apitude quantitative-apitude speed-time-distance

Answer key



### 9.59.17 Speed Time Distance: GATE2018 CH: GA-6

An automobile travels from city  $A$  to city  $B$  and returns to city  $A$  by the same route. The speed of the vehicle during the onward and return journeys were constant at 60 km/h and 90 km/h, respectively. What is the average speed in km/h for the entire journey?

A. 72 km/h  
C. 74 km/h

B. 73 km/h  
D. 75 km/h

gate2018-ch general-apitude quantitative-apitude normal speed-time-distance

Answer key



### 9.59.18 Speed Time Distance: GATE2018 ME-1: GA-8

From the time the front of a train enters a platform, it takes 25 seconds for the back of the train to leave the platform, while traveling at a constant speed of 54 km/h. At the same speed, it takes 14 seconds to pass a man running at 9 km/h in the same direction as the train. What is the length of the train and that of the platform in meters, respectively?

A. 210 and 140      B. 162.5 and 187.5      C. 245 and 130      D. 175 and 200

gate2018-me-1 general-apitude quantitative-apitude speed-time-distance

Answer key



### 9.59.19 Speed Time Distance: GATE2019 IN: GA-9

Two trains started at 7AM from the same point. The first train travelled north at a speed of 80 km/h and the second train travelled south at a speed of 100 km/h. The time at which they were 540 km apart is \_\_\_\_\_ AM.

A. 9      B. 10      C. 11      D. 11.30

gate2019-in general-apitude quantitative-apitude speed-time-distance

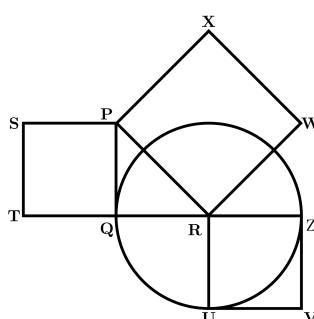
Answer key

## Squares (4)

### 9.60 Squares: GATE Civil 2022 Set 1 | GA Question: 5



In the following diagram, the point  $R$  is the center of the circle. The lines  $PQ$  and  $ZV$  are tangential to the circle. The relation among the areas of the squares,  $PXWR$ ,  $RU梓Z$  and  $SPQT$  is

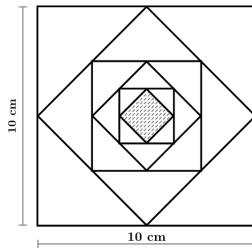


- A. Area of SPQT = Area of RUVZ – Area of PXWR  
 B. Area of SPQT = Area of PXWR – Area of RUVZ  
 C. Area of PXWR = Area of SPQT – Area of RUVZ  
 D. Area of PXWR = Area of RUVZ – Area of SPQT

gatecivil-2022-set1 quantitative-apitude geometry squares area

[Answer key](#)

#### 9.60.2 Squares: GATE Electrical 2021 | GA Question: 7



In the figure shown above, each inside square is formed by joining the midpoints of the sides of the next larger square. The area of the smallest square (shaded) as shown, in  $\text{cm}^2$  is:

- A. 12.50      B. 6.25      C. 3.125      D. 1.5625

gateee-2021 quantitative-apitude geometry squares area

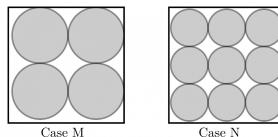
[Answer key](#)

#### 9.60.3 Squares: GATE Mechanical 2022 Set 2 | GA Question: 10



Equal sized circular regions are shaded in a square sheet of paper of 1 cm side length. Two cases, case M and case N, are considered as shown in the figures below. In the case M, four circles are shaded in the square sheet and in the case N, nine circles are shaded in the square sheet as shown.

What is the ratio of the areas of unshaded regions of case M to that of case N?



- A. 2 : 3      B. 1 : 1      C. 3 : 2      D. 2 : 1

gateme-2022-set2 quantitative-apitude geometry circle squares area

[Answer key](#)

#### 9.60.4 Squares: GATE2019 CE-1: GA-9



A square has side 5 cm smaller than the sides of a second square. The area of the larger square is four times the area of the smaller square. The side of the larger square is \_\_\_\_\_ cm.

- A. 18.50      B. 15.10      C. 10.00      D. 8.50

gate2019-ce-1 general-apitude quantitative-apitude geometry squares

[Answer key](#)

9.61

Statistics (9)

#### 9.61.1 Statistics: GATE CSE 2012 | Question: 64



Which of the following assertions are **CORRECT**?

- P: Adding 7 to each entry in a list adds 7 to the mean of the list

- Q: Adding 7 to each entry in a list adds 7 to the standard deviation of the list
- R: Doubling each entry in a list doubles the mean of the list
- S: Doubling each entry in a list leaves the standard deviation of the list unchanged

A. P, Q

B. Q, R

C. P, R

D. R, S

gatecse-2012 quantitative-aptitude statistics normal

[Answer key](#)



### 9.61.2 Statistics: GATE CSE 2024 | Set 1 | GA Question: 3

Consider the following sample of numbers:

9, 18, 11, 14, 15, 17, 10, 69, 11, 13

The median of the sample is

A. 13.5

B. 14

C. 11

D. 18.7

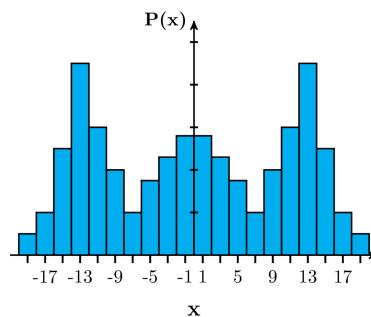
gatecse2024-set1 quantitative-aptitude statistics one-mark

[Answer key](#)



### 9.61.3 Statistics: GATE Civil 2023 Set 1 | GA Question: 7

Which one of the options can be inferred about the mean, median, and mode for the given probability distribution (i.e. probability mass function),  $P(x)$ , of a variable  $x$ ?



- A. mean = median  $\neq$  mode
- B. mean = median = mode
- C. mean  $\neq$  median = mode
- D. mean  $\neq$  mode = median

gatecivil-2023-set1 quantitative-aptitude statistics

[Answer key](#)



### 9.61.4 Statistics: GATE IN 2023 | GA Question: 4

Which one among the following statements must be TRUE about the mean and the median of the scores of all candidates appearing for GATE 2023?

- A. The median is at least as large as the mean.
- B. The mean is at least as large as the median.
- C. At most half the candidates have a score that is larger than the median
- D. At most half the candidates have a score that is larger than the mean.

gatein-2023 quantitative-aptitude statistics

[Answer key](#)



### 9.61.5 Statistics: GATE2012 AE: GA-5

The arithmetic mean of five different natural numbers is 12. The largest possible value among the numbers is

A. 12

B. 40

C. 50

D. 60

gate2012-ae statistics quantitative-aptitude

[Answer key](#)

### 9.61.6 Statistics: GATE2014 EC-1: GA-4



The statistics of runs scored in a series by four batsmen are provided in the following table. Who is the most consistent batsman of these four?

Batsman	Average	Standard deviation
K	31.2	5.21
L	46.0	6.35
M	54.4	6.22
N	17.9	5.90

- A. K      B. L      C. M      D. N

gate2014-ec-1 statistics quantitative-aptitude

[Answer key](#)

### 9.61.7 Statistics: GATE2016 ME-2: GA-6



Students taking an exam are divided into two groups, P and Q such that each group has the same number of students. The performance of each of the students in a test was evaluated out of 200 marks. It was observed that the mean of group P was 105, while that of group Q was 85. The standard deviation of group P was 25, while that of group Q was 5. Assuming that the marks were distributed on a normal distribution, which of the following statements will have the highest probability of being TRUE?

- A. No student in group Q scored less marks than any student in group P.  
 B. No student in group P scored less marks than any student in group Q.  
 C. Most students of group Q scored marks in a narrower range than students in group P.  
 D. The median of the marks of group P is 100.

gate2016-me-2 probability statistics

[Answer key](#)

### 9.61.8 Statistics: GATE2017 CE-1: GA-5



The following sequence of numbers is arranged in increasing order:  $1, x, x, x, y, y, 9, 16, 18$ . Given that the mean and median are equal, and are also equal to twice the mode, the value of y is

- A. 5      B. 6      C. 7      D. 8

gate2017-ce-1 general-aptitude quantitative-aptitude statistics

[Answer key](#)

### 9.61.9 Statistics: GATE2017 ME-1: GA-4



In a company with 100 employees, 45 earn *Rs.* 20,000 per month, 25 earn *Rs.* 30000, 20 earn *Rs.* 40000, 8 earn *Rs.* 60000, and 2 earn *Rs.* 150,000. The median of the salaries is

- A. *Rs.* 20,000      B. *Rs.* 30,000      C. *Rs.* 32,300      D. *Rs.* 40,000

gate2017-me-1 general-aptitude quantitative-aptitude statistics

[Answer key](#)

## 9.62

### System of Equations (1)



#### 9.62.1 System of Equations: GATE2011 GG: GA-6

The number of solutions for the following system of inequalities is

- $X_1 \geq 0$
- $X_2 \geq 0$
- $X_1 + X_2 \leq 10$
- $2X_1 + 2X_2 \geq 22$

A. 0

B. infinite

C. 1

D. 2

gate2011-gg quantitative-aptitude system-of-equations

Answer key 

9.63

Tables (1)



#### 9.63.1 Tables: GATE CSE 2025 | Set 2 | GA Question: 8

Which one of the following options is correct for the given data in the table?

Iteration ( $i$ )	0	1	2	3
Input ( $I$ )	20	-4	10	15
Output ( $X$ )	20	16	26	41
Output ( $Y$ )	20	-80	-800	-12000

- A.  $X(i) = X(i-1) + I(i); Y(i) = Y(i-1)I(i); i > 0$
- B.  $X(i) = X(i-1)I(i); Y(i) = Y(i-1) + I(i); i > 0$
- C.  $X(i) = X(i-1)I(i); Y(i) = Y(i-1)I(i); i > 0$
- D.  $X(i) = X(i-1) + I(i); Y(i) = Y(i-1)I(i-1); i > 0$

gatecse2025-set2 quantitative-aptitude tables two-marks

Answer key 

9.64

Tabular Data (10)



#### 9.64.1 Tabular Data: GATE CSE 2014 Set 1 | Question: GA-9

In a survey, 300 respondents were asked whether they own a vehicle or not. If yes, they were further asked to mention whether they own a car or scooter or both. Their responses are tabulated below. What percent of respondents do not own a scooter?

		Men	Women
Own vehicle	Car	40	34
Own vehicle	Scooter	30	20
Own vehicle	Both	60	46
Do not own vehicle		20	50

gatecse-2014-set1 quantitative-aptitude normal numerical-answers data-interpretation tabular-data

Answer key 



#### 9.64.2 Tabular Data: GATE CSE 2014 Set 3 | Question: GA-5

The table below has question-wise data on the performance of students in an examination. The marks for each question are also listed. There is no negative or partial marking in the examination.

Q No.	Marks	Answered Correctly	Answered Wrongly	Not Attempted
1	2	21	17	6
2	3	15	27	2
3	2	23	18	3

What is the average of the marks obtained by the class in the examination?

A. 1.34

B. 1.74

C. 3.02

D. 3.91

gatecse-2014-set3 quantitative-aptitude normal data-interpretation tabular-data

Answer key 

### 9.64.3 Tabular Data: GATE CSE 2015 Set 1 | Question: GA-6



The number of students in a class who have answered correctly, wrongly, or not attempted each question in an exam, are listed in the table below. The marks for each question are also listed. There is no negative or partial marking.

Q No.	Marks	Answered Correctly	Answered Wrongly	Not Attempted
1	2	21	17	6
2	3	15	27	2
3	1	11	29	4
4	2	23	18	3
5	5	31	12	1

What is the average of the marks obtained by the class in the examination?

- A. 2.290      B. 2.970      C. 6.795      D. 8.795

gatecse-2015-set1 quantitative-apitude easy data-interpretation tabular-data

[Answer key](#)

### 9.64.4 Tabular Data: GATE CSE 2016 Set 1 | Question: GA06



A shaving set company sells 4 different types of razors- Elegance, Smooth, Soft and Executive.

Elegance sells at Rs. 48, Smooth at Rs. 63, Soft at Rs. 78 and Executive at Rs. 173 per piece. The table below shows the numbers of each razor sold in each quarter of a year.

Quarter/Product	Elegance	Smooth	Soft	Executive
Q1	27300	20009	17602	9999
Q2	25222	19392	18445	8942
Q3	28976	22429	19544	10234
Q4	21012	18229	16595	10109

Which product contributes the greatest fraction to the revenue of the company in that year?

- A. Elegance      B. Executive      C. Smooth      D. Soft

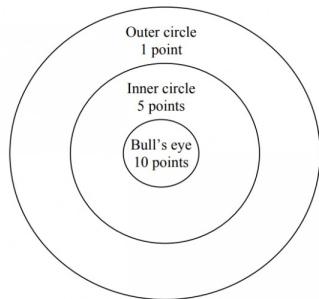
gatecse-2016-set1 quantitative-apitude data-interpretation easy tabular-data

[Answer key](#)

### 9.64.5 Tabular Data: GATE2011 MN: GA-64



Four archers P, Q, R, and S try to hit a bull's eye during a tournament consisting of seven rounds. As illustrated in the figure below, a player receives 10 points for hitting the bull's eye, 5 points for hitting within the inner circle and 1 point for hitting within the outer circle.



The final scores received by the players during the tournament are listed in the table below.

<b>Round</b>	<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>
<b>1</b>	1	5	1	10
<b>2</b>	5	10	10	1
<b>3</b>	1	1	1	5
<b>4</b>	10	10	1	1
<b>5</b>	1	5	5	10
<b>6</b>	10	5	1	1
<b>7</b>	5	10	1	1

The most accurate and the most consistent players during the tournament are respectively

- A. P and S      B. Q and R      C. Q and Q      D. R and Q

gate2011-mn    data-interpretation    quantitative-aptitude    tabular-data

[Answer key](#) 

#### 9.64.6 Tabular Data: GATE2013 AE: GA-7



Following table gives data on tourist from different countries visiting India in the year 2011

<b>Country</b>	<b>Number of tourists</b>
USA	2000
England	3500
Germany	1200
Italy	1100
Japan	2400
Australia	2300
France	1000

Which two countries contributed to the one third of the total number of tourists who visited India in 2011?

- A. USA and Japan      B. USA and Australia      C. England and France      D. Japan and Australia

gate2013-ae    quantitative-aptitude    data-interpretation    normal    tabular-data

[Answer key](#) 

#### 9.64.7 Tabular Data: GATE2013 CE: GA-8



Following table provides figures(in rupees) on annual expenditure of a firm for two years -2010 and 2011.

<b>Category</b>	<b>2010</b>	<b>2011</b>
Raw material	5200	6240
Power & fuel	7000	9450
Salary & wages	9000	12600
Plant & machinery	20000	25000
Advertising	15000	19500
Research & Development	22000	26400

In 2011, which of the two categories have registered increase by same percentage?

- A. Raw material and Salary & wages.  
 C. Power & fuel and Advertising.  
 B. Salary & wages and Advertising.  
 D. Raw material and research & Development.

quantitative-aptitude    gate2013-ce    data-interpretation    normal    tabular-data

[Answer key](#) 

#### 9.64.8 Tabular Data: GATE2015 CE-2: GA-9



Read the following table giving sales data of five types of batteries for years 2006 to 2012:

Year	Type I	Type II	Type III	Type IV	Type V
2006	75	144	114	102	108
2007	90	126	102	84	126
2008	96	114	75	105	135
2009	105	90	150	90	75
2010	90	75	135	75	90
2011	105	60	165	45	120
2012	115	85	160	100	145

Out of the following , which type of battery achieved highest growth between the years 2006 and 2012?

- A. Type V      B. Type III      C. Type II      D. Type I

gate2015-ce-2 general-aptitude quantitative-aptitude data-interpretation tabular-data

Answer key

#### 9.64.9 Tabular Data: GATE2015 EC-2: GA-4



An electric bus has onboard instruments that report the total electricity consumed since the start of the trip, as well as the total distance, covered. During a single day of operation, the bus travels on stretches M, N, O, and P, in that order. The cumulative distances travelled and the corresponding electricity consumption are shown in the Table below:

Stretch	Cumulative distance (km)	Electricity used (kWh)
M	20	12
N	45	25
O	75	45
P	100	57

The stretch where the electricity consumption per km is minimum is

- A. M      B. N      C. O      D. P

gate2015-ec-2 quantitative-aptitude data-interpretation tabular-data

Answer key

#### 9.64.10 Tabular Data: GATE2019 ME-2: GA-9



Mola is a digital platform for taxis in a city. It offers three types of rides – Pool, Mini and Prime. The table below presents the number of rides for the past four months. The platform earns one US dollar per ride. What is the percentage share of the revenue contributed by Prime to the total revenues of Mola, for the entire duration?

Type	Month			
	January	February	March	April
Pool	170	320	215	190
Mini	110	220	180	70
Prime	75	180	120	90

- A. 16.24      B. 23.97      C. 25.86      D. 38.74

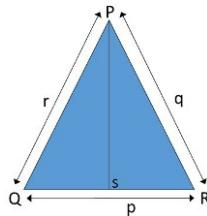
gate2019-me-2 general-aptitude quantitative-aptitude data-interpretation tabular-data

Answer key

### 9.65.1 Triangles: GATE CSE 2015 Set 2 | Question: GA-8



In a triangle  $PQR$ ,  $PS$  is the angle bisector of  $\angle QPR$  and  $\angle QPS = 60^\circ$ . What is the length of  $PS$ ?



- A.  $\left(\frac{(q+r)}{qr}\right)$   
B.  $\left(\frac{qr}{q+r}\right)$   
C.  $\sqrt{(q^2 + r^2)}$   
D.  $\left(\frac{(q+r)^2}{qr}\right)$

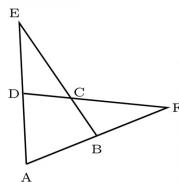
gatecse-2015-set2 quantitative-aptitude geometry difficult triangles

Answer key

### 9.65.2 Triangles: GATE CSE 2018 | Question: GA-9



In the figure below,  $\angle DEC + \angle BFC$  is equal to \_\_\_\_\_



- A.  $\angle BCD - \angle BAD$   
B.  $\angle BAD + \angle BCF$   
C.  $\angle BAD + \angle BCD$   
D.  $\angle CBA + \angle ADC$

gatecse-2018 quantitative-aptitude geometry normal triangles two-marks

Answer key

### 9.65.3 Triangles: GATE CSE 2022 | GA Question: 9



The corners and mid-points of the sides of a triangle are named using the distinct letters P, Q, R, S, T and U, but not necessarily in the same order. Consider the following statements:

- The line joining P and R is parallel to the line joining Q and S.
- P is placed on the side opposite to the corner T.
- S and U cannot be placed on the same side.

Which one of the following statements is correct based on the above information?

- A. P cannot be placed at a corner  
B. S cannot be placed at a corner  
C. U cannot be placed at a mid-point  
D. R cannot be placed at a corner

gatecse-2022 quantitative-aptitude geometry triangles two-marks

Answer key

### 9.65.4 Triangles: GATE Civil 2021 Set 2 | GA Question: 10



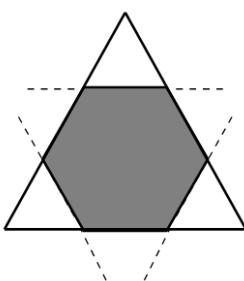
In an equilateral triangle PQR, side PQ is divided into four equal parts, side QR is divided into six equal parts and side PR is divided into eight equal parts. The length of each subdivided part in cm is an integer. The minimum area of the triangle PQR possible, in  $\text{cm}^2$ , is

- A. 18      B. 24      C.  $48\sqrt{3}$       D.  $144\sqrt{3}$

gatecivil-2021-set2 quantitative-aptitude geometry triangles

Answer key

### 9.65.5 Triangles: GATE ECE 2021 | GA Question: 10



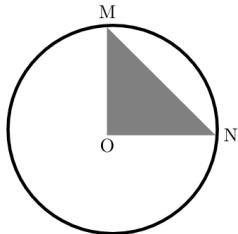
Corners are cut from an equilateral triangle to produce a regular convex hexagon as shown in the figure above. The ratio of the area of the regular convex hexagon to the area of the original equilateral triangle is

- A. 2 : 3      B. 3 : 4      C. 4 : 5      D. 5 : 6

gateec-2021 quantitative-aptitude geometry triangles area

Answer key

### 9.65.6 Triangles: GATE Mechanical 2021 Set 1 | GA Question: 3



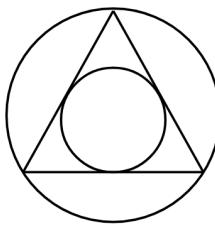
In the above figure, O is the center of the circle and, M and N lie on the circle. The area of the right triangle MON is  $50\text{ cm}^2$ . What is the area of the circle in  $\text{cm}^2$ ?

- A.  $2\pi$       B.  $50\pi$       C.  $75\pi$       D.  $100\pi$

gateme-2021-set1 quantitative-aptitude geometry triangles circle area

Answer key

### 9.65.7 Triangles: GATE Mechanical 2021 Set 2 | GA Question: 8



The ratio of the area of the inscribed circle to the area of the circumscribed circle of an equilateral triangle is

- A.  $\frac{1}{8}$   
B.  $\frac{1}{6}$   
C.  $\frac{1}{4}$   
D.  $\frac{1}{2}$

gateme-2021-set2 quantitative-aptitude geometry triangles

Answer key

### 9.65.8 Triangles: GATE Mechanical 2022 Set 1 | GA Question: 8



An equilateral triangle, a square and a circle have equal areas.

What is the ratio of the perimeters of the equilateral triangle to square to circle?

- A.  $3\sqrt{3} : 2 : \sqrt{\pi}$   
B.  $\sqrt{(3\sqrt{3})} : 2 : \sqrt{\pi}$   
C.  $\sqrt{(3\sqrt{3})} : 4 : 2\sqrt{\pi}$   
D.  $\sqrt{(3\sqrt{3})} : 2 : 2\sqrt{\pi}$

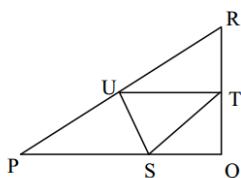
gateme-2022-set1 quantitative-apitude geometry triangles

Answer key

### 9.65.9 Triangles: GATE2015 ME-3: GA-8



In the given figure angle  $Q$  is a right angle,  $PS : QS = 3 : 1$ ,  $RT : QT = 5 : 2$  and  $PU : UR = 1 : 1$ . If area of triangle  $QTS$  is  $20\text{cm}^2$ , then the area of triangle  $PQR$  in  $\text{cm}^2$  is \_\_\_\_\_



gate2015-me-3 quantitative-apitude numerical-answers triangles

Answer key

### 9.65.10 Triangles: GATE2015 ME-3: GA-9



Right triangle  $PQR$  is to be constructed in the  $xy$ -plane so that the right angle is at  $P$  and line  $PR$  is parallel to the  $x$ -axis. The  $x$  and  $y$  coordinates of  $P, Q$ , and  $R$  are to be integers that satisfy the inequalities:  $-4 \leq x \leq 5$  and  $6 \leq y \leq 16$ . How many different triangles could be constructed with these properties?

- A. 110      B. 1,100      C. 9,900      D. 10,000

gate2015-me-3 quantitative-apitude triangles

Answer key

### 9.65.11 Triangles: GATE2018 CH: GA-4



The area of an equilateral triangle is  $\sqrt{3}$ . What is the perimeter of the triangle?

- A. 2      B. 4      C. 6      D. 8

gate2018-ch general-apitude quantitative-apitude easy geometry triangles

Answer key

## 9.66

### Trigonometry (1)

#### 9.66.1 Trigonometry: GATE2018 CH: GA-3



For  $0 \leq x \leq 2\pi$ ,  $\sin x$  and  $\cos x$  are both decreasing functions in the interval \_\_\_\_\_.

- A.  $(0, \frac{\pi}{2})$       B.  $(\frac{\pi}{2}, \pi)$       C.  $(\pi, \frac{3\pi}{2})$       D.  $(\frac{3\pi}{2}, 2\pi)$

gate2018-ch quantitative-apitude functions trigonometry

Answer key

## 9.67

### Unit Digit (2)

#### 9.67.1 Unit Digit: GATE Civil 2020 Set 1 | GA Question: 9



The unit's place in  $26591749^{110016}$  is \_\_\_\_\_.

- A. 1      B. 3      C. 6      D. 9

gate2020-ce-1 quantitative-apitude number-system unit-digit

Answer key

9.67.2 Unit Digit: GATE2017 CE-1: GA-8



The last digit of  $(2171)^7 + (2172)^9 + (2173)^{11} + (2174)^{13}$  is



gate2017-ce-1 modular-arithmetic quantitative-aptitude unit-digit

Answer key

9.68

## Venn Diagram (16)

9.68.1 Venn Diagram: GATE CSE 2010 | Question: 59



25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is:

- A. 2                      B. 17                      C. 13                      D. 3

gatcse-2010 quantitative-aptitude easy set-theory&algebra venn-diagrams

Answer key

9.68.2 Venn Diagram: GATE CSE 2016 Set 2 | Question: GA-06



Among 150 faculty members in an institute, 55 are connected with each other through Facebook and 85 are connected through Whatsapp. 30 faculty members do not have Facebook or Whatsapp accounts. The numbers of faculty members connected only through Facebook accounts is .

- A. 35                      B. 45                      C. 65                      D. 90

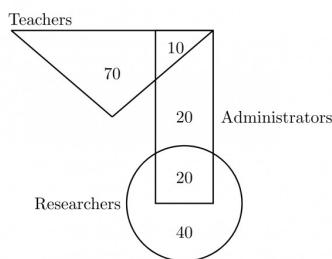
gatecse-2016-set2 quantitative-aptitude venn-diagram easw

Answer key

9.68.3 Venn Diagram: GATE CSE 2019 | Question: GA-7



In the given diagram, teachers are represented in the triangle, researchers in the circle and administrators in the rectangle. Out of the total number of the people, the percentage of administrators shall be in the range of






gatecse-2019 general-aptitude quantitative-aptitude venn-diagram two-marks

Answer key

9.68.4 Venn Diagram: GATE CSE 2019 | Question: GA-9



In a college, there are three student clubs, 60 students are only in the Drama club, 80 students are only in the Dance club, 30 students are only in Maths club, 40 students are in both Drama and Dance clubs, 12 students are in both Dance and Maths clubs, 7 students are in both Drama and Maths clubs, and 2 students are in all clubs. If 75% of the students in the college are not in any of these clubs, then the total number of students in the college is \_\_\_\_\_. 



qatecse-2019 general-aptitude quantitative-aptitude venn-diagram two-marks

Answer key

### 9.68.5 Venn Diagram: GATE CSE 2024 | Set 2 | GA Question: 3

In an engineering college of 10,000 students, 1,500 like neither their core branches nor other branches. The number of students who like their core branches is  $\frac{1}{4}$ th of the number of students who like other branches. The number of students who like both their core and other branches is 500.

The number of students who like their core branches is

- A. 1,800      B. 3,500      C. 1,600      D. 1,500

gatecse2024-set2 quantitative-apitude venn-diagram one-mark

[Answer key](#)



### 9.68.6 Venn Diagram: GATE Civil 2020 Set 2 | GA Question: 9

In a school of 1000 students, 300 students play chess and 600 students play football. If 50 students play both chess and football, the number of students who play neither is \_\_\_\_\_.

- A. 200      B. 150      C. 100      D. 50

gate2020-ce-2 quantitative-apitude venn-diagram

[Answer key](#)



### 9.68.7 Venn Diagram: GATE Civil 2021 Set 1 | GA Question: 3

In a company, 35% of the employees drink coffee, 40% of the employees drink tea and 10% of the employees drink both tea and coffee. What % of employees drink neither tea nor coffee?

- A. 15      B. 25      C. 35      D. 40

gatecivil-2021-set1 quantitative-apitude venn-diagram

[Answer key](#)



### 9.68.8 Venn Diagram: GATE Civil 2022 Set 2 | GA Question: 4

A survey of 450 students about their subjects of interest resulted in the following outcome.

- 150 students are interested in Mathematics.
- 200 students are interested in Physics.
- 175 students are interested in Chemistry.
- 50 students are interested in Mathematics and Physics.
- 60 students are interested in Physics and Chemistry.
- 40 students are interested in Mathematics and Chemistry.
- 30 students are interested in Mathematics, Physics, and Chemistry.
- Remaining students are interested in Humanities.

Based on the above information, the number of students interested in Humanities is

- A. 10      B. 30      C. 40      D. 45

gatecivil-2022-set2 quantitative-apitude venn-diagram

[Answer key](#)



### 9.68.9 Venn Diagram: GATE ECE 2023 | GA Question: 4

In a class of 100 students,

- i. there are 30 students who neither like romantic movies nor comedy movies,
- ii. the number of students who like romantic movies is twice the number of students who like comedy movies, and
- iii. the number of students who like both romantic movies and comedy movies is 20.

How many students in the class like romantic movies?

- A. 40      B. 20      C. 60      D. 30

gateece-2023 quantitative-apitude venn-diagram

[Answer key](#)



### 9.68.10 Venn Diagram: GATE2010 TF: GA-8



A gathering of 50 linguists discovered that 4 knew Kannada, Telugu and Tamil , 7 knew only Telugu and Tamil , 5 knew only Kannada and Tamil , 6 knew only Telugu and Kannada. If the number of linguists who knew Tamil is 24 and those who knew Kannada is also 24, how many linguists knew only Telugu?

- A. 9      B. 10      C. 11      D. 8

general-aptitude quantitative-aptitude gate2010-tf venn-diagram

[Answer key](#)

### 9.68.11 Venn Diagram: GATE2011 GG: GA-7



In a class of 300 students in an M.Tech programme, each student is required to take at least one subject from the following three:

- M600: Advanced Engineering Mathematics
- C600: Computational Methods for Engineers
- E600: Experimental Techniques for Engineers

The registration data for the M.Tech class shows that 100 students have taken M600, 200 students have taken C600, and 60 students have taken E600. What is the maximum possible number of students in the class who have taken all the above three subjects?

- A. 20      B. 30      C. 40      D. 50

gate2011-gg quantitative-aptitude set-theory&algebra venn-diagram

[Answer key](#)

### 9.68.12 Venn Diagram: GATE2015 CE-2: GA-10



There are 16 teachers who can teach Thermodynamics (TD), 11 who can teach Electrical Sciences (ES), and 5 who can teach both TD and Engineering Mechanics (EM). There are a total of 40 teachers. 6 cannot teach any of the three subjects, i.e. EM, ES or TD. 6 can teach only ES. 4 can teach all three subjects, i.e. EM, ES and TD. 4 can teach ES and TD. How many can teach both ES and EM but not TD?

- A. 1      B. 2      C. 3      D. 4

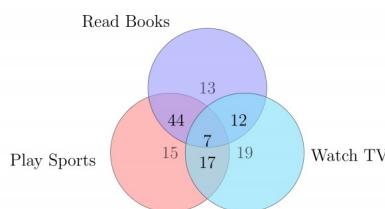
gate2015-ce-2 quantitative-aptitude venn-diagram

[Answer key](#)

### 9.68.13 Venn Diagram: GATE2016 EC-2: GA-6



The Venn diagram shows the preference of the student population for leisure activities.



From the data given, the number of students who like to read books or play sports is \_\_\_\_\_.

- A. 44      B. 51      C. 79      D. 108

gate2016-ec-2 venn-diagram

[Answer key](#)

### 9.68.14 Venn Diagram: GATE2017 EC-2: GA-5



500 students are taking one or more course out of Chemistry, Physics, and Mathematics. Registration records indicate course enrollment as follows: Chemistry (329), Physics (186), and Mathematics (295). Chemistry and Physics (83), Chemistry and Mathematics (217), and Physics and Mathematics (63). How many students are taking all 3 subjects?

- A. 37      B. 43      C. 47      D. 53

**Answer key****9.68.15 Venn Diagram: GATE2018 ME-2: GA-6**

Forty students watched films A, B and C over a week. Each student watched either only one film or all three. Thirteen students watched film A, sixteen students watched film B and nineteen students watched film C. How many students watched all three films?

- A. 0      B. 2      C. 4      D. 8

**Answer key****9.68.16 Venn Diagram: GATE2019 CE-1: GA-7**

In a sports academy of 300 peoples, 105 play only cricket, 70 play only hockey, 50 play only football, 25 play both cricket and hockey, 15 play both hockey and football and 30 play both cricket and football. The rest of them play all three sports. What is the percentage of people who play at least two sports?

- A. 23.30      B. 25.00      C. 28.00      D. 50.00

**Answer key****9.69****Volume (2)****9.69.1 Volume: GATE CH 2022 | GA Question: 2**

A sphere of radius  $r$  cm is packed in a box of cubical shape.

What should be the minimum volume (in  $\text{cm}^3$ ) of the box that can enclose the sphere?

- A.  $\frac{r^3}{8}$       B.  $r^3$       C.  $2r^3$       D.  $8r^3$

**Answer key****9.69.2 Volume: GATE CSE 2021 Set 1 | GA Question: 6**

We have 2 rectangular sheets of paper, M and N, of dimensions  $6 \text{ cm} \times 1 \text{ cm}$  each. Sheet M is rolled to form an open cylinder by bringing the short edges of the sheet together. Sheet N is cut into equal square patches and assembled to form the largest possible closed cube. Assuming the ends of the cylinder are closed, the ratio of the volume of the cylinder to that of the cube is \_\_\_\_\_.

- A.  $\frac{\pi}{2}$       B.  $\frac{3}{\pi}$       C.  $\frac{9}{\pi}$       D.  $3\pi$

**Answer key****9.70****Work Time (17)****9.70.1 Work Time: GATE CH 2022 | GA Question: 3**

Pipes P and Q can fill a storage tank in full with water in 10 and 6 minutes, respectively. Pipe R draws the water out from the storage tank at a rate of 34 litres per minute. P, Q and R operate at a constant rate.

If it takes one hour to completely empty a full storage tank with all the pipes operating simultaneously, what is the capacity of the storage tank (in litres)?

- A. 26.8      B. 60.0      C. 120.0      D. 127.5

**Answer key****9.70.2 Work Time: GATE CSE 2010 | Question: 64**

5 skilled workers can build a wall in 20 days; 8 semi-skilled workers can build a wall in 25 days; 10 unskilled workers can build a wall in 30 days. If a team has 2 skilled, 6 semi-skilled and 5 unskilled workers, how long it will

take to build the wall?

- A. 20 days      B. 18 days      C. 16 days      D. 15 days

gatecse-2010 quantitative-aptitude normal work-time

Answer key 

#### 9.70.3 Work Time: GATE CSE 2011 | Question: 64

A transporter receives the same number of orders each day. Currently, he has some pending orders (backlog) to be shipped. If he uses 7 trucks, then at the end of the 4<sup>th</sup> day he can clear all the orders. Alternatively, if he uses only 3 trucks, then all the orders are cleared at the end of the 10<sup>th</sup> day. What is the minimum number of trucks required so that there will be no pending order at the end of 5<sup>th</sup> day?

- A. 4      B. 5      C. 6      D. 7

gatecse-2011 quantitative-aptitude normal work-time

Answer key 

#### 9.70.4 Work Time: GATE CSE 2013 | Question: 65

The current erection cost of a structure is Rs. 13,200. If the labour wages per day increase by 1/5 of the current wages and the working hours decrease by 1/24 of the current period, then the new cost of erection in Rs. is

- A. 16,500      B. 15,180      C. 11,000      D. 10,120

gatecse-2013 quantitative-aptitude normal work-time

Answer key 

#### 9.70.5 Work Time: GATE Mechanical 2020 Set 2 | GA Question: 8

IT was estimated that 52 men can complete a strip in a newly constructed highway connecting cities *P* and *Q* in 10 days. Due to an emergency, 12 men were sent to another project. How many number of days, more than the original estimate, will be required to complete the strip?

- A. 3 days      B. 5 days      C. 10 days      D. 13 days

gateme-2020-set2 quantitative-aptitude work-time

Answer key 

#### 9.70.6 Work Time: GATE2016 CE-2: GA-10

Ananth takes 6 hours and Bharath takes 4 hours to read a book. Both started reading copies of the book at the same time. After how many hours is the number of pages to be read by Ananth, twice that to be read by Bharath? Assume Ananth and Bharath read all the pages with constant pace.

- A. 1      B. 2      C. 3      D. 4

gate2016-ce-2 work-time quantitative-aptitude

Answer key 

#### 9.70.7 Work Time: GATE2016 EC-1: GA-10

**P, Q, R and S** are working on a project. **Q** can finish the task in 25 days, working alone for 12 hours a day. **R** can finish the task in 50 days, working alone for 12 hours per day. **Q** worked 12 hours a day but took sick leave in the beginning for two days. **R** worked 18 hours a day on all days. What is the ratio of work done by **Q** and **R** after 7 days from the start of the project?

- A. 10 : 11      B. 11 : 10      C. 20 : 21      D. 21 : 20

gate2016-ec-1 quantitative-aptitude work-time

Answer key 

#### 9.70.8 Work Time: GATE2016 EC-2: GA-5

**S, M, E and F** are working in shifts in a team to finish a project. **M** works with twice the efficiency of others but for half as many days as **E** worked. **S** and **M** have 6 hour shifts in a day, whereas **E** and **F** have 12 hours shifts. What is the ratio of contribution of **M** to contribution of **E** in the project?

A. 1 : 1

B. 1 : 2

C. 1 : 4

D. 2 : 1

gate2016-ec-2 quantitative-apitude work-time

Answer key 

### 9.70.9 Work Time: GATE2017 CE-1: GA-9

Two machine  $M_1$  and  $M_2$  are able to execute any of four jobs  $P, Q, R$  and  $S$ . The machines can perform one job on one object at a time. Jobs  $P, Q, R$  and  $S$  take 30 minutes, 20 minutes, 60 minutes and 15 minutes each respectively. There are 10 objects each requiring exactly 1 job. Job  $P$  is to be performed on 2 objects. Job  $Q$  on 3 objects, Job  $R$  on 1 object and Job  $S$  on 4 objects. What is the minimum time needed to complete all the jobs?

A. 2 hours

B. 2.5 hours

C. 3 hours

D. 3.5 hours

gate2017-ce-1 general-apitude quantitative-apitude work-time

Answer key 

### 9.70.10 Work Time: GATE2017 EC-2: GA-8

1200 men and 500 women can build a bridge in 2 weeks. 900 men and 250 women will take 3 weeks to build the same bridge. How many men will be needed to build the bridge in one week?

A. 3000

B. 3300

C. 3600

D. 3900

gate2017-ec-2 general-apitude quantitative-apitude work-time

Answer key 

### 9.70.11 Work Time: GATE2017 ME-2: GA-7

$X$  bullocks and  $Y$  tractors take 8 days to plough a field. If we have half the number of bullocks and double the number of tractors, it takes 5 days to plough the same field. How many days will it take  $X$  bullocks alone to plough the field?

A. 30

B. 35

C. 40

D. 45

gate2017-me-2 general-apitude quantitative-apitude work-time

Answer key 

### 9.70.12 Work Time: GATE2018 ME-1: GA-3

Seven machines take 7 minutes to make 7 identical toys. At the same rate, how many minutes would it take for 100 machine to make 100 toys?

A. 1

B. 7

C. 100

D. 700

gate2018-me-1 general-apitude quantitative-apitude work-time

Answer key 

### 9.70.13 Work Time: GATE2018 ME-2: GA-8

A contract is to be completed in 52 days and 125 identical robots were employed, each operational for 7 hours a day. After 39 days, five-seventh of the work was completed. How many additional robots would be required to complete the work on time, if each robot is now operational for 8 hours a day?

A. 50

B. 89

C. 146

D. 175

gate2018-me-2 general-apitude quantitative-apitude work-time

Answer key 

### 9.70.14 Work Time: GATE2019 CE-2: GA-9

An oil tank can be filled by pipe  $X$  in 5 hours and pipe  $Y$  in 4 hours, each pump working on its own. When the oil tank is full and the drainage hole is open, the oil is drained in 20 hours. If initially the tank was empty and someone started the two pipes together but left the drainage hole open, how many hours will it take for the tank to be filled? (Assume that the rate of drainage is independent of the Head)

A. 1.50

B. 2.00

C. 2.50

D. 4.00

**Answer key****9.70.15 Work Time: GATE2019 EC: GA-3**

It would take one machine 4 hours to complete a production order and another machine 2 hours to complete the same order. If both machines work simultaneously at their respective constant rates, the time taken to complete the same order is \_\_\_\_\_ hours.

- A. 2/3      B. 3/4      C. 4/3      D. 7/3

**Answer key****9.70.16 Work Time: GATE2019 EE: GA-4**

It takes two hours for a person  $X$  to mow the lawn.  $Y$  can mow the same lawn in four hours. How long (in minutes) will it take  $X$  and  $Y$ , if they work together to mow the lawn?

- A. 60      B. 80      C. 90      D. 120

**Answer key****9.70.17 Work Time: GATE2019 ME-2: GA-7**

Two pipes  $P$  and  $Q$  can fill a tank in 6 hours and 9 hours respectively, while a third pipe  $R$  can empty the tank in 12 hours. Initially,  $P$  and  $R$  are open for 4 hours, Then  $P$  is closed and  $Q$  is opened. After 6 more hours  $R$  is closed. The total time taken to fill the tank (in hours) is \_\_\_\_\_

- A. 13.50      B. 14.50      C. 15.50      D. 16.50

**Answer key****Answer Keys**

9.0.1	B	9.0.2	A	9.1.1	D	9.1.2	B	9.1.3	A
9.1.4	D	9.1.5	B	9.1.6	B	9.1.7	B	9.2.1	D
9.3.1	B	9.3.2	D	9.3.3	B	9.3.4	A	9.3.5	B
9.3.6	B	9.4.1	A	9.4.2	D	9.4.3	B	9.5.1	A
9.5.2	A	9.6.1	C	9.6.2	B	9.6.3	B	9.6.4	C
9.6.5	A	9.6.6	A	9.6.7	D	9.6.8	C	9.6.9	C
9.7.1	C	9.7.2	A	9.7.3	C	9.8.1	C	9.8.2	2006
9.8.3	C	9.8.4	A	9.8.5	B	9.8.6	B	9.8.7	A
9.8.8	A	9.8.9	B	9.8.10	C	9.8.11	C	9.8.12	C
9.8.13	D	9.8.14	C	9.8.15	C	9.8.16	D	9.8.17	C
9.8.18	A	9.9.1	C	9.9.2	A	9.10.1	B	9.10.2	C
9.10.3	A	9.10.4	C	9.10.5	C	9.10.6	C	9.10.7	C
9.10.8	A	9.10.9	B	9.10.10	C	9.11.1	D	9.11.2	A
9.11.3	C	9.11.4	A	9.11.5	C	9.11.6	A	9.11.7	B
9.12.1	A	9.12.2	C	9.12.3	B	9.12.4	A	9.12.5	X
9.12.6	A	9.12.7	D	9.12.8	B	9.12.9	B	9.12.10	D
9.13.1	B	9.13.2	C	9.13.3	D	9.13.4	C	9.13.5	D
9.13.6	B	9.13.7	4536	9.13.8	B	9.13.9	C	9.13.10	C

9.13.11	D	9.13.12	B	9.14.1	B	9.14.2	C	9.14.3	D
9.14.4	A	9.14.5	B	9.15.1	B	9.15.2	B	9.15.3	C
9.15.4	0.4895 : 0.4897	9.15.5	B	9.15.6	B	9.16.1	A	9.17.1	C
9.17.2	C	9.17.3	C	9.17.4	B	9.18.1	C	9.18.2	A
9.18.3	A	9.18.4	C	9.18.5	B	9.18.6	1300	9.19.1	A
9.19.2	C	9.19.3	A	9.19.4	A	9.19.5	D	9.19.6	C
9.20.1	D	9.20.2	B	9.21.1	A	9.22.1	B	9.22.2	A
9.23.1	D	9.23.2	B	9.23.3	B	9.23.4	C	9.23.5	C
9.24.1	C	9.25.1	D	9.25.2	C	9.25.3	C	9.25.4	B
9.26.1	B	9.26.2	C	9.26.3	A	9.26.4	C	9.27.1	8
9.27.2	C	9.27.3	B	9.27.4	C	9.27.5	B	9.27.6	C
9.27.7	B	9.27.8	A	9.27.9	A	9.27.10	B	9.27.11	A
9.27.12	D	9.27.13	A	9.27.14	A	9.27.15	C	9.27.16	A
9.27.17	C	9.27.18	A	9.28.1	A	9.28.2	X	9.28.3	B
9.28.4	6	9.28.5	A	9.28.6	D	9.28.7	A	9.28.8	B
9.28.9	B	9.28.10	A	9.28.11	A	9.28.12	B	9.28.13	D
9.28.14	A	9.28.15	2.06	9.28.16	D	9.28.17	B	9.28.18	B
9.28.19	D	9.28.20	22.2 : 22.3	9.28.21	D	9.28.22	C	9.28.23	B
9.28.24	B	9.28.25	A	9.28.26	C	9.28.27	C	9.28.28	A
9.28.29	C	9.29.1	A	9.30.1	A	9.30.2	C	9.30.3	C
9.30.4	A	9.31.1	A	9.32.1	140	9.32.2	C	9.32.3	C
9.32.4	C	9.32.5	B	9.32.6	B	9.32.7	D	9.32.8	A
9.32.9	B	9.32.10	B	9.32.11	C	9.32.12	A	9.33.1	D
9.34.1	B	9.34.2	C	9.34.3	A	9.34.4	C	9.34.5	A
9.34.6	C	9.34.7	C	9.34.8	D	9.34.9	A	9.34.10	C
9.34.11	A	9.34.12	B	9.34.13	A	9.34.14	C	9.35.1	C
9.36.1	B	9.36.2	C	9.36.3	C	9.36.4	A	9.37.1	C
9.38.1	A	9.38.2	D	9.39.1	B	9.39.2	C	9.39.3	C
9.39.4	B	9.39.5	D	9.39.6	725	9.39.7	45	9.39.8	16
9.39.9	C	9.39.10	D	9.40.1	D	9.40.2	C	9.40.3	A
9.40.4	D	9.40.5	B	9.40.6	A	9.40.7	B	9.41.1	C
9.41.2	D	9.41.3	D	9.41.4	X	9.41.5	A	9.41.6	D
9.42.1	96	9.42.2	B	9.42.3	D	9.42.4	B	9.42.5	B
9.42.6	A	9.42.7	D	9.42.8	163	9.42.9	A	9.42.10	D
9.42.11	D	9.42.12	D	9.42.13	C	9.42.14	X	9.43.1	850
9.43.2	D	9.43.3	C	9.43.4	D	9.43.5	D	9.43.6	A
9.43.7	B	9.43.8	D	9.43.9	C	9.43.10	D	9.43.11	B
9.43.12	D	9.43.13	A	9.43.14	A	9.43.15	C	9.43.16	D
9.43.17	C	9.43.18	D	9.43.19	C	9.43.20	A	9.43.21	A
9.44.1	A	9.44.2	B	9.44.3	A	9.44.4	B	9.45.1	32
9.45.2	C	9.45.3	D	9.45.4	C	9.45.5	X	9.45.6	B
9.45.7	D	9.45.8	C	9.45.9	A	9.45.10	D	9.45.11	D

9.45.12	D	9.45.13	20000	9.45.14	22	9.45.15	B	9.45.16	C
9.46.1	A	9.46.2	B	9.46.3	C	9.46.4	D	9.47.1	C
9.48.1	B	9.49.1	D	9.49.2	D	9.49.3	A	9.49.4	C
9.49.5	D	9.49.6	C	9.49.7	C	9.49.8	D	9.49.9	A
9.49.10	D	9.49.11	A	9.49.12	C	9.49.13	A	9.49.14	A
9.49.15	D	9.49.16	A	9.49.17	C	9.49.18	C	9.49.19	A
9.49.20	25	9.49.21	B	9.49.22	0.81	9.49.23	B	9.49.24	B
9.49.25	C	9.49.26	B	9.49.27	C	9.49.28	X	9.49.29	B
9.50.1	D	9.51.1	C	9.51.2	C	9.51.3	B	9.51.4	A
9.51.5	C	9.51.6	D	9.52.1	D	9.52.2	B	9.52.3	B
9.52.4	D	9.52.5	C	9.52.6	C	9.52.7	B	9.52.8	B
9.52.9	C	9.52.10	C	9.52.11	D	9.53.1	A	9.54.1	A
9.54.2	B	9.54.3	B	9.54.4	C	9.54.5	C	9.54.6	D
9.54.7	C	9.54.8	D	9.54.9	B	9.54.10	D	9.54.11	B
9.54.12	D	9.54.13	B	9.54.14	A	9.54.15	C	9.54.16	A
9.54.17	C	9.54.18	D	9.54.19	B	9.54.20	180	9.54.21	C
9.54.22	B	9.54.23	B	9.54.24	C	9.54.25	B	9.54.26	B
9.55.1	D	9.56.1	C	9.56.2	C	9.56.3	D	9.56.4	B
9.57.1	A	9.57.2	B	9.57.3	A	9.57.4	B	9.57.5	C
9.57.6	495	9.57.7	C	9.57.8	C	9.57.9	C	9.57.10	B
9.58.1	X	9.59.1	C	9.59.2	B	9.59.3	B	9.59.4	C
9.59.5	A	9.59.6	C	9.59.7	C	9.59.8	C	9.59.9	560
9.59.10	A	9.59.11	4	9.59.12	800	9.59.13	A	9.59.14	D
9.59.15	D	9.59.16	A	9.59.17	A	9.59.18	D	9.59.19	B
9.60.1	B	9.60.2	C	9.60.3	B	9.60.4	C	9.61.1	C
9.61.2	A	9.61.3	A	9.61.4	C	9.61.5	C	9.61.6	A
9.61.7	C	9.61.8	D	9.61.9	B	9.62.1	A	9.63.1	A
9.64.1	48	9.64.2	C	9.64.3	C	9.64.4	B	9.64.5	B
9.64.6	C	9.64.7	D	9.64.8	D	9.64.9	D	9.64.10	B
9.65.1	B	9.65.2	A	9.65.3	B	9.65.4	D	9.65.5	A
9.65.6	D	9.65.7	C	9.65.8	B	9.65.9	280	9.65.10	C
9.65.11	C	9.66.1	B	9.67.1	A	9.67.2	B	9.68.1	D
9.68.2	A	9.68.3	C	9.68.4	C	9.68.5	A	9.68.6	B
9.68.7	C	9.68.8	D	9.68.9	C	9.68.10	C	9.68.11	B
9.68.12	A	9.68.13	D	9.68.14	D	9.68.15	C	9.68.16	B
9.69.1	D	9.69.2	C	9.70.1	C	9.70.2	D	9.70.3	C
9.70.4	B	9.70.5	A	9.70.6	C	9.70.7	C	9.70.8	B
9.70.9	A	9.70.10	C	9.70.11	A	9.70.12	B	9.70.13	X
9.70.14	C	9.70.15	C	9.70.16	B	9.70.17	B		



Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping, Paper folding, cutting, and patterns in 2 and 3 dimensions

**Mark Distribution in Previous GATE**

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
<b>1 Mark Count</b>	0	1	0	0	1	1	2	1	0	0.75	2
<b>2 Marks Count</b>	1	0	2	1	1	1	0	1	0	0.88	2
<b>Total Marks</b>	2	1	4	2	3	3	2	3	1	2.5	4

## 10.1

### Assembling Pieces (4)

#### 10.1.1 Assembling Pieces: GATE CH 2022 | GA Question: 10



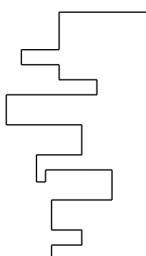
Which one of the following sets of pieces can be assembled to form a square with a single round hole near the center? Pieces cannot overlap.

- A.
- B.
- C.
- D.

gatech-2022 spatial-aptitude assembling-pieces

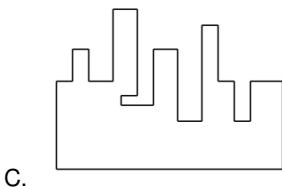
Answer key

#### 10.1.2 Assembling Pieces: GATE CSE 2021 Set 2 | GA Question: 7

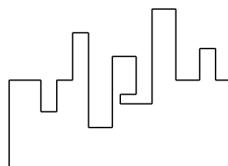


A jigsaw puzzle has 2 pieces. One of the pieces is shown above. Which one of the given options for the missing piece when assembled will form a rectangle? The piece can be moved, rotated or flipped to assemble with the above piece.

- A.
- B.

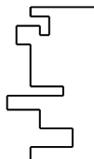


C. gatecse-2021-set2 spatial-aptitude assembling-pieces two-marks

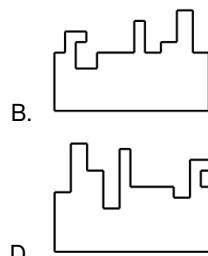
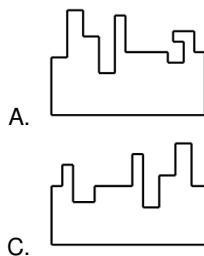


[Answer key](#)

#### 10.1.3 Assembling Pieces: GATE Mechanical 2021 Set 1 | GA Question: 7



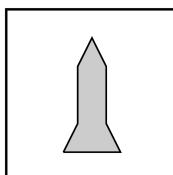
A jigsaw puzzle has 2 pieces. One of the pieces is shown above. Which one of the given options for the missing piece when assembled will form a rectangle? The piece can be moved, rotated or flipped to assemble with the above piece.



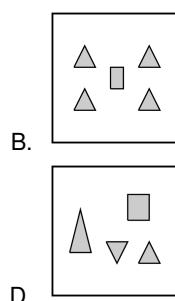
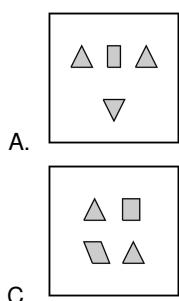
gateme-2021-set1 spatial-aptitude assembling-pieces

[Answer key](#)

#### 10.1.4 Assembling Pieces: GATE Mechanical 2022 Set 2 | GA Question: 5



Which one of the groups given below can be assembled to get the shape that is shown above using each piece only once without overlapping with each other? (rotation and translation operations may be used).



gateme-2022-set2 spatial-aptitude assembling-pieces

[Answer key](#)

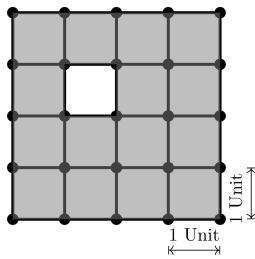
#### 10.2

#### Counting Figure (1)



#### 10.2.1 Counting Figure: GATE ECE 2022 | GA Question: 4

The figure shows a grid formed by a collection of unit squares. The unshaded unit square in the grid represents a hole.



What is the maximum number of squares without a “hole in the interior” that can be formed within the  $4 \times 4$  grid using the unit squares as building blocks?

- A. 15      B. 20      C. 21      D. 26

gateece-2022 spatial-aptitude patterns-in-two-dimensions counting-figure

[Answer key](#)

### 10.3

### Grouping (1)

#### 10.3.1 Grouping: GATE Civil 2024 Set 1 | GA Question: 9



In the  $4 \times 4$  array shown below, each cell of the first three columns has either a cross ( $X$ ) or a number, as per the given rule.

1	1	2	
2	$X$	3	
2	$X$	4	
1	2	$X$	

**Rule:** The number in a cell represents the count of crosses around its immediate neighboring cells (left, right, top, bottom, diagonals).

As per this rule, the **maximum** number of crosses possible in the empty column is

- A. 0      B. 1      C. 2      D. 3

gatecivil-2024-set1 grouping spatial-aptitude

[Answer key](#)

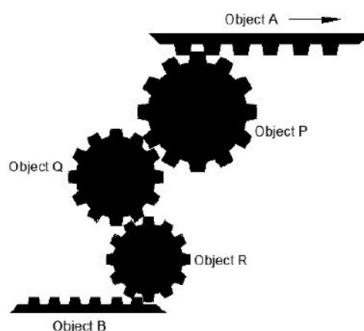
### 10.4

### Image Rotation (7)

#### 10.4.1 Image Rotation: GATE 2024 Electrical | GA Question: 9



The assembly shown below has three toothed circular objects (Pinions) and two toothed flat objects (Racks), which are perfectly mating with each other. Pinions can only rotate clockwise or anti-clockwise staying at its own center. Racks can translate towards the left ( $\leftarrow$ ) or the right ( $\rightarrow$ ) direction.



If the object A (Rack) is translating towards the right ( $\rightarrow$ ) direction, the correct statement among the following is

- A. Object B translates towards the right direction.
- B. Object B translates towards the left direction.
- C. Object R rotates in the anticlockwise direction.
- D. Object Q rotates in the clockwise direction.

gate2024-ee image-rotation spatial-aptitude

[Answer key](#)

#### 10.4.2 Image Rotation: GATE CSE 2022 | GA Question: 5



A palindrome is a word that reads the same forwards and backwards. In a game of words, a player has the following two plates painted with letters.

A     D

From the additional plates given in the options, which one of the combinations of additional plates would allow the player to construct a five-letter palindrome. The player should use all the five plates exactly once. The plates can be rotated in their plane.

- A.  D     I     J
- B.  R     A     R
- C.  Z     E     D
- D.  I     T     Y

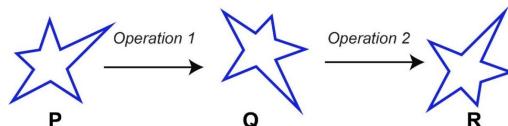
gatecse-2022 spatial-aptitude image-rotation one-mark

[Answer key](#)

#### 10.4.3 Image Rotation: GATE CSE 2023 | GA Question: 10



Which one of the options best describes the transformation of the 2-dimensional figure **P** to **Q**, and then to **R**, as shown?



- A. Operation 1: A clockwise rotation by  $90^\circ$  about an axis perpendicular to the plane of the figure  
Operation 2: A reflection along a horizontal line
- B. Operation 1: A counter clockwise rotation by  $90^\circ$  about an axis perpendicular to the plane of the figure  
Operation 2: A reflection along a horizontal line
- C. Operation 1: A clockwise rotation by  $90^\circ$  about an axis perpendicular to the plane of the figure  
Operation 2: A reflection along a vertical line
- D. Operation 1: A counter clockwise rotation by  $180^\circ$  about an axis perpendicular to the plane of the figure  
Operation 2: A reflection along a vertical line

gatecse-2023 spatial-aptitude image-rotation two-marks

[Answer key](#)

#### 10.4.4 Image Rotation: GATE Civil 2023 Set 2 | GA Question: 5

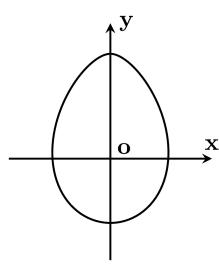
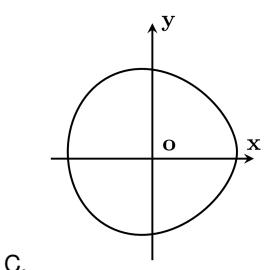
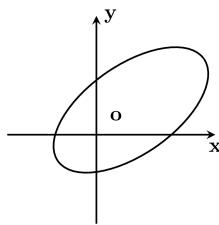
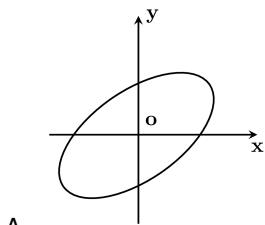
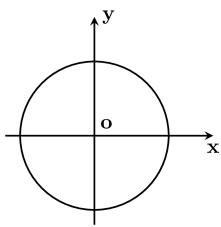


Consider a circle with its centre at the origin (**O**), as shown. Two operations are allowed on the circle.

*Operation 1* : Scale independently along the x and y axes.

*Operation 2* : Rotation in any direction about the origin.

Which figure among the options can be achieved through a combination of these two operations on the given circle?



gatecivil-2023-set2 spatial-aptitude image-rotation

[Answer key](#)

#### 10.4.5 Image Rotation: GATE Civil 2024 Set 2 | GA Question: 10



Visualize a cube that is held with one of the four body diagonals aligned to the vertical axis. Rotate the cube about this axis such that its view remains unchanged. The magnitude of the minimum angle of rotation is

- A.  $120^\circ$       B.  $60^\circ$       C.  $90^\circ$       D.  $180^\circ$

gatecivil-2024-set2 spatial-aptitude image-rotation

[Answer key](#)

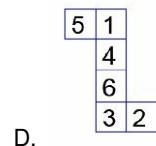
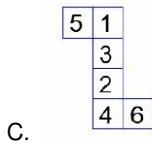
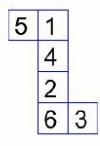
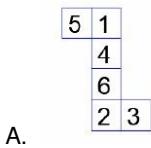
#### 10.4.6 Image Rotation: GATE DS&AI 2024 | GA Question: 9



Three different views of a dice are shown in the figure below.



The piece of paper that can be folded to make this dice is



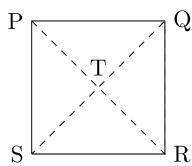
gate-ds-ai-2024 spatial-aptitude image-rotation two-marks

[Answer key](#)

#### 10.4.7 Image Rotation: GATE ECE 2022 | GA Question: 10



Consider the following square with the four corners and the center marked as P, Q, R, S and T respectively.



Let X, Y and Z represent the following operations:

X: rotation of the square by 180 degree with respect to the S – Q axis.

Y: rotation of the square by 180 degree with respect to the P – R axis.

Z: rotation of the square by 90 degree clockwise with respect to the axis perpendicular, going into the screen and passing through the point T.

Consider the following three distinct sequences of operation (which are applied in the left to right order).

1. XYZZ
2. XY
3. ZZZZ

Which one of the following statements is correct as per the information provided above?

- A. The sequence of operations (1) and (2) are equivalent
- B. The sequence of operations (1) and (3) are equivalent
- C. The sequence of operations (2) and (3) are equivalent
- D. The sequence of operations (1), (2) and (3) are equivalent

gateece-2022 spatial-aptitude image-rotation

[Answer key](#)

## 10.5

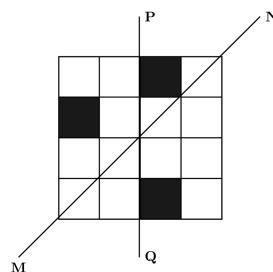
## Mirror Image (7)

### 10.5.1 Mirror Image: GATE CH 2023 | GA Question: 5



A line of symmetry is defined as a line that divides a figure into two parts in a way such that each part is a mirror image of the other part about that line.

The given figure consists of 16 unit squares arranged as shown. In addition to the three black squares, what is the minimum number of squares that must be coloured black, such that both PQ and MN form lines of symmetry? (The figure is representative)



A. 3

B. 4

C. 5

D. 6

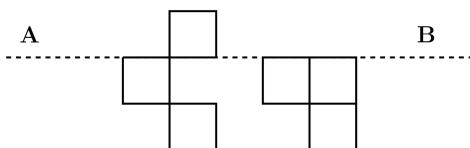
gatech-2023 spatial-aptitude mirror-image

[Answer key](#)

### 10.5.2 Mirror Image: GATE CSE 2024 | Set 1 | GA Question: 10



The least number of squares to be added in the figure to make A B a line of symmetry is



A. 6

B. 4

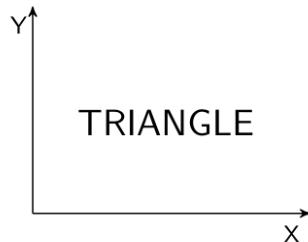
C. 5

D. 7

gatecse2024-set1 spatial-aptitude mirror-image two-marks

Answer key 

#### 10.5.3 Mirror Image: GATE Civil 2021 Set 1 | GA Question: 2



The mirror image of the above text about the X-axis is

A. TIRGNALIT

B. TIRGNCLGE

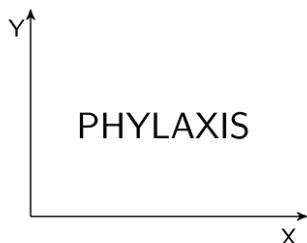
C. TIRNACGE

D. TIRNAGLT

gatecivil-2021-set1 mirror-image

Answer key 

#### 10.5.4 Mirror Image: GATE Civil 2021 Set 2 | GA Question: 2



The mirror image of the above text about the x-axis is

A. PHYΛXIS

B. ΣΗΧΑΓΥΗΣ

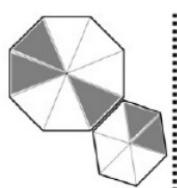
C. ΗΡΗΛΥΑΗΣ

D. ΣΗΧΑΓΥΗΣ

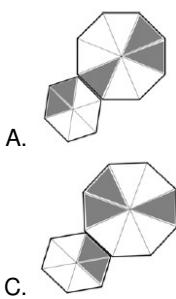
gatecivil-2021-set2 mirror-image

Answer key 

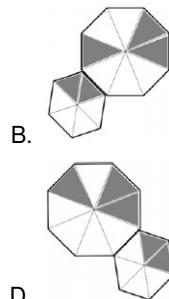
#### 10.5.5 Mirror Image: GATE Civil 2022 Set 2 | GA Question: 5



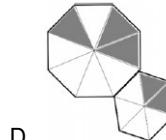
For the picture shown above, which one of the following is the correct picture representing reflection with respect to the mirror shown as the dotted line?



A.



B.



C.

D.

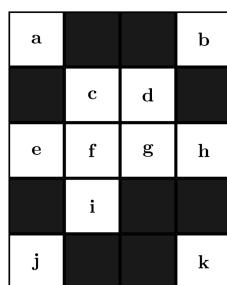
gatecivil-2022-set2 spatial-aptitude mirror-image

Answer key

**10.5.6 Mirror Image: GATE Civil 2023 Set 1 | GA Question: 5**

A line of symmetry is defined as a line that divides a figure into two parts in a way such that each part is a mirror image of the other part about that line.

The figure below consists of 20 unit squares arranged as shown. In addition to the given black squares, upto 5 more may be coloured black. Which one among the following options depicts the minimum number of boxes that must be coloured black to achieve two lines of symmetry? (The figure is representative)



A. d

B. c, d, i

C. c, i

D. c, d, i, f, g

gatecivil-2023-set1 spatial-aptitude mirror-image

Answer key

**10.5.7 Mirror Image: GATE ECE 2024 | GA Question: 9**

Examples of mirror and water reflections are shown in the figures below:



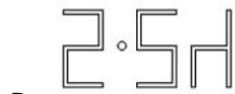
An object appears as the following image after first reflecting in a mirror and then reflecting on water.



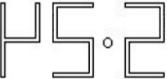
The original object is



A.

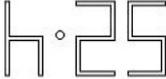


B.

C. 

gatecse-2024 spatial-aptitude mirror-image

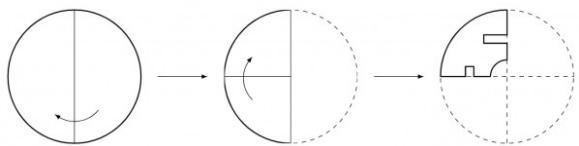
Answer key 

D. 

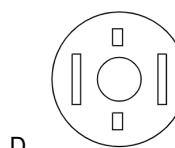
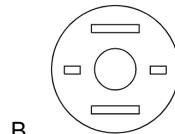
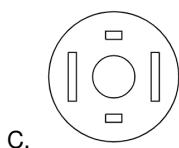
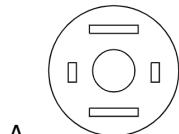
10.6

## Paper Folding (12)

### 10.6.1 Paper Folding: GATE CSE 2021 Set 1 | GA Question: 4



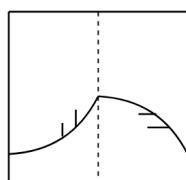
A circular sheet of paper is folded along the lines in the directions shown. The paper, after being punched in the final folded state as shown and unfolded in the reverse order of folding, will look like \_\_\_\_\_.



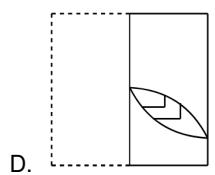
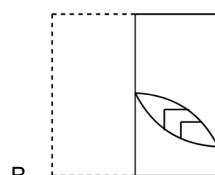
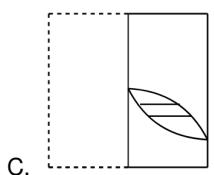
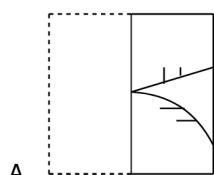
gatecse-2021-set1 spatial-aptitude paper-folding one-mark

Answer key 

### 10.6.2 Paper Folding: GATE CSE 2021 Set 2 | GA Question: 2



A transparent square sheet shown above is folded along the dotted line. The folded sheet will look like \_\_\_\_\_.



gatecse-2021-set2 spatial-aptitude paper-folding one-mark

Answer key 

### 10.6.3 Paper Folding: GATE CSE 2024 | Set 1 | GA Question: 9



A rectangular paper of  $20\text{ cm} \times 8\text{ cm}$  is folded 3 times. Each fold is made along the line of symmetry, which is perpendicular to its long edge. The perimeter of the final folded sheet (in cm) is

- A. 18      B. 24      C. 20      D. 21

gatecse2024-set1 spatial-aptitude paper-folding two-marks

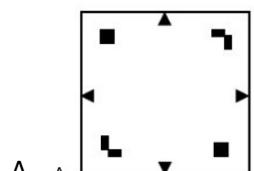
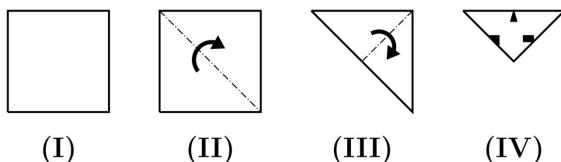
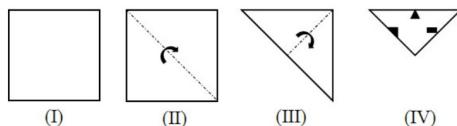
Answer key

### 10.6.4 Paper Folding: GATE CSE 2025 | Set 1 | GA Question: 9

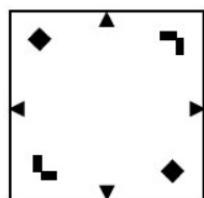


A square paper, shown in figure (I), is folded along the dotted lines as shown in the figures (II) and (III). Then a few cuts are made as shown in figure (IV). Which one of the following patterns will be obtained when the paper is unfolded?

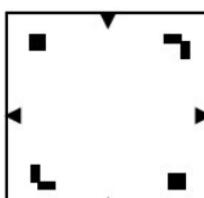
Note: The figures shown are representative.



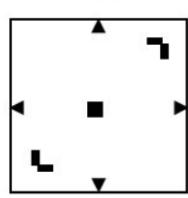
A. A.



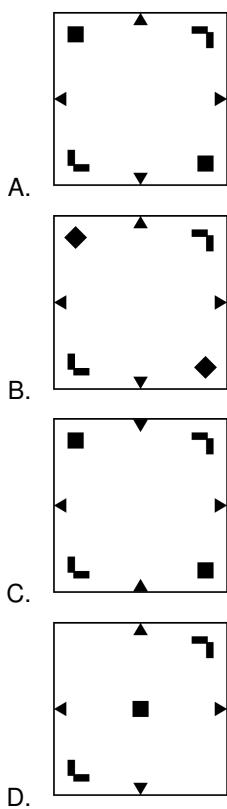
B. B.



C. C.



D. D.



gatecse2025-set1 spatial-aptitude paper-folding two-marks

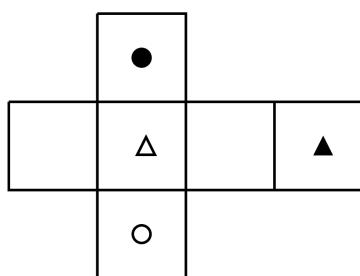
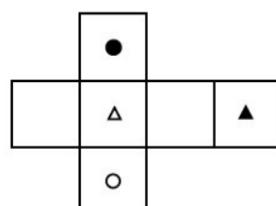
[Answer key](#)

#### 10.6.5 Paper Folding: GATE CSE 2025 | Set 2 | GA Question: 4



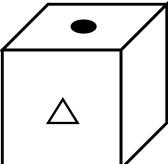
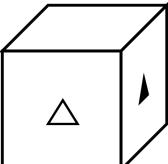
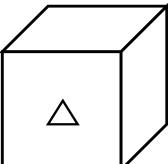
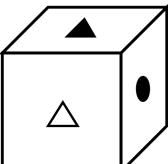
The paper as shown in the figure is folded to make a cube where each square corresponds to a particular face of the cube. Which one of the following options correctly represents the cube?

Note: The figures shown are representative.



A.

- B. 
- C. 
- D. 
- E. 

- A. 
- B. 
- C. 
- D. 

gatecse2025-set2 spatial-aptitude paper-folding easy one-mark

**Answer key** 

#### 10.6.6 Paper Folding: GATE Civil 2021 Set 1 | GA Question: 7



Consider two rectangular sheets, Sheet M and Sheet N of dimensions  $6\text{ cm} \times 4\text{ cm}$  each.

- Folding operation 1 : The sheet is folded into half by joining the short edges of the current shape.
- Folding operation 2 : The sheet is folded into half by joining the long edges of the current shape.

Folding operation 1 is carried out on Sheet M three times.

Folding operation 2 is carried out on Sheet N three times.

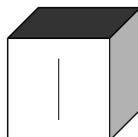
The ratio of perimeters of the final folded shape of Sheet N to the final folded shape of Sheet M is \_\_\_\_\_.

- A. 13 : 7      B. 3 : 2      C. 7 : 5      D. 5 : 13

gatecivil-2021-set1 spatial-aptitude paper-folding

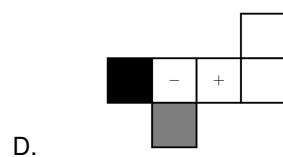
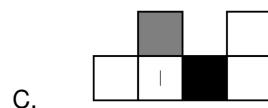
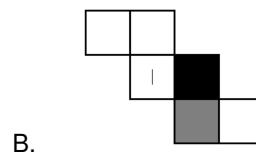
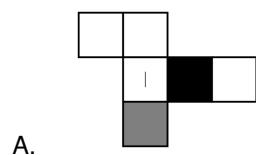
**Answer key** 

### 10.6.7 Paper Folding: GATE Civil 2022 Set 1 | GA Question: 10



Consider a cube made by folding a single sheet of paper of appropriate shape. The interior faces of the cube are all blank. However, the exterior faces that are not visible in the above view may not be blank.

Which one of the following represents a possible unfolding of the cube?



gatecivil-2022-set1 spatial-aptitude paper-folding

Answer key

### 10.6.8 Paper Folding: GATE ECE 2023 | GA Question: 10



A  $100 \text{ cm} \times 32 \text{ cm}$  rectangular sheet is folded 5 times. Each time the sheet is folded, the long edge aligns with its opposite side. Eventually, the folded sheet is a rectangle of dimensions  $100 \text{ cm} \times 1 \text{ cm}$ .

The total number of creases visible when the sheet is unfolded is \_\_\_\_\_.

A. 32

B. 5

C. 31

D. 63

gateece-2023 spatial-aptitude paper-folding

Answer key

### 10.6.9 Paper Folding: GATE ECE 2024 | GA Question: 10



Two identical sheets A and B, of dimensions  $24 \text{ cm} \times 16 \text{ cm}$ , can be folded into half using two distinct operations, FO1 or FO2.

In FO1, the axis of folding remains parallel to the initial long edge, and in FO2, the axis of folding remains parallel to the initial short edge.

If sheet A is folded twice using FO1, and sheet B is folded twice using FO2, the ratio of the perimeters of the final shapes of A and B is

A. 14 : 11

B. 11 : 14

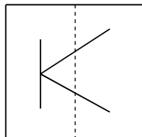
C. 18 : 11

D. 11 : 18

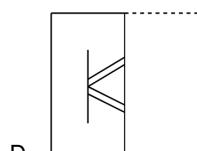
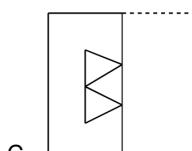
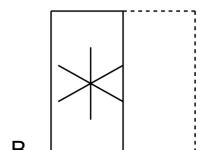
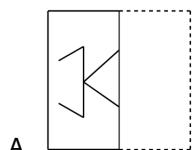
gateece-2024 geometry paper-folding spatial-aptitude

Answer key

### 10.6.10 Paper Folding: GATE Electrical 2021 | GA Question: 2



A transparent square sheet shown above is folded along the dotted line. The folded sheet will look like \_\_\_\_\_.



gateee-2021 spatial-aptitude paper-folding

[Answer key](#)

### 10.6.11 Paper Folding: GATE Mechanical 2021 Set 2 | GA Question: 9

Consider a square sheet of side 1 unit. The sheet is first folded along the main diagonal. This is followed by a fold along its line of symmetry. The resulting folded shape is again folded along its line of symmetry. The area of each face of the final folded shape, in square units, equal to \_\_\_\_\_

A.  $\frac{1}{4}$

B.  $\frac{1}{8}$

C.  $\frac{1}{16}$

D.  $\frac{1}{32}$

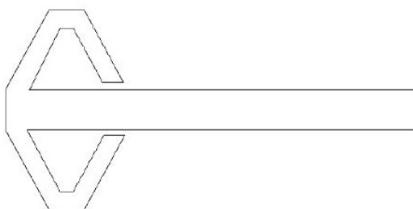
gateme-2021-set2 spatial-aptitude paper-folding area

[Answer key](#)

### 10.6.12 Paper Folding: GATE Mechanical 2024 | GA Question: 9



A planar rectangular paper has two V-shaped pieces attached as shown below.



This piece of paper is folded to make the following closed three-dimensional object.



The number of folds required to form the above object is

A. 9

B. 7

C. 11

D. 8

gateme-2024 spatial-aptitude paper-folding

[Answer key](#)



### 10.7.1 Patterns In Three Dimensions: GATE CH 2023 | GA Question: 10

Which one of the following shapes can be used to tile (completely cover by repeating) a flat plane, extending to infinity in all directions, without leaving any empty spaces in between them? The copies of the shape used to tile are identical and are not allowed to overlap.

- A. circle
- B. regular octagon
- C. regular pentagon
- D. rhombus

gatech-2023 spatial-aptitude patterns-in-three-dimensions

[Answer key](#)



### 10.7.2 Patterns In Three Dimensions: GATE CSE 2023 | GA Question: 5

Looking at the surface of a smooth 3-dimensional object from the outside, which one of the following options is TRUE?

- A. The surface of the object must be concave everywhere.
- B. The surface of the object must be convex everywhere.
- C. The surface of the object may be concave in some places and convex in other places.
- D. The object can have edges, but no corners.

gatecse-2023 spatial-aptitude patterns-in-three-dimensions one-mark

[Answer key](#)



### 10.7.3 Patterns In Three Dimensions: GATE CSE 2024 | Set 2 | GA Question: 9

A cube is to be cut into 8 pieces of equal size and shape. Here, each cut should be straight and it should not stop till it reaches the other end of the cube.

The minimum number of such cuts required is

- A. 3
- B. 4
- C. 7
- D. 8

gatecse2024-set2 spatial-aptitude patterns-in-three-dimensions two-marks

[Answer key](#)



### 10.7.4 Patterns In Three Dimensions: GATE Civil 2024 Set 2 | GA Question: 9

Five cubes of identical size and another smaller cube are assembled as shown in Figure A. If viewed from direction X, the planar image of the assembly appears as Figure B.

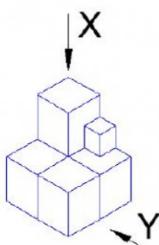
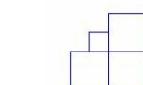
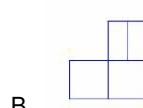
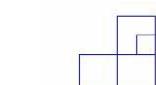


Figure A



Figure B

If viewed from direction Y, the planar image of the assembly (Figure A) will appear as



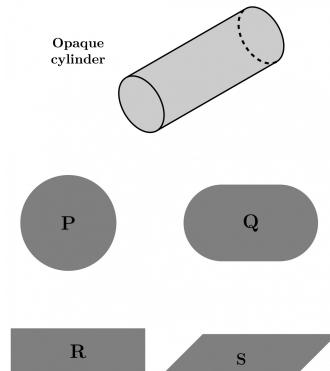
**Answer key****10.7.5 Patterns In Three Dimensions: GATE DS&AI 2024 | GA Question: 10**

Visualize two identical right circular cones such that one is inverted over the other and they share a common circular base. If a cutting plane passes through the vertices of the assembled cones, what shape does the outer boundary of the resulting cross-section make?

- A. A rhombus      B. A triangle      C. An ellipse      D. A hexagon

**Answer key****10.7.6 Patterns In Three Dimensions: GATE IN 2023 | GA Question: 10**

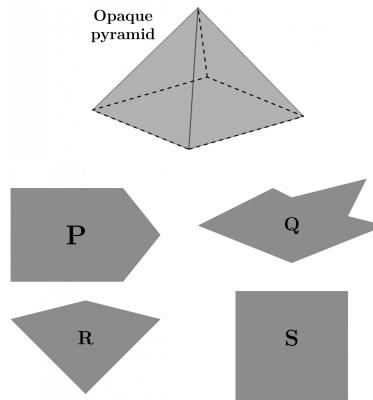
An opaque cylinder (shown below) is suspended in the path of a parallel beam of light, such that its shadow is cast on a screen oriented perpendicular to the direction of the light beam. The cylinder can be reoriented in any direction within the light beam. Under these conditions, which one of the shadows **P**, **Q**, **R**, and **S** is NOT possible?



- A. **P**      B. **Q**      C. **R**      D. **S**

**Answer key****10.7.7 Patterns In Three Dimensions: GATE Mechanical 2023 | GA Question: 10**

An opaque pyramid (shown below), with a square base and isosceles faces, is suspended in the path of a parallel beam of light, such that its shadow is cast on a screen oriented perpendicular to the direction of the light beam. The pyramid can be reoriented in any direction within the light beam. Under these conditions, which one of the shadows **P**, **Q**, **R**, and **S** is NOT possible?



- A. **P**      B. **Q**      C. **R**      D. **S**

**Answer key**

### 10.7.8 Patterns In Three Dimensions: GATE Mechanical 2024 | GA Question: 10



Four equilateral triangles are used to form a regular closed three-dimensional object by joining along the edges. The angle between any two faces is

- A.  $30^\circ$       B.  $60^\circ$       C.  $45^\circ$       D.  $90^\circ$

gateme-2024 spatial-aptitude patterns-in-three-dimensions

[Answer key](#)

## 10.8

### Patterns In Two Dimensions (9)

#### 10.8.1 Patterns In Two Dimensions: GATE CSE 2021 Set 1 | GA Question: 2



A polygon is convex if, for every pair of points, P and Q belonging to the polygon, the line segment PQ lies completely inside or on the polygon.

Which one of the following is NOT a convex polygon?



gatecse-2021-set1 spatial-aptitude patterns-in-two-dimensions one-mark

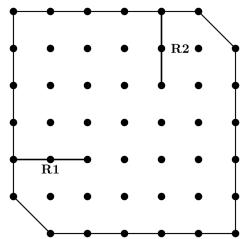
[Answer key](#)

#### 10.8.2 Patterns In Two Dimensions: GATE CSE 2022 | GA Question: 10



A plot of land must be divided between four families. They want their individual plots to be similar in shape, not necessarily equal in area. The land has equally spaced poles, marked as dots in the below figure. Two ropes, R<sub>1</sub> and R<sub>2</sub>, are already present and cannot be moved.

What is the least number of additional straight ropes needed to create the desired plots? A single rope can pass through three poles that are aligned in a straight line.

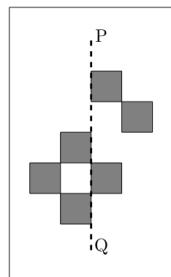


- A. 2      B. 4      C. 5      D. 3

gatecse-2022 spatial-aptitude patterns-in-two-dimensions two-marks

[Answer key](#)

#### 10.8.3 Patterns In Two Dimensions: GATE ECE 2021 | GA Question: 3



The least number of squares that must be added so that the line P – Q becomes the line of symmetry is \_\_\_\_\_

- A. 4      B. 3      C. 6      D. 7

gateec-2021 spatial-aptitude patterns-in-two-dimensions

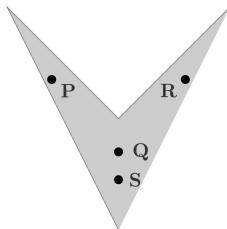
[Answer key](#)

#### 10.8.4 Patterns In Two Dimensions: GATE ECE 2022 | GA Question: 5



An art gallery engages a security guard to ensure that the items displayed are protected. The diagram below represents the plan of the gallery where the boundary walls are opaque. The location the security guard posted is identified such that all the inner space (shaded region in the plan) of the gallery is within the line of sight of the security guard.

If the security guard does not move around the posted location and has a  $360^\circ$  view, which one of the following correctly represents the set of ALL possible locations among the locations P, Q, R and S, where the security guard can be posted to watch over the entire inner space of the gallery.



- A. P and Q      B. Q      C. Q and S      D. R and S

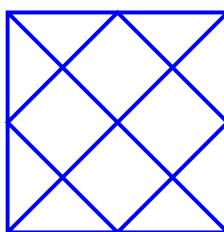
gateece-2022 spatial-aptitude patterns-in-two-dimensions

[Answer key](#)

#### 10.8.5 Patterns In Two Dimensions: GATE ECE 2023 | GA Question: 5



How many rectangles are present in the given figure?



- A. 8      B. 9      C. 10      D. 12

gateece-2023 spatial-aptitude patterns-in-two-dimensions

[Answer key](#)

#### 10.8.6 Patterns In Two Dimensions: GATE Electrical 2021 | GA Question: 3



For a regular polygon having 10 sides, the interior angle between the sides of the polygon, in degrees, is:

- A. 396      B. 324      C. 216      D. 144

gateee-2021 spatial-aptitude patterns-in-two-dimensions

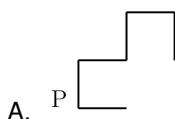
[Answer key](#)

#### 10.8.7 Patterns In Two Dimensions: GATE Electrical 2022 | GA Question: 10

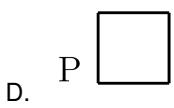
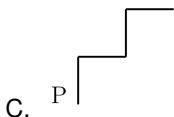
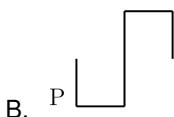


An ant is at the bottom-left corner of a grid (point P) as shown above. It aims to move to the top-right corner of the grid. The ant moves only along the lines marked in the grid such that the current distance to the top-right corner strictly decreases.

Which one of the following is a part of a possible trajectory of the ant during the movement?



- A. P



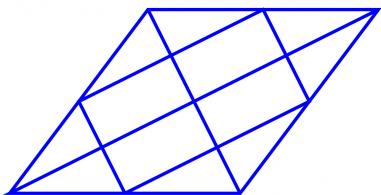
gate2022-ee spatial-aptitude patterns-in-two-dimensions

Answer key 

#### 10.8.8 Patterns In Two Dimensions: GATE Electrical 2023 | GA Question: 5



How many triangles are present in the given figure?

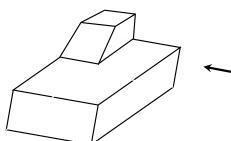


- A. 12      B. 16      C. 20      D. 24

gate2023-ee spatial-aptitude patterns-in-two-dimensions

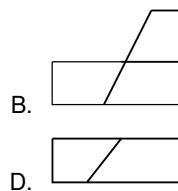
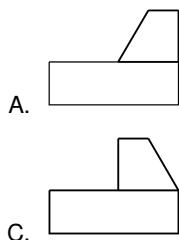
Answer key 

#### 10.8.9 Patterns In Two Dimensions: GATE Mechanical 2022 Set 1 | GA Question: 5



A block with a trapezoidal cross-section is placed over a block with rectangular cross section as shown above.

Which one of the following is the correct drawing of the view of the 3D object as viewed in the direction indicated by an arrow in the above figure?



gateme-2022-set1 spatial-aptitude patterns-in-two-dimensions

Answer key 

## Answer Keys

10.1.1	C
10.3.1	C
10.4.5	A
10.5.3	B

10.1.2	A
10.4.1	B
10.4.6	A
10.5.4	B

10.1.3	A
10.4.2	B
10.4.7	B
10.5.5	A

10.1.4	B,C
10.4.3	A
10.5.1	C
10.5.6	B

10.2.1	B
10.4.4	A
10.5.2	A
10.5.7	A

10.6.1	A	10.6.2	B	10.6.3	A	10.6.4	A	10.6.5	A
10.6.6	A	10.6.7	X	10.6.8	C	10.6.9	A	10.6.10	C
10.6.11	B	10.6.12	A	10.7.1	D	10.7.2	C	10.7.3	A
10.7.4	A	10.7.5	A	10.7.6	D	10.7.7	B	10.7.8	X
10.8.1	A	10.8.2	D	10.8.3	C	10.8.4	C	10.8.5	C
10.8.6	D	10.8.7	C	10.8.8	C	10.8.9	A		



**Syllabus:** English grammar, Sentence completion. Verbal analogies, Word groups. Instructions, Critical reasoning and Verbal deduction

#### Mark Distribution in Previous GATE

Year	2025 - 1	2025 - 2	2024 - 1	2024 - 2	2023	2022	2021 - 1	2021 - 2	Minimum	Average	Maximum
<b>1 Mark Count</b>	2	2	1	1	2	1	2	2	1	1.63	2
<b>2 Marks Count</b>	1	0	1	1	1	1	1	1	0	0.88	1
<b>Total Marks</b>	4	2	3	3	4	3	4	4	2	3.38	4

## 11.1

## Articles (2)



## 11.1.1 Articles: GATE CSE 2016 Set 2 | Question: GA-01

The man who is now Municipal Commissioner worked as \_\_\_\_\_.

- A. the security guard at a university
- B. a security guard at the university
- C. a security guard at university
- D. the security guard at the university

gatecse-2016-set2 verbal-aptitude english-grammar normal articles

**Answer key**

## 11.1.2 Articles: GATE CSE 2025 | Set 1 | GA Question: 1



Ravi had \_\_\_\_\_ younger brother who taught at \_\_\_\_\_ university. He was widely regarded as \_\_\_\_\_ honorable man.

Select the option with the correct sequence of articles to fill in the blanks.

- A. a; a; an
- B. the; an; a
- C. a; an; a
- D. an; an; a

gatecse2025-set1 verbal-aptitude articles easy one-mark

**Answer key**

## 11.2

## Comparative Forms (7)



## 11.2.1 Comparative Forms: GATE CSE 2015 Set 1 | Question: GA-1

Didn't you buy \_\_\_\_\_ when you went shopping?

- A. any paper
- B. much paper
- C. no paper
- D. a few paper

gatecse-2015-set1 verbal-aptitude easy english-grammar comparative-forms

**Answer key**

## 11.2.2 Comparative Forms: GATE CSE 2021 Set 2 | GA Question: 1



Gauri said that she can play the keyboard \_\_\_\_\_ her sister.

- A. as well as
- B. as better as
- C. as nicest as
- D. as worse as

gatecse-2021-set2 verbal-aptitude comparative-forms one-mark

**Answer key**

## 11.2.3 Comparative Forms: GATE Civil 2021 Set 1 | GA Question: 1



Getting to the top is \_\_\_\_\_ than staying on top.

- A. more easy
- B. much easy
- C. easiest
- D. easier

gatcivil-2021-set1 verbal-aptitude english-grammar comparative-forms

**Answer key**

## 11.2.4 Comparative Forms: GATE Mechanical 2020 Set 1 | GA Question: 2



Jofra Archer, the England fast bowler, is \_\_\_\_\_ than accurate.

- A. more fast
- B. faster
- C. less fast
- D. more faster

**Answer key****11.2.5 Comparative Forms: GATE2016 EC-2: GA-1**

Based on the given statements, select the appropriate option with respect to grammar and usage.

**Statements**

- (i) The height of Mr. *X* is 6 feet.
  - (ii) The height of Mr. *Y* is 5 feet.
- |   |   |
|---|---|
| A. Mr. <i>X</i> is longer than Mr. <i>Y</i> . | B. Mr. <i>X</i> is more elongated than Mr. <i>Y</i> . |
| C. Mr. <i>X</i> is taller than Mr. <i>Y</i> . | D. Mr. <i>X</i> is lengthier than Mr. <i>Y</i> .      |

**Answer key****11.2.6 Comparative Forms: GATE2016 EC-3: GA-1**

An apple costs Rs. 10. An onion costs Rs. 8.

Select the most suitable sentence with respect to grammar and usage.

- A. The price of an apple is greater than an onion.
- B. The price of an apple is more than onion.
- C. The price of an apple is greater than that of an onion.
- D. Apples are more costlier than onions.

**Answer key****11.2.7 Comparative Forms: GATE2017 EC-2: GA-2**

It is \_\_\_\_\_ to read this year's textbook \_\_\_\_\_ the last year's.

- |                 |                    |
|-----------------|--------------------|
| A. easier, than | B. most easy, than |
| C. easier, from | D. easiest, from   |

**Answer key****11.3****English Grammar (12)****11.3.1 English Grammar: GATE CSE 2015 Set 2 | Question: GA-1**

We \_\_\_\_\_ our friend's birthday and we \_\_\_\_\_ how to make it up to him.

- |  |  |
|--|--|
| A. completely forgot --- don't just know | B. forgot completely --- don't just know |
| C. completely forgot --- just don't know | D. forgot completely --- just don't know |

**Answer key****11.3.2 English Grammar: GATE CSE 2015 Set 3 | Question: GA-2**

The Tamil version of \_\_\_\_\_ John Abraham-starrer *Madras Cafe* \_\_\_\_\_ cleared by the Censor Board with no cuts last week, but the film's distributor \_\_\_\_\_ no takers among the exhibitors for a release in Tamilnadu \_\_\_\_\_ this Friday.

- |                        |                       |
|------------------------|-----------------------|
| A. Mr., was, found, on | B. a, was, found, at  |
| C. the, was, found, on | D. a, being, find, at |

**Answer key****11.3.3 English Grammar: GATE CSE 2017 Set 1 | Question: GA-2**

Research in the workplace reveals that people work for many reasons \_\_\_\_\_.

- |                  |                  |
|------------------|------------------|
| A. money beside  | B. beside money  |
| C. money besides | D. besides money |

**Answer key****11.3.4 English Grammar: GATE CSE 2017 Set 2 | Question: GA-2**

Saturn is \_\_\_\_\_ to be seen on a clear night with the naked eye.



- A. enough bright      B. bright enough      C. as enough bright      D. bright as enough

**Answer key****11.3.5 English Grammar: GATE CSE 2020 | Question: GA-1**

Raman is confident of speaking English \_\_\_\_\_ six months as he has been practising regularly \_\_\_\_\_ the last three weeks



- A. during, for      B. for, since      C. for, in      D. within, for

**Answer key****11.3.6 English Grammar: GATE CSE 2021 Set 1 | GA Question: 3**

Consider the following sentences:



- Everybody in the class is prepared for the exam.
- Babu invited Danish to his home because he enjoys playing chess.

Which of the following is the CORRECT observation about the above two sentences?



- A. (i) is grammatically correct and (ii) is unambiguous  
 B. (i) is grammatically incorrect and (ii) is unambiguous  
 C. (i) is grammatically correct and (ii) is ambiguous  
 D. (i) is grammatically incorrect and (ii) is ambiguous

**Answer key****11.3.7 English Grammar: GATE ECE 2020 | GA Question: 2**

He was not only accused of theft \_\_\_\_\_ of conspiracy.



- A. rather      B. but also      C. but even      D. rather than

**Answer key****11.3.8 English Grammar: GATE2015 EC-1: GA-6**

The following question presents a sentence, part of which is underlined. Beneath the sentence, you find four ways of phrasing the underlined part. Following the requirements of the standard written English, select the answer that produces the most effective sentence.

Tuberculosis, together with its effects, ranks one of the leading causes of death in India.

- A. ranks as one of the leading causes of death  
 B. rank as one of the leading causes of death  
 C. has the rank of one of the leading causes of death  
 D. are one of the leading causes of death

**Answer key**

### 11.3.9 English Grammar: GATE2015 EC-3: GA-6



Ram and Shyam shared a secret and promised to each other that it would remain between them. Ram expressed himself in one of the following ways as given in the choices below. Identify the correct way as per standard English.

- A. It would remain between you and me.
- B. It would remain between I and you.
- C. It would remain between you and I.
- D. It would remain with me.

gate2015-ec-3 english-grammar verbal-aptitude

[Answer key](#)

### 11.3.10 English Grammar: GATE2016 EC-1: GA-1



Which of the following is CORRECT with respect to grammar and usage?

Mount Everest is \_\_\_\_\_.

- A. The highest peak in the world
- B. Highest peak in the world
- C. One of highest peak in the world
- D. One of the highest peak in the world

gate2016-ec-1 verbal-aptitude english-grammar

[Answer key](#)

### 11.3.11 English Grammar: GATE2018 ME-1: GA-1



"Going by the \_\_\_\_\_ that many hands make light work, the school \_\_\_\_\_ involved all the students in the task."

The words that best fill the blanks in the above sentence are

- A. principle, principal
- B. principal, principle
- C. principle, principle
- D. principal, principal

gate2018-me-1 general-aptitude verbal-aptitude english-grammar

[Answer key](#)

### 11.3.12 English Grammar: GATE2019 CE-1: GA-1



The lecture was attended by quite \_\_\_\_\_ students, so the hall was not very \_\_\_\_\_.

- A. a few, quite
- B. few, quiet
- C. a few, quiet
- D. few, quite

gate2019-ce-1 general-aptitude verbal-aptitude english-grammar

[Answer key](#)

## 11.4

### Grammatical Error (9)

#### 11.4.1 Grammatical Error: GATE CSE 2012 | Question: 59



Choose the grammatically INCORRECT sentence:

- A. They gave us the money back less the service charges of Three Hundred rupees.
- B. This country's expenditure is not less than that of Bangladesh.
- C. The committee initially asked for a funding of Fifty Lakh rupees, but later settled for a lesser sum.
- D. This country's expenditure on educational reforms is very less.

gatecse-2012 verbal-aptitude grammatical-error normal

[Answer key](#)

#### 11.4.2 Grammatical Error: GATE CSE 2013 | Question: 60



Choose the grammatically INCORRECT sentence:

- A. He is of Asian origin.
- B. They belonged to Africa.
- C. She is an European.
- D. They migrated from India to Australia.

gatecse-2013 verbal-aptitude grammatical-error normal

[Answer key](#)

### 11.4.3 Grammatical Error: GATE CSE 2015 Set 2 | Question: GA-10



Out of the following 4 sentences, select the most suitable sentence with respect to grammar and usage:

- A. Since the report lacked needed information, it was of no use to them.
- B. The report was useless to them because there were no needed information in it.
- C. Since the report did not contain the needed information, it was not real useful to them.
- D. Since the report lacked needed information, it would not had been useful to them.

gatecse-2015-set2 verbal-aptitude normal english-grammar grammatical-error

[Answer key](#)

### 11.4.4 Grammatical Error: GATE CSE 2016 Set 1 | Question: GA01



Out of the following four sentences, select the most suitable sentence with respect to grammar and usage.

- A. I will not leave the place until the minister does not meet me.
- B. I will not leave the place until the minister doesn't meet me.
- C. I will not leave the place until the minister meet me.
- D. I will not leave the place until the minister meets me.

gatecse-2016-set1 verbal-aptitude english-grammar easy grammatical-error

[Answer key](#)

### 11.4.5 Grammatical Error: GATE Civil 2021 Set 2 | GA Question: 1



- i. Arun and Aparna are here.
- ii. Arun and Aparna is here.
- iii. Arun's families is here.
- iv. Arun's family is here.

Which of the above sentences are grammatically CORRECT?

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

gatcivil-2021-set2 verbal-aptitude grammatical-error easy

[Answer key](#)

### 11.4.6 Grammatical Error: GATE Mechanical 2021 Set 1 | GA Question: 1



Consider the following sentences:

- i. After his surgery, Raja hardly could walk.
- ii. After his surgery, Raja could barely walk.
- iii. After his surgery, Raja barely could walk.
- iv. After his surgery, Raja could hardly walk.

Which of the above sentences are grammatically CORRECT?

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

gateme-2021-set1 verbal-aptitude grammatical-error

[Answer key](#)

### 11.4.7 Grammatical Error: GATE Mechanical 2021 Set 2 | GA Question: 2



Consider the following sentences:

- i. The number of candidates who appear for the GATE examination is staggering.
- ii. A number of candidates from my class are appearing for the GATE examination.
- iii. The number of candidates who appear for the GATE examination are staggering.
- iv. A number of candidates from my class is appearing for the GATE examination.

Which of the above sentences are grammatically CORRECT?

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iii)

D. (ii) and (iv)

gateme-2021-set2 verbal-aptitude grammatical-error

Answer key 



#### 11.4.8 Grammatical Error: GATE2012 AR: GA-3

Choose the grammatically CORRECT sentence:

- A. He laid in bed till 8 o'clock in the morning.
- B. He layed in bed till 8 o'clock in the morning.
- C. He lain in bed till 8 o'clock in the morning.
- D. He lay in bed till 8 o'clock in the morning.

gate2012-ar verbal-aptitude english-grammar easy grammatical-error

Answer key 



#### 11.4.9 Grammatical Error: GATE2013 EE: GA-4

Choose the grammatically CORRECT sentence:

- A. Two and two add four.
- B. Two and two become four.
- C. Two and two are four.
- D. Two and two make four.

gate2013-ee english-grammar verbal-aptitude grammatical-error

Answer key 

### 11.5

#### Incorrect Sentence Part (5)



##### 11.5.1 Incorrect Sentence Part: GATE CSE 2014 Set 3 | Question: GA-1

While trying to collect I an envelope from under the table, II Mr. X fell down III and IV was losing consciousness.

Which one of the above underlined parts of the sentence is NOT appropriate?

- A. I
- B. II
- C. III
- D. IV

gatecse-2014-set3 verbal-aptitude easy english-grammar incorrect-sentence-part

Answer key 



##### 11.5.2 Incorrect Sentence Part: GATE2012 AR: GA-4

Which one of the parts (A, B, C, D) in the sentence contains an **ERROR**?

**No sooner had the doctor seen the results of the blood test, than he suggested the patient to see the specialist.**

- A. no sooner had
- B. results of the blood test
- C. suggested the patient
- D. see the specialist

gate2012-ar verbal-aptitude incorrect-sentence-part

Answer key 



##### 11.5.3 Incorrect Sentence Part: GATE2012 CY: GA-2

One of the parts (A,B,C,D) in the sentence given below contains an ERROR. Which one of the following is **INCORRECT**?

**I requested that he should be given the driving test today instead of tomorrow.**

- A. requested that
- B. should be given
- C. the driving test
- D. instead of tomorrow

gate2012-cy verbal-aptitude incorrect-sentence-part

Answer key 



#### 11.5.4 Incorrect Sentence Part: GATE2013 AE: GA-4



All engineering students should learn mechanics, mathematics and how to do computation.

I

II

III

IV

Which of the above underlined parts of the sentence is not appropriate?

a. I

b. II

c. III

d. IV

gate2013-ae verbal-aptitude incorrect-sentence-part

**Answer key**

#### 11.5.5 Incorrect Sentence Part: GATE2013 CE: GA-2



The professor ordered to the students to go out of the class.

I

II

III

IV

Which of the above underlined parts of the sentence is grammatically incorrect?

A. I

B. II

C. III

D. IV

gate2013-ce incorrect-sentence-part verbal-aptitude

**Answer key**

### 11.6

#### Most Appropriate Word (113)



##### 11.6.1 Most Appropriate Word: GATE 2024 Electrical | GA Question: 1

If '→' denotes increasing order of intensity, then the meaning of the words [talk → shout → scream] is analogous to [please → \_\_\_\_\_ → pander].

Which one of the given options is appropriate to fill the blank?

A. flatter

B. flutter

C. fritter

D. frizzle

gate2024-ee verbal-aptitude most-appropriate-word

**Answer key**

##### 11.6.2 Most Appropriate Word: GATE 2024 Electrical | GA Question: 6



In the given text, the blanks are numbered (i)-(iv). Select the best match for all the blanks.

Following a row (i) the shopkeeper (ii) the price of a frying pan, the cook stood (iii) a row to withdraw cash (iv) the ATM booth.

- A. (i) with (ii) over (iii) at (iv) with
- B. (i) at (ii) over (iii) over (iv) in
- C. (i) with (ii) over (iii) in (iv) at
- D. (i) over (ii) with (iii) over (iv) at

gate2024-ee verbal-aptitude most-appropriate-word

**Answer key**

##### 11.6.3 Most Appropriate Word: GATE CH 2022 | GA Question: 1



Inhaling the smoke from a burning \_\_\_\_\_ could \_\_\_\_\_ you quickly.

A. tire / tier

B. tire / tyre

C. tyre / tire

D. tyre / tier

gatech-2022 verbal-aptitude most-appropriate-word

**Answer key**

##### 11.6.4 Most Appropriate Word: GATE CSE 2010 | Question: 56



Choose the most appropriate word from the options given below to complete the following sentence:

**His rather casual remarks on politics \_\_\_\_\_ his lack of seriousness about the subject.**

A. masked

B. belied

C. betrayed

D. suppressed

**Answer key****11.6.5 Most Appropriate Word: GATE CSE 2010 | Question: 58**

Choose the most appropriate word from the options given below to complete the following sentence:

**If we manage to \_\_\_\_\_ our natural resources, we would leave a better planet for our children.**

- A. uphold      B. restrain      C. cherish      D. conserve

**Answer key****11.6.6 Most Appropriate Word: GATE CSE 2011 | Question: 58**

Choose the most appropriate word(s) from the options given below to complete the following sentence.

**I contemplated \_\_\_\_\_ Singapore for my vacation but decided against it.**

- A. to visit      B. having to visit      C. visiting      D. for a visit

**Answer key****11.6.7 Most Appropriate Word: GATE CSE 2011 | Question: 59**

Choose the most appropriate word from the options given below to complete the following sentence.

**If you are trying to make a strong impression on your audience, you cannot do so by being understated, tentative or \_\_\_\_\_.**

- A. hyperbolic      B. restrained      C. argumentative      D. indifferent

**Answer key****11.6.8 Most Appropriate Word: GATE CSE 2012 | Question: 57**

Choose the most appropriate alternative from the options given below to complete the following sentence:

**Despite several \_\_\_\_\_ the mission succeeded in its attempt to resolve the conflict.**

- A. attempts      B. setbacks      C. meetings      D. delegations

**Answer key****11.6.9 Most Appropriate Word: GATE CSE 2012 | Question: 60**

Choose the most appropriate alternative from the options given below to complete the following sentence:

**Suresh's dog is the one \_\_\_\_\_ was hurt in the stampede.**

- A. that      B. which      C. who      D. whom

**Answer key****11.6.10 Most Appropriate Word: GATE CSE 2014 Set 1 | Question: GA-2**

Choose the most appropriate word from the options given below to complete the following sentence.

**She could not understand the judges awarding her the first prize, because she thought that her performance was quite \_\_\_\_\_.**

- A. superb      B. medium      C. mediocre      D. exhilarating

**Answer key**

### 11.6.11 Most Appropriate Word: GATE CSE 2014 Set 2 | Question: GA-1



Choose the most appropriate phrase from the options given below to complete the following sentence.

India is a post-colonial country because

- A. it was a former British colony
- B. Indian Information Technology professionals have colonized the world
- C. India does not follow any colonial practices
- D. India has helped other countries gain freedom

gatecse-2014-set2 verbal-aptitude most-appropriate-word easy

[Answer key](#)

### 11.6.12 Most Appropriate Word: GATE CSE 2015 Set 2 | Question: GA-4



A generic term that includes various items of clothing such as a skirt, a pair of trousers and a shirt is

- A. fabric
- B. textile
- C. fiber
- D. apparel

gatecse-2015-set2 verbal-aptitude easy most-appropriate-word

[Answer key](#)

### 11.6.13 Most Appropriate Word: GATE CSE 2015 Set 3 | Question: GA-3



Extreme focus on syllabus and studying for tests has become such a dominant concern of Indian student that they close their minds to anything \_\_\_\_\_ to the requirements of the exam.

- A. related
- B. extraneous
- C. outside
- D. useful

gatecse-2015-set3 verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.14 Most Appropriate Word: GATE CSE 2016 Set 1 | Question: GA03



Archimedes said, "Give me a lever long enough and a fulcrum on which to place it, and I will move the world."

The sentence above is an example of a \_\_\_\_\_ statement.

- A. figurative
- B. collateral
- C. literal
- D. figurine

gatecse-2016-set1 verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.15 Most Appropriate Word: GATE CSE 2018 | Question: GA-1



"From where are they bringing their books? \_\_\_\_\_ bringing \_\_\_\_\_ books from \_\_\_\_\_"

The words that best fill the blanks in the above sentence are

- A. Their, they're, there
- B. They're, their, there
- C. There, their, they're
- D. They're, there,there

gatecse-2018 verbal-aptitude most-appropriate-word easy one-mark

[Answer key](#)

### 11.6.16 Most Appropriate Word: GATE CSE 2018 | Question: GA-2



A \_\_\_\_\_ investigation can sometimes yield new facts, but typically organized ones are more successful.

The word that best fills the blank in the above sentence is

- A. meandering
- B. timely
- C. consistent
- D. systematic

gatecse-2018 verbal-aptitude most-appropriate-word normal one-mark

[Answer key](#)

### 11.6.17 Most Appropriate Word: GATE CSE 2019 | Question: GA-1



The expenditure on the project \_\_\_\_\_ as follows: equipment Rs.20 lakhs, salaries Rs.12 lakhs, and contingency Rs.3 lakhs.

- A. break down      B. break      C. breaks down      D. breaks

gatecse-2019 general-aptitude verbal-aptitude most-appropriate-word one-mark

Answer key 

#### 11.6.18 Most Appropriate Word: GATE CSE 2019 | Question: GA-2



The search engine's business model \_\_\_\_\_ around the fulcrum of trust.

- A. revolves      B. plays      C. sinks      D. bursts

gatecse-2019 general-aptitude verbal-aptitude most-appropriate-word one-mark

Answer key 

#### 11.6.19 Most Appropriate Word: GATE CSE 2019 | Question: GA-5



A court is to a judge as \_\_\_\_\_ is to a teacher

- A. a student      B. a punishment      C. a syllabus      D. a school

gatecse-2019 general-aptitude verbal-aptitude most-appropriate-word one-mark

Answer key 

#### 11.6.20 Most Appropriate Word: GATE CSE 2022 | GA Question: 1



The \_\_\_\_\_ is too high for it to be considered \_\_\_\_\_.

- A. fair / fare      B. faer / fair      C. fare / fare      D. fare / fair

gatecse-2022 verbal-aptitude most-appropriate-word one-mark

Answer key 

#### 11.6.21 Most Appropriate Word: GATE CSE 2023 | GA Question: 1



We reached the station late, and \_\_\_\_\_ missed the train.

- A. near      B. nearly      C. utterly      D. mostly

gatecse-2023 verbal-aptitude most-appropriate-word one-mark

Answer key 

#### 11.6.22 Most Appropriate Word: GATE CSE 2024 | Set 1 | GA Question: 1



If '→' denotes increasing order of intensity, then the meaning of the words [dry → arid → parched] is analogous to [diet → fast → \_\_\_\_\_].

Which one of the given options is appropriate to fill the blank?

- A. starve      B. reject      C. feast      D. deny

gatecse2024-set1 verbal-aptitude most-appropriate-word one-mark

Answer key 

#### 11.6.23 Most Appropriate Word: GATE CSE 2024 | Set 1 | GA Question: 6



In the given text, the blanks are numbered (i) - (iv). Select the best match for all the blanks.

Steve was advised to keep his head \_\_\_\_\_ before heading (ii) to bat; for, while he had a head \_\_\_\_\_ batting, he could only do so with a cool head \_\_\_\_\_ his shoulders.

- A. (i) down (ii) down (iii) on (iv) for  
C. (i) down (ii) out (iii) for (iv) on
- B. (i) on (ii) down (iii) for (iv) on  
D. (i) on (ii) out (iii) on (iv) for

gatecse2024-set1 verbal-aptitude most-appropriate-word two-marks

Answer key 

#### 11.6.24 Most Appropriate Word: GATE CSE 2024 | Set 2 | GA Question: 1



If '→' denotes increasing order of intensity, then the meaning of the words [walk → jog → sprint] is analogous to [bothered → \_\_\_\_\_ → daunted].

Which one of the given options is appropriate to fill the blank?

- A. phased      B. phrased      C. fazed      D. fused

gatecse2024-set2   verbal-aptitude   most-appropriate-word   one-mark

[Answer key](#) 

#### 11.6.25 Most Appropriate Word: GATE CSE 2025 | Set 1 | GA Question: 2

The CEO's decision to downsize the workforce was considered myopic because it sacrificed long-term stability to accommodate short-term gains.

Select the most appropriate option that can replace the word "myopic" without changing the meaning of the sentence.

- A. visionary      B. shortsighted      C. progressive      D. innovative

gatecse2025-set1   verbal-aptitude   most-appropriate-word   easy   one-mark

[Answer key](#) 

#### 11.6.26 Most Appropriate Word: GATE CSE 2025 | Set 2 | GA Question: 1

Despite his initial hesitation, Rehman's \_\_\_\_\_ to contribute to the success of the project never wavered.

Select the most appropriate option to complete the above sentence.

- A. ambivalence      B. satisfaction      C. resolve      D. revolve

gatecse2025-set2   verbal-aptitude   most-appropriate-word   easy   one-mark

[Answer key](#) 

#### 11.6.27 Most Appropriate Word: GATE Chemical 2020 | GA Question: 1

Rajiv Gandhi Khel Ratna Award was conferred \_\_\_\_\_ Mary Kom, a six-time world champion in boxing, recently in a ceremony \_\_\_\_\_ the Rashtrapati Bhawan (the President's official residence) in New Delhi.

- A. with, at      B. on, in      C. on, at      D. to, at

gate2020-ch   verbal-aptitude   most-appropriate-word

[Answer key](#) 

#### 11.6.28 Most Appropriate Word: GATE Chemical 2020 | GA Question: 2

Despite a string of poor performances, the chances of *K.L. Rahul*'s selection in the team are \_\_\_\_\_

- A. slim      B. bright      C. obvious      D. uncertain

gate2020-ch   verbal-aptitude   most-appropriate-word

[Answer key](#) 

#### 11.6.29 Most Appropriate Word: GATE Civil 2020 Set 1 | GA Question: 1

It is a common criticism that most of the academicians live in their \_\_\_\_\_, so, they are not aware of their real life challenges.

- A. homes      B. ivory towers      C. glass palaces      D. big flats

gate2020-ce-1   verbal-aptitude   most-appropriate-word

[Answer key](#) 

#### 11.6.30 Most Appropriate Word: GATE Civil 2020 Set 1 | GA Question: 2

His hunger for reading is insatiable. He reads indiscriminately. He is most certainly a/an \_\_\_\_\_ reader.

- A. all-round      B. precocious      C. voracious      D. wise

gate2020-ce-1   verbal-aptitude   most-appropriate-word

[Answer key](#) 

### 11.6.31 Most Appropriate Word: GATE Civil 2020 Set 2 | GA Question: 2



Select the most appropriate word that can replace the underlined word without changing the meaning of the sentence:

Now-a-days, most children have a tendency to bewill the legitimate concerns of their parents.

- A. disparage      B. applaud      C. reduce      D. begrudge

gate2020-ce-2    verbal-aptitude    most-appropriate-word

[Answer key](#)

### 11.6.32 Most Appropriate Word: GATE Civil 2022 Set 1 | GA Question: 1



You should \_\_\_\_\_ when to say \_\_\_\_\_.

- A. no/no      B. no / know      C. know / know      D. know / no

gatecivil-2022-set1    verbal-aptitude    most-appropriate-word

[Answer key](#)

### 11.6.33 Most Appropriate Word: GATE Civil 2022 Set 2 | GA Question: 1



The movie was funny and I \_\_\_\_\_.

- A. could help laughing  
C. couldn't help laughing      B. couldn't help laughed  
D. could helped laughed

gatecivil-2022-set2    verbal-aptitude    most-appropriate-word

[Answer key](#)

### 11.6.34 Most Appropriate Word: GATE Civil 2023 Set 1 | GA Question: 1



"I have not yet decided what I will do this evening; I \_\_\_\_\_ visit a friend."

- A. mite      B. would      C. might      D. didn't

gatecivil-2023-set1    verbal-aptitude    most-appropriate-word

[Answer key](#)

### 11.6.35 Most Appropriate Word: GATE Civil 2024 Set 1 | GA Question: 1



If '→' denotes increasing order of intensity, then the meaning of the words [simmer → seethe → smolder] is analogous to [break → raze \_\_\_\_\_ → ]

Which one of the given options is appropriate to fill the blank?

- A. obfuscate      B. obliterate      C. fracture      D. fissure

gatecivil-2024-set1    most-appropriate-word    verbal-aptitude

[Answer key](#)

### 11.6.36 Most Appropriate Word: GATE Civil 2024 Set 1 | GA Question: 6



In the given text, the blanks are numbered (i)-(iv). Select the best match for all the blanks.

From the ancient Athenian arena to the modern Olympic stadiums, athletics (i) the potential for a spectacle. The crowd (ii) with bated breath as the Olympian artist twists his body, stretching the javelin behind him. Twelve strides in, he begins to cross-step. Six cross-steps (iii) in an abrupt stop on his left foot. As his body (iv) like a door turning on a hinge, the javelin is launched skyward at a precise angle.

- A. (i) hold (ii) waits (iii) culminates (iv) pivot  
B. (i) holds (ii) wait (iii) culminates (iv) pivot  
C. (i) hold (ii) wait (iii) culminate (iv) pivots  
D. (i) holds (ii) waits (iii) culminate (iv) pivots

gatecivil-2024-set1    verbal-aptitude    most-appropriate-word

[Answer key](#)

### 11.6.37 Most Appropriate Word: GATE Civil 2024 Set 2 | GA Question: 1



If '→' denotes increasing order of intensity, then the meaning of the words [drizzle → rain → downpour] is analogous to [\_\_\_\_\_ → quarrel → feud].

Which one of the given options is appropriate to fill the blank?

- A. bicker      B. bog      C. dither      D. dodge

gatecivil-2024-set2   most-appropriate-word   verbal-aptitude

[Answer key](#)

### 11.6.38 Most Appropriate Word: GATE Civil 2024 Set 2 | GA Question: 6



In the given text, the blanks are numbered (i)-(iv). Select the best match for all the blanks.

Yoko Roi stands (i) as an author for standing (ii) as an honorary fellow, after she stood (iii) her writings that stand (iv) the freedom of speech.

- A. (i) out (ii) down (iii) in (iv) for  
B. (i) down (ii) out (iii) by (iv) in  
C. (i) down (ii) out (iii) for (iv) in  
D. (i) out (ii) down (iii) by (iv) for

gatecivil-2024-set2   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.39 Most Appropriate Word: GATE DA 2025 | GA Question: 1



Courage : Bravery :: Yearning : \_\_\_\_\_.

Select the most appropriate option to complete the analogy.

- A. Longing      B. Yelling      C. Yawning      D. Glaring

gateda-2025   verbal-aptitude   most-appropriate-word   easy   one-mark

[Answer key](#)

### 11.6.40 Most Appropriate Word: GATE DS&AI 2024 | GA Question: 1



If '→' denotes increasing order of intensity, then the meaning of the words [sick → infirm → moribund] is analogous to [silly → \_\_\_\_\_ → daft].

Which one of the given options is appropriate to fill the blank?

- A. frown      B. fawn      C. vein      D. vain

gate-ds-ai-2024   verbal-aptitude   most-appropriate-word   one-mark

[Answer key](#)

### 11.6.41 Most Appropriate Word: GATE ECE 2020 | GA Question: 1



The untimely loss of life is a cause of serious global concern as thousands of people get killed \_\_\_\_\_ accidents every year while many other die \_\_\_\_\_ diseases like cardio vascular disease, cancer, etc.

- A. in, of      B. from, of      C. during, from      D. from, from

gate2020-ece   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.42 Most Appropriate Word: GATE ECE 2022 | GA Question: 1



Mr. X speaks \_\_\_\_\_ Japanese \_\_\_\_\_ Chinese.

- A. neither / or      B. either / nor      C. neither / nor      D. also / but

gateece-2022   verbal-aptitude   most-appropriate-word   easy

[Answer key](#)

#### 11.6.43 Most Appropriate Word: GATE ECE 2023 | GA Question: 1



"I cannot support this proposal. My \_\_\_\_\_ will not permit it."

- A. conscious      B. consensus      C. conscience      D. consent

gateece-2023    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.44 Most Appropriate Word: GATE ECE 2024 | GA Question: 1



If ' → ' denotes increasing order of intensity, then the meaning of the words

[ charm → enamor → bewitch] is analogous to [bored → \_\_\_\_\_ → weary]

Which one of the given options is appropriate to fill the blank?

- A. jaded      B. baffled      C. dead      D. worsted

gateece-2024    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.45 Most Appropriate Word: GATE Electrical 2020 | GA Question: 2



People were prohibited \_\_\_\_\_ their vehicles near the entrance of the main administrative building.

- A. to park      B. from parking      C. parking      D. to have parked

gate2020-ee    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.46 Most Appropriate Word: GATE Electrical 2020 | GA Question: 4



Stock markets \_\_\_\_\_ at the news of the coup.

- A. poised      B. plunged      C. plugged      D. probed

gate2020-ee    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.47 Most Appropriate Word: GATE Electrical 2022 | GA Question: 1



As you grow older, an injury to your \_\_\_\_\_ may take longer to \_\_\_\_\_.

- A. heel / heel      B. heal / heel      C. heal / heal      D. heel / heal

gate2022-ee    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.48 Most Appropriate Word: GATE Mechanical 2020 Set 1 | GA Question: 1



He is known for his unscrupulous ways. He always sheds \_\_\_\_\_ tears to deceive people.

- A. fox's      B. crocodile's      C. crocodile      D. fox

gateme-2020-set1    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.49 Most Appropriate Word: GATE Mechanical 2022 Set 1 | GA Question: 1



After playing \_\_\_\_\_ hours of tennis, I am feeling \_\_\_\_\_ tired to walk back.

- A. too/too      B. too/two      C. two/ two      D. two/too

gateme-2022-set1    verbal-aptitude    most-appropriate-word

[Answer key](#)

#### 11.6.50 Most Appropriate Word: GATE Mechanical 2022 Set 2 | GA Question: 1



Writing too many things on the \_\_\_\_\_ while teaching could make the students get \_\_\_\_\_.

- A. bored / board  
C. board / board

- B. board / bored  
D. bored / bored

gateme-2022-set2 verbal-aptitude most-appropriate-word

Answer key 

#### 11.6.51 Most Appropriate Word: GATE Mechanical 2024 | GA Question: 1



If '→' denotes increasing order of intensity, then the meaning of the words [smile → giggle → laugh] is analogous to [disapprove → \_\_\_\_\_ → chide]

Which one of the given options is appropriate to fill the blank?

- A. reprove      B. praise      C. reprise      D. grieve

gateme-2024 most-appropriate-word verbal-aptitude

Answer key 

#### 11.6.52 Most Appropriate Word: GATE Mechanical 2024 | GA Question: 6



In the given text, the blanks are numbered (i)-(iv). Select the best match for all the blanks.

Prof. P (i) merely a man who narrated funny stories. (ii) in his blackest moments he was capable of self-deprecating humor.

Prof. Q (iii) a man who hardly narrated funny stories. (iv) in his blackest moments was he able to find humor.

- A. (i) was (ii) Only (iii) wasn't (iv) Even  
B. (i) wasn't (ii) Even (iii) was (iv) Only  
C. (i) was (ii) Even (iii) wasn't (iv) Only  
D. (i) wasn't (ii) Only (iii) was (iv) Even

gateme-2024 verbal-aptitude most-appropriate-word

Answer key 

#### 11.6.53 Most Appropriate Word: GATE2010 MN: GA-3



Choose the most appropriate word from the options given below to complete the following sentence:

The committee wrote a \_\_\_\_\_ report, extolling only the strengths of the proposal.

- A. reasonable      B. supportive      C. biased      D. fragmented

general-aptitude verbal-aptitude gate2010-mn most-appropriate-word

Answer key 

#### 11.6.54 Most Appropriate Word: GATE2010 MN: GA-4



Choose the most appropriate word from the options given below to complete the following sentence:

If the country has to achieve real prosperity, it is \_\_\_\_\_ that the fruits of progress reach all, and in equal measure.

- A. inevitable      B. contingent      C. oblivious      D. imperative

general-aptitude verbal-aptitude gate2010-mn most-appropriate-word

Answer key 

#### 11.6.55 Most Appropriate Word: GATE2010 TF: GA-3



Choose the most appropriate word from the options given below to complete the following sentence:

The two child norm with \_\_\_\_\_ for the violators will have significant implications for our demographic profile.

- A. disincentives      B. incitements      C. restrictions      D. restraints

general-aptitude verbal-aptitude gate2010-tf most-appropriate-word

Answer key 

### 11.6.56 Most Appropriate Word: GATE2010 TF: GA-4



Choose the most appropriate word from the options given below to complete the following sentence:

There is no fixed relation between food and famine; famines can occur with or without a substantial \_\_\_\_\_ in food output.

- A. aberration      B. weakening      C. decline      D. deterioration

general-aptitude    verbal-aptitude    gate2010-tf    most-appropriate-word

[Answer key](#)

### 11.6.57 Most Appropriate Word: GATE2011 AG: GA-1



Choose the most appropriate word from the options given below to complete the following sentence:

Under ethical guidelines recently adopted by the India Medical Association, human genes are to be manipulated only to correct diseases for which \_\_\_\_\_ treatments are unsatisfactory.

- A. similar      B. most      C. uncommon      D. available

general-aptitude    verbal-aptitude    gate2011-ag    most-appropriate-word

[Answer key](#)

### 11.6.58 Most Appropriate Word: GATE2011 AG: GA-3



Choose the most appropriate word from the options given below to complete the following sentence:

**It was her view that the country's problem had been \_\_\_\_\_ by foreign technocrats, so that to invite them to come back would be counter-productive.**

- A. identified      B. ascertained  
C. exacerbated      D. analysed

general-aptitude    verbal-aptitude    gate2011-ag    most-appropriate-word

[Answer key](#)

### 11.6.59 Most Appropriate Word: GATE2011 GG: GA-1



Choose the most appropriate word or phrase from the options given below to complete the following sentence.

**The environmentalists hope \_\_\_\_\_ the lake to its pristine condition.**

- A. in restoring      B. in the restoration of  
C. to restore      D. restoring

gate2011-gg    verbal-aptitude    most-appropriate-word

[Answer key](#)

### 11.6.60 Most Appropriate Word: GATE2011 GG: GA-3



Choose the most appropriate word from the options given below to complete the following sentence.

**Despite the mixture's \_\_\_\_\_ nature, we found that by lowering its temperature in the laboratory we could dramatically reduce its tendency to vaporize.**

- A. acerbic      B. resilient      C. volatile      D. heterogeneous

gate2011-gg    verbal-aptitude    most-appropriate-word    normal

[Answer key](#)

### 11.6.61 Most Appropriate Word: GATE2011 GG: GA-5



Choose the most appropriate words from the options given below to complete the following sentence.

**Because she had a reputation for \_\_\_\_\_ we were surprised and pleased when she greeted us so \_\_\_\_\_.**

- A. insolence ..... irately  
C. graciousness ..... amiably      B. insouciance ..... curtly  
D. querulousness ..... affably

gate2011-gg    most-appropriate-word    verbal-aptitude

[Answer key](#)

### 11.6.62 Most Appropriate Word: GATE2011 MN: GA-57



Choose the most appropriate word(s) from the options given below to complete the following sentence.  
**We lost confidence in him because he never \_\_\_\_\_ the grandiose promises he had made.**

- A. delivered      B. delivered on      C. forgot      D. reneged on

gate2011-mn   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.63 Most Appropriate Word: GATE2011 MN: GA-58



Choose the word or phrase that best completes the sentence below.  
\_\_\_\_\_ in the frozen wastes of Arctic takes special equipment.

- A. To survive      B. Surviving      C. Survival      D. That survival

verbal-aptitude   gate2011-mn   most-appropriate-word

[Answer key](#)

### 11.6.64 Most Appropriate Word: GATE2011 MN: GA-60



Choose the most appropriate word from the options given below to complete the following sentence.

The \_\_\_\_\_ of evidence was on the side of the plaintiff since all but one witness testified that his story was correct.

- A. paucity      B. propensity      C. preponderance      D. accuracy

verbal-aptitude   gate2011-mn   most-appropriate-word

[Answer key](#)

### 11.6.65 Most Appropriate Word: GATE2012 AE: GA-3



Choose the most appropriate alternative from the options given below to complete the following sentence:

**The administrators went on to implement yet another unreasonable measure, arguing that the measures were already \_\_\_ and one more would hardly make a difference.**

- A. reflective      B. utopian      C. luxuriant      D. unpopular

gate2012-ae   most-appropriate-word   verbal-aptitude

[Answer key](#)

### 11.6.66 Most Appropriate Word: GATE2012 AE: GA-4



Choose the most appropriate alternative from the options given below to complete the following sentence:

**To those of us who had always thought him timid, his \_\_\_ came as a surprise.**

- A. intrepidity      B. inevitability      C. inability      D. inertness

gate2012-ae   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.67 Most Appropriate Word: GATE2012 AR: GA-2



Choose the most appropriate pair of words from the options given below to complete the following sentence:

The high level of \_\_\_ of the questions in the test was \_\_\_ by an increase in the period of time allotted for answering them.

- A. difficulty, compensated      B. exactitude, magnified  
C. aptitude, decreased      D. attitude, mitigated

gate2012-ar   most-appropriate-word   verbal-aptitude   normal

[Answer key](#)

### 11.6.68 Most Appropriate Word: GATE2012 CY: GA-4



Choose the most appropriate word from the options given below to complete the following sentence:

**Given the seriousness of the situation that he had to face, his \_\_\_\_\_ was impressive.**

- A. beggary      B. nomenclature      C. jealousy      D. nonchalance

gate2012-cy    most-appropriate-word

**Answer key**

### 11.6.69 Most Appropriate Word: GATE2013 CE: GA-4



Friendship, no matter how \_\_\_\_\_ it is, has its limitations.

- A. cordial      B. intimate      C. secret      D. pleasant

gate2013-ce    most-appropriate-word    verbal-aptitude

**Answer key**

### 11.6.70 Most Appropriate Word: GATE2013 EE: GA-3



Complete the sentence:

Dare \_\_\_\_\_ mistakes.

- A. commit      B. to commit      C. committed      D. committing

gate2013-ee    most-appropriate-word    easy    verbal-aptitude

**Answer key**

### 11.6.71 Most Appropriate Word: GATE2014 AE: GA-2



Choose the most appropriate word from the options given below to complete the following sentence.

One of his biggest \_\_\_\_\_ was his ability to forgive.

- A. vice      B. virtues      C. choices      D. strength

gate2014-ae    most-appropriate-word

**Answer key**

### 11.6.72 Most Appropriate Word: GATE2014 AG: GA-1



Choose the most appropriate word from the options given below to complete the following sentence. A person suffering from Alzheimer's disease \_\_\_\_\_ short-term memory loss.

- A. Experienced  
C. Is experiencing      B. Has experienced  
D. Experiences

gate2014-ag    verbal-aptitude    most-appropriate-word    normal

**Answer key**

### 11.6.73 Most Appropriate Word: GATE2014 AG: GA-2



Choose the most appropriate word from the options given below to complete the following sentence. \_\_\_\_\_ is the key to their happiness; they are satisfied with what they have.

- A. Contentment      B. Ambition      C. Perseverance      D. Hunger

gate2014-ag    verbal-aptitude    most-appropriate-word    easy

**Answer key**

### 11.6.74 Most Appropriate Word: GATE2014 EC-1: GA-3



Choose the most appropriate word from the options given below to complete the following sentence.

Many ancient cultures attributed disease to supernatural causes. However, modern science has largely helped \_\_\_\_\_ such notions.

- A. Impel      B. Dispel      C. Propel      D. Repel

gate2014-ec-1 most-appropriate-word verbal-aptitude

Answer key 

#### 11.6.75 Most Appropriate Word: GATE2014 EC-2: GA-1



Choose the most appropriate word from the options given below to complete the following sentence.

Communication and interpersonal skills are \_\_\_\_\_ important in their own ways.

- A. Each      B. Both      C. All      D. Either

gate2014-ec-2 verbal-aptitude most-appropriate-word easy

Answer key 

#### 11.6.76 Most Appropriate Word: GATE2014 EC-2: GA-3



Choose the most appropriate pair of words from the options given below to complete the following sentence.

She could not \_\_\_\_\_ the thought of \_\_\_\_\_ the election to her bitter rival.

- A. Bear, loosing  
C. Bear, losing  
B. Bare, loosing  
D. Bare, losing

gate2014-ec-2 most-appropriate-word

Answer key 

#### 11.6.77 Most Appropriate Word: GATE2014 EC-3: GA-2



The value of one U.S. dollar is 65 Indian Rupees today, compared to 60 last year. The Indian Rupee has \_\_\_\_\_.

- A. Depressed  
C. Appreciated  
B. Depreciated  
D. Stabilized

gate2014-ec-3 most-appropriate-word verbal-aptitude

Answer key 

#### 11.6.78 Most Appropriate Word: GATE2015 CE-2: GA-1



Choose the most appropriate word from the options given below to complete the following sentence.

The official answered \_\_\_\_\_ that the complaints of the citizen would be looked into.

- A. respectably      B. respectfully      C. reputably      D. respectively

gate2015-ce-2 verbal-aptitude most-appropriate-word

Answer key 

#### 11.6.79 Most Appropriate Word: GATE2015 EC-1: GA-1



Choose the most appropriate word from the options given below to complete the following sentence.

The principal presented the chief guest with a \_\_\_\_\_, as token of appreciation.

- A. momento      B. memento      C. momentum      D. moment

gate2015-ec-1 most-appropriate-word

Answer key 

#### 11.6.80 Most Appropriate Word: GATE2015 EC-1: GA-2



Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:

Frogs \_\_\_\_\_.

- A. croak      B. roar      C. hiss      D. patter

gate2015-ec-1 most-appropriate-word

Answer key 

### 11.6.81 Most Appropriate Word: GATE2015 EC-2: GA- 1



Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:

Dhoni, as well as the other team members of Indian team, \_\_\_\_\_ present on the occasion.

- A. were      B. was      C. has      D. have

gate2015-ec-2   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.82 Most Appropriate Word: GATE2015 EC-3: GA-3



Choose the correct verb to fill in the blank below:

Let us \_\_\_\_\_.

- A. introvert      B. alternate  
C. atheist      D. altruist

gate2015-ec-3   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.83 Most Appropriate Word: GATE2015 ME-3: GA-1



Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:  
Apparent lifelessness \_\_\_\_\_ dormant life.

- A. harbours      B. leads to      C. supports      D. affects

gate2015-me-3   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.84 Most Appropriate Word: GATE2015 ME-3: GA-2



Fill in the blank with the correct idiom/phrase.

That boy from the town was a \_\_\_\_\_ in the sleepy village.

- A. dog out of herd      B. sheep from the heap  
C. fish out of water      D. bird from the flock

gate2015-me-3   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.85 Most Appropriate Word: GATE2016 CE-2: GA-1



If I were you, I \_\_\_\_\_ that laptop. It's much too expensive.

- A. Won't buy      B. Shan't buy      C. Wouldn't buy      D. Would buy

gate2016-ce-2   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.86 Most Appropriate Word: GATE2016 CE-2: GA-3



Choose the most appropriate set of words from the options given below to complete the following sentence.

\_\_\_\_\_, \_\_\_\_\_ is a will, \_\_\_\_\_ is a way.

- A. Wear, there, their      B. Were, their, there  
C. Where, there, there      D. Where, their, their

gate2016-ce-2   most-appropriate-word   verbal-aptitude

[Answer key](#)

### 11.6.87 Most Appropriate Word: GATE2016 EC-1: GA-3



Despite the new medicine's \_\_\_\_\_ in treating diabetes, it is not \_\_\_\_\_ widely.

- A. effectiveness --- prescribed      B. availability --- used  
C. prescription --- available      D. acceptance --- proscribed

gate2016-ec-1   verbal-aptitude   most-appropriate-word

[Answer key](#)

### 11.6.88 Most Appropriate Word: GATE2016 EC-2: GA-2



The students \_\_\_\_\_ the teacher on teachers' day for twenty years of dedicated teaching.

- A. Facilitated      B. Felicitated      C. Fantasized      D. Facillitated

gate2016-ec-2 verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.89 Most Appropriate Word: GATE2016 ME-2: GA-1



The volume of a sphere of diameter 1 unit is \_\_\_\_\_ than the volume of a cube of side 1 unit.

- A. Least      B. Less      C. Lesser      D. Low

gate2016-me-2 verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.90 Most Appropriate Word: GATE2016 ME-2: GA-2



The unruly crowd demanded that the accused be \_\_\_\_\_ without trial.

- A. Hanged      B. Hanging      C. Hankering      D. Hung

gate2016-me-2 most-appropriate-word verbal-aptitude

[Answer key](#)

### 11.6.91 Most Appropriate Word: GATE2017 CE-1: GA-2



\_\_\_\_\_ with someone else's email account is now a very serious offence.

- A. Involving      B. Assisting      C. Tampering      D. Incubating

gate2017-ce-1 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.92 Most Appropriate Word: GATE2018 CE-1: GA-1



"The driver applied the \_\_\_\_\_ as soon as she approached the hotel where she wanted to take a \_\_\_\_\_"

- A. brake, break      B. break, brake      C. brake, brake      D. break, break

gate2018-ce-1 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.93 Most Appropriate Word: GATE2018 CE-1: GA-2



"It is no surprise that every society has had codes of behavior; however, the nature of these codes is often \_\_\_\_\_."

The word that best fills the blank in the above sentence is

- A. unpredictable      B. simple      C. expected      D. strict

gate2018-ce-1 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.94 Most Appropriate Word: GATE2018 CE-2: GA-1



"His face \_\_\_\_\_ with joy when the solution of the puzzle was \_\_\_\_\_ to him."

The words that best fill the blanks in the above sentence are

- A. shone, shown      B. shone, shone      C. shown, shone      D. shown, shown

gate2018-ce-2 verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.95 Most Appropriate Word: GATE2018 CE-2: GA-2



"Although it does contain some pioneering ideas, one would hardly characterize the work as \_\_\_\_\_."

- A. innovative
- B. simple
- C. dull
- D. boring

gate2018-ce-2 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.96 Most Appropriate Word: GATE2018 CH: GA-1



"When she fell down the \_\_\_\_\_, she received many \_\_\_\_\_ but little help."

The words that best fill the blanks in the above sentence are

- A. stairs, stares
- B. stairs, stairs
- C. stares, stairs
- D. stares, stares

gate2018-ch general-aptitude verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.97 Most Appropriate Word: GATE2018 CH: GA-2



"In spite of being warned repeatedly, he failed to correct his \_\_\_\_\_ behaviour ."

The word that best fills the blank in the above sentence is

- A. rational
- B. reasonable
- C. errant
- D. good

gate2018-ch general-aptitude verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.98 Most Appropriate Word: GATE2018 EC: GA-1



"By giving him the last \_\_\_\_\_ of the cake, you will ensure lasting \_\_\_\_\_ in our house today."

The words that best fill the blanks in the above sentence are

- A. peas, piece
- B. piece, peace
- C. peace, piece
- D. peace, peas

gate2018-ec general-aptitude verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.99 Most Appropriate Word: GATE2018 EC: GA-2



"Even though there is a vast scope for its \_\_\_\_\_, tourism has remained a/an \_\_\_\_\_ area."

The words that best fill the blanks in the above sentence are

- A. improvement, neglected
- B. rejection, approved
- C. fame, glum
- D. interest, disinterested

gate2018-ec general-aptitude verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.100 Most Appropriate Word: GATE2018 EE: GA-1



"Since you have gone off the \_\_\_\_\_, the \_\_\_\_\_ sand is likely to damage the car."

The words that best fill the blanks in the above sentence are

- A. course, coarse
- B. course, course
- C. coarse, course
- D. coarse, coarse

gate2018-ee verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.101 Most Appropriate Word: GATE2018 EE: GA-2



"A common misconception among writers is that sentence structure mirrors thought; the more \_\_\_\_\_ the structure, the more complicated the ideas."

The word that best fills the blank in the above sentence is

- A. detailed
- B. simple
- C. clear
- D. convoluted

gate2018-ee general-aptitude verbal-aptitude normal most-appropriate-word

[Answer key](#)

### 11.6.102 Most Appropriate Word: GATE2018 ME-1: GA-2

"Her \_\_\_\_\_ should not be confused with miserliness; she is ever willing to assist those in need."



The word that best fills the blank in the above sentence is

- A. cleanliness      B. punctuality      C. frugality      D. greatness

gate2018-me-1 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.103 Most Appropriate Word: GATE2018 ME-2: GA-1

"The dress \_\_\_\_\_ her so well that they all immediately \_\_\_\_\_ her on her appearance."



The words that best fill the blanks in the above sentence are

- A. complemented, complemented      B. complimented, complemented  
C. complimented, complimented      D. complemented, complimented

gate2018-me-2 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.104 Most Appropriate Word: GATE2018 ME-2: GA-2

" The judge's standing in the legal community, though shaken by false allegations of wrongdoing, remained \_\_\_\_\_ ."



The word that best fills the blank in the above sentence is

- A. undiminished      B. damaged      C. illegal      D. uncertain

gate2018-me-2 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.105 Most Appropriate Word: GATE2019 CE-1: GA-2

They have come a long way in \_\_\_\_\_ trust among the users.



- A. creating      B. created      C. creation      D. create

gate2019-ce-1 general-aptitude verbal-aptitude most-appropriate-word easy

[Answer key](#)

### 11.6.106 Most Appropriate Word: GATE2019 CE-2: GA-1

Daytime temperature in Delhi can \_\_\_\_\_ 40°C.



- A. get      B. stand      C. reach      D. peak

gate2019-ce-2 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.107 Most Appropriate Word: GATE2019 EC: GA-5

When he did not come home, she \_\_\_\_\_ him lying dead on the roadside somewhere.



- A. concluded      B. looked      C. notice      D. pictured

gate2019-ec general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.108 Most Appropriate Word: GATE2019 EE: GA-1

I am not sure if the bus that has been booked will be able to \_\_\_\_\_ all the students.



- A. sit      B. deteriorate  
C. fill      D. accommodate

gate2019-ee general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.109 Most Appropriate Word: GATE2019 EE: GA-5



Newspapers are a constant source of delight and recreation for me. The \_\_\_\_\_ trouble is that I read \_\_\_\_\_ many of them.

- A. even, quite      B. even, too      C. only, quite      D. only, too

gate2019-ee general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.110 Most Appropriate Word: GATE2019 ME-1: GA-1



John Thomas, an \_\_\_\_\_ writer, passed away in 2018.

- A. imminent      B. prominent      C. eminent      D. dominant

gate2019-me-1 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.111 Most Appropriate Word: GATE2019 ME-1: GA-5



The minister avoided any mention of the issue of women's reservation in the private sector. He was accused of \_\_\_\_\_ the issue.

- A. collaring      B. skirting      C. tying      D. belting

gate2019-me-1 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.112 Most Appropriate Word: GATE2019 ME-2: GA-2



A final examination is the \_\_\_\_\_ of a series of evaluations that a student has to go through

- A. culmination      B. consultation      C. desperation      D. insinuation

gate2019-me-2 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

### 11.6.113 Most Appropriate Word: GATE2019 ME-2: GA-5



Are there enough seats here? There are \_\_\_\_\_ people here than I expected

- A. many      B. most      C. least      D. more

gate2019-me-2 general-aptitude verbal-aptitude most-appropriate-word

[Answer key](#)

## 11.7

### Narrative Sequencing (1)

#### 11.7.1 Narrative Sequencing: GATE DA 2025 | GA Question: 6



Column-I has statements made by Shanthala; and, Column-II has responses given by Kanishk.

	<b>Column-I</b>		<b>Column-II</b>
P.	This house is in a mess.	1.	Alright, I won't bring it up during our conversations.
Q.	I am not happy with the marks given to me.	2.	Well, you can easily look it up.
R.	Politics is a subject I avoid talking about.	3.	No problem, let me clear it up for you.
S.	I don't know what this word means.	4.	Don't worry, I will take it up with your teacher.

Identify the option that has the correct match between Column-I and Column-II.

- A. P – 2; Q – 3; R – 1; S – 4
- B. P – 3; Q – 4; R – 1; S – 2
- C. P – 4; Q – 1; R – 2; S – 3
- D. P – 1; Q – 2; R – 4; S – 3

gateda-2025 verbal-aptitude narrative-sequencing two-marks

[Answer key](#)

11.8

### Noun Verb Adjective (3)

#### 11.8.1 Noun Verb Adjective: GATE2014 EC-3: GA-3



'Advice' is \_\_\_\_\_.

- A. A verb
- B. A noun
- C. An adjective
- D. Both a verb and a noun

gate2014-ec-3 verbal-aptitude noun-verb-adjective

[Answer key](#)

#### 11.8.2 Noun Verb Adjective: GATE2015 EC-2: GA- 3



What is the adverb for the given word below?

Misogynous

- A. Misogynousness
- B. Misogyny
- C. Misogynously
- D. Misogynous

gate2015-ec-2 verbal-aptitude noun-verb-adjective

[Answer key](#)

#### 11.8.3 Noun Verb Adjective: GATE2017 ME-1: GA-1



He was one of my best \_\_\_\_\_ and I felt his loss \_\_\_\_\_.

- A. friend, keenly
- B. friends, keen
- C. friend, keener
- D. friends, keenly

gate2017-me-1 general-aptitude verbal-aptitude noun-verb-adjective

[Answer key](#)

11.9

### Opposite (5)

#### 11.9.1 Opposite: GATE CSE 2011 | Question: 60



Choose the word from the options given below that is most nearly opposite in the meaning to the given word

**Amalgamate**

- A. merge
- B. split
- C. collect
- D. separate

gatecse-2011 verbal-aptitude opposite normal

[Answer key](#)

#### 11.9.2 Opposite: GATE CSE 2014 Set 3 | Question: GA-3



Choose the word that is opposite in meaning to the word "coherent".

- A. sticky
- B. well-connected
- C. rambling
- D. friendly

gatecse-2014-set3 verbal-aptitude opposite easy

[Answer key](#)

#### 11.9.3 Opposite: GATE2011 AG: GA-2



Choose the word from the questions given below that is most nearly opposite in meaning to the given word:

**Frequency**

- A. periodicity      B. rarity      C. gradualness      D. persistency

general-aptitude    verbal-aptitude    gate2011-ag    opposite

Answer key 

#### 11.9.4 Opposite: GATE2011 GG: GA-2



Choose the word from the options given below that is most nearly opposite in meaning to the given word:

##### Polemical

- A. imitative      B. conciliatory      C. truthful      D. ideological

gate2011-gg    verbal-aptitude    opposite

Answer key 

#### 11.9.5 Opposite: GATE2011 MN: GA-56



Choose the word from the options given below that is most nearly opposite in meaning to the given word:

##### Deference

- A. aversion      B. resignation      C. suspicion      D. contempt

verbal-aptitude    gate2011-mn    opposite

Answer key 

#### 11.10

#### Passage Reading (57)

##### 11.10.1 Passage Reading: GATE CH 2023 | GA Question: 4



In 2022, June Huh was awarded the Fields medal, which is the highest prize in Mathematics.

When he was younger, he was also a poet. He did not win any medals in the International Mathematics Olympiads. He dropped out of college.

Based only on the above information, which one of the following statements can be logically inferred with *certainty*?

- A. Every Fields medalist has won a medal in an International Mathematics Olympiad.
- B. Everyone who has dropped out of college has won the Fields medal.
- C. All Fields medalists are part-time poets.
- D. Some Fields medalists have dropped out of college.

gatech-2023    verbal-aptitude    passage-reading

Answer key 

##### 11.10.2 Passage Reading: GATE CH 2023 | GA Question: 8



The World Bank has declared that it does not plan to offer new financing to Sri Lanka, which is battling its worst economic crisis in decades, until the country has an adequate macroeconomic policy framework in place. In a statement, the World Bank said Sri Lanka needed to adopt structural reforms that focus on economic stabilisation and tackle the root causes of its crisis. The latter has starved it of foreign exchange and led to shortages of food, fuel, and medicines. The bank is repurposing resources under existing loans to help alleviate shortages of essential items such as medicine, cooking gas, fertiliser, meals for children, and cash for vulnerable households.

Based only on the above passage, which one of the following statements can be inferred with *certainty*?

- A. According to the World Bank, the root cause of Sri Lanka's economic crisis is that it does not have enough foreign exchange.
- B. The World Bank has stated that it will advise the Sri Lankan government about how to tackle the root causes of its economic crisis.
- C. According to the World Bank, Sri Lanka does not yet have an adequate macroeconomic policy framework.
- D. The World Bank has stated that it will provide Sri Lanka with additional funds for essentials such as food, fuel, and medicines.

gatech-2023    verbal-aptitude    passage-reading

Answer key 

### 11.10.3 Passage Reading: GATE CSE 2010 | Question: 63



**Modern warfare has changed from large scale clashes of armies to suppression of civilian populations. Chemical agents that do their work silently appear to be suited to such warfare; and regrettably, there exist people in military establishments who think that chemical agents are useful tools for their cause.**

Which of the following statements best sums up the meaning of the above passage:

- A. Modern warfare has resulted in civil strife.
- B. Chemical agents are useful in modern warfare.
- C. Use of chemical agents in warfare would be undesirable.
- D. People in military establishments like to use chemical agents in war.

gatecse-2010 verbal-aptitude passage-reading normal

[Answer key](#)

### 11.10.4 Passage Reading: GATE CSE 2011 | Question: 61



**Few school curricula include a unit on how to deal with bereavement and grief, and yet all students at some point in their lives suffer from losses through death and parting.**

Based on the above passage which topic would not be included in a unit on bereavement?

- A. how to write a letter of condolence
- B. what emotional stages are passed through in the healing process
- C. what the leading causes of death are
- D. how to give support to a grieving friend

gatecse-2011 verbal-aptitude passage-reading normal

[Answer key](#)

### 11.10.5 Passage Reading: GATE CSE 2013 | Question: 63



After several defeats in wars, Robert Bruce went in exile and wanted to commit suicide. Just before committing suicide, he came across a spider attempting tirelessly to have its net. Time and again, the spider failed but that did not deter it to refrain from making attempts. Such attempts by the spider made Bruce curious. Thus, Bruce started observing the near-impossible goal of the spider to have the net. Ultimately, the spider succeeded in having its net despite several failures. Such act of the spider encouraged Bruce not to commit suicide. And then, Bruce went back again and won many a battle, and the rest is history.

Which one of the following assertions is best supported by the above information?

- |  |   |
|--|---|
| A. Failure is the pillar of success.     | B. Honesty is the best policy.            |
| C. Life begins and ends with adventures. | D. No adversity justifies giving up hope. |

gatecse-2013 verbal-aptitude passage-reading normal

[Answer key](#)

### 11.10.6 Passage Reading: GATE CSE 2014 Set 1 | Question: GA-6



The Palghat Gap (or Palakkad Gap) , a region about 30 km wide in the southern part of the Western Ghats in India, is lower than the hilly terrain to its north and south. The exact reasons for the formation of this gap are not clear. It results in the neighbouring regions of Tamil Nadu getting more rainfall from the South West monsoon and the neighbouring regions of Kerala having higher summer temperatures.

What can be inferred from this passage?

Select one:

- A. The Palghat gap is caused by high rainfall and high temperatures in southern Tamil Nadu and Kerala
- B. The regions in Tamil Nadu and Kerala that are near the Palghat Gap are low-lying
- C. The low terrain of the Palghat Gap has a significant impact on weather patterns in neighbouring parts of Tamil Nadu and Kerala
- D. Higher summer temperatures result in higher rainfall near the Palghat Gap area

**Answer key****11.10.7 Passage Reading: GATE CSE 2014 Set 2 | Question: GA-6**

The old city of Koenigsberg, which had a German majority population before World War 2, is now called Kaliningrad. After the events of the war, Kaliningrad is now a Russian territory and has a predominantly Russian population. It is bordered by the Baltic Sea on the north and the countries of Poland to the south and west and Lithuania to the east respectively. Which of the statements below can be inferred from this passage?

- A. Kaliningrad was historically Russian in its ethnic make up
- B. Kaliningrad is a part of Russia despite it not being contiguous with the rest of Russia
- C. Koenigsberg was renamed Kaliningrad, as that was its original Russian name
- D. Poland and Lithuania are on the route from Kaliningrad to the rest of Russia

**Answer key****11.10.8 Passage Reading: GATE CSE 2014 Set 2 | Question: GA-7**

Number of people diagnosed with dengue fever (contracted from the bite of a mosquito) in North India is twice the number diagnosed last year. Municipal authorities have concluded that measures to control the mosquito population have failed in this region.

Which one of the following statements, if true, does not contradict this conclusion?

- A. A high proportion of the affected population has returned from neighbouring countries where dengue is prevalent
- B. More cases of dengue are now reported because of an increase in the Municipal Office's administrative efficiency
- C. Many more cases of dengue are being diagnosed this year since the introduction of a new and effective diagnostic test
- D. The number of people with malarial fever (also contracted from mosquito bites) has increased this year

**Answer key****11.10.9 Passage Reading: GATE CSE 2014 Set 3 | Question: GA-6**

A dance programme is scheduled for 10.00 a.m. Some students are participating in the programme and they need to come an hour earlier than the start of the event. These students should be accompanied by a parent. Other students and parents should come in time for the programme. The instruction you think that is appropriate for this is

- A. Students should come at 9.00 a.m. and parents should come at 10.00 a.m.
- B. Participating students should come at 9.00 a.m. accompanied by a parent, and other parents and students should come by 10.00 a.m.
- C. Students who are not participating should come by 10.00 a.m. and they should not bring their parents. Participating students should come at 9.00 a.m.
- D. Participating students should come before 9.00 a.m. Parents who accompany them should come at 9.00 a.m. All others should come at 10.00 a.m.

**Answer key****11.10.10 Passage Reading: GATE CSE 2014 Set 3 | Question: GA-7**

By the beginning of the 20<sup>th</sup> century, several hypotheses were being proposed, suggesting a paradigm shift in our understanding of the universe. However, the clinching evidence was provided by experimental measurements of the position of a star which was directly behind our sun.

Which of the following inference(s) may be drawn from the above passage?

- i. Our understanding of the universe changes based on the positions of stars
- ii. Paradigm shifts usually occur at the beginning of centuries
- iii. Stars are important objects in the universe
- iv. Experimental evidence was important in confirming this paradigm shift

A. i, ii and iv

B. iii only

C. i and iv

D. iv only

gatecse-2014-set3 verbal-aptitude passage-reading easy

Answer key 



#### 11.10.11 Passage Reading: GATE CSE 2015 Set 3 | Question: GA-9

Most experts feel that in spite of possessing all the technical skills required to be a batsman of the highest order, he is unlikely to be so due to lack of requisite temperament. He was guilty of throwing away his wicket several times after working hard to lay a strong foundation. His critics pointed out that until he addressed his problem, success at the highest level will continue to elude him.

Which of the statement(s) below is/are logically valid and can be inferred from the above passage?

- i. He was already a successful batsman at the highest level.
- ii. He was to improve his temperament in order to become a great batsman.
- iii. He failed to make many of his good starts count.
- iv. Improving his technical skills will guarantee success.

A. iii and iv

B. ii and iii

C. i, ii and iii

D. ii only

gatecse-2015-set3 verbal-aptitude normal passage-reading

Answer key 



#### 11.10.12 Passage Reading: GATE CSE 2016 Set 2 | Question: GA-07

Computers were invented for performing only high-end useful computations. However, it is no understatement that they have taken over our world today. The internet, for example, is ubiquitous. Many believe that the internet itself is an unintended consequence of the original invention. With the advent of mobile computing on our phones, a whole new dimension is now enabled. One is left wondering if all these developments are good or, more importantly, required.

Which of the statement(s) below is/are logically valid and can be inferred from the above paragraph?

- (i) The author believes that computers are not good for us.
- (ii) Mobile computers and the internet are both intended inventions.

A. (i) only

C. Both (i) and (ii)

B. (ii) only

D. Neither (i) nor (ii)

gatecse-2016-set2 verbal-aptitude passage-reading normal

Answer key 



#### 11.10.13 Passage Reading: GATE CSE 2017 Set 1 | Question: GA-6

"The hold of the nationalist imagination on our colonial past is such that anything inadequately or improperly nationalist is just not history."

Which of the following statements best reflects the author's opinion?

- A. Nationalists are highly imaginative.
- B. History is viewed through the filter of nationalism.
- C. Our colonial past never happened.
- D. Nationalism has to be both adequately and properly imagined.

gatecse-2017-set1 general-aptitude verbal-aptitude passage-reading

Answer key 



#### 11.10.14 Passage Reading: GATE CSE 2022 | GA Question: 6

Some people believe that "what gets measured, improves". Some others believe that "what gets measured, gets gamed". One possible reason for the difference in the beliefs is the work culture in organizations. In organizations with good work culture, metrics help improve outcomes. However, the same metrics are counterproductive in organizations with poor work culture.

Which one of the following is the CORRECT logical inference based on the information in the above passage?

- A. Metrics are useful in organizations with poor work culture
- B. Metrics are useful in organizations with good work culture
- C. Metrics are always counterproductive in organizations with good work culture

D. Metrics are never useful in organizations with good work culture

gatecse-2022 verbal-aptitude passage-reading two-marks

Answer key 

#### 11.10.15 Passage Reading: GATE CSE 2025 | Set 1 | GA Question: 6



"I put the brown paper in my pocket along with the chalks, and possibly other things. I suppose every one must have reflected how primeval and how poetical are the things that one carries in one's pocket: the pocket-knife, for instance the type of all human tools, the infant of the sword. Once I planned to write a book of poems entirely about the things in my pocket. But I found it would be too long: and the age of the great epics is past."  
(From G.K. Chesterton's "A Piece of Chalk")

Based only on the information provided in the above passage, which one of the following statements is true?

- A. The author of the passage carries a mirror in his pocket to reflect upon things.
- B. The author of the passage had decided to write a poem on epics.
- C. The pocket-knife is described as the infant of the sword.
- D. Epics are described as too inconvenient to write.

gatecse2025-set1 verbal-aptitude passage-reading two-marks

#### 11.10.16 Passage Reading: GATE Civil 2022 Set 1 | GA Question: 6



Healthy eating is a critical component of healthy aging. When should one start eating healthy? It turns out that it is never too early. For example, babies who start eating healthy in the first year are more likely to have better overall health as they get older.

Which one of the following is the CORRECT logical inference based on the information in the above passage?

- A. Healthy eating is important for those with good health conditions, but not for others
- B. Eating healthy can be started at any age, earlier the better
- C. Eating healthy and better overall health are more correlated at a young age, but not older age
- D. Healthy eating is more important for adults than kids

gatecivil-2022-set1 verbal-aptitude passage-reading

Answer key 

#### 11.10.17 Passage Reading: GATE Civil 2022 Set 2 | GA Question: 6



In the last few years, several new shopping malls were opened in the city. The total number of visitors in the malls is impressive. However, the total revenue generated through sales in the shops in these malls is generally low.

Which one of the following is the CORRECT logical inference based on the information in the above passage?

- A. Fewer people are visiting the malls but spending more
- B. More people are visiting the malls but not spending enough
- C. More people are visiting the malls and spending more
- D. Fewer people are visiting the malls and not spending enough

gatecivil-2022-set2 verbal-aptitude passage-reading

Answer key 

#### 11.10.18 Passage Reading: GATE Civil 2023 Set 1 | GA Question: 8



The James Webb telescope, recently launched in space, is giving humankind unprecedented access to the depths of time by imaging very old stars formed almost 13 billion years ago. Astrophysicists and cosmologists believe that this odyssey in space may even shed light on the existence of dark matter. Dark matter is supposed to interact only via the gravitational interaction and not through the electromagnetic-, the weak- or the strong-interaction. This may justify the epithet "dark" in dark matter.

Based on the above paragraph, which one of the following statements is FALSE?

- A. No other telescope has captured images of stars older than those captured by the James Webb telescope.
- B. People other than astrophysicists and cosmologists may also believe in the existence of dark matter.
- C. The James Webb telescope could be of use in the research on dark matter.

D. If dark matter was known to interact via the strong-interaction, then the epithet "dark" would be justified.

gatecivil-2023-set1 verbal-aptitude passage-reading

Answer key 

#### 11.10.19 Passage Reading: GATE Civil 2023 Set 2 | GA Question: 8



Based only on the following passage, which one of the options can be inferred with *certainty*?

When the congregation sang together, Apenyo would also join, though her little screams were not quite audible because of the group singing. But whenever there was a special number, trouble would begin; Apenyo would try singing along, much to the embarrassment of her mother. After two or three such mortifying Sunday evenings, the mother stopped going to church altogether until Apenyo became older and learnt to behave.

At home too, Apenyo never kept quiet; she hummed or made up silly songs to sing by herself, which annoyed her mother at times but most often made her become pensive. She was by now convinced that her daughter had inherited her love of singing from her father who had died unexpectedly away from home.

[Excerpt from *These Hills Called Home* by Temsula Ao]

- A. The mother was embarrassed about her daughter's singing at home.
- B. The mother's feelings about her daughter's singing at home were only of annoyance.
- C. The mother was not sure if Apenyo had inherited her love of singing from her father.
- D. When Apenyo hummed at home, her mother tended to become thoughtful.

gatecivil-2023-set2 verbal-aptitude passage-reading

Answer key 

#### 11.10.20 Passage Reading: GATE ECE 2023 | GA Question: 8



Which one of the following options can be inferred from the given passage alone?

When I was a kid, I was partial to stories about other worlds and interplanetary travel. I used to imagine that I could just gaze off into space and be whisked to another planet.

[Excerpt from *The Truth about Stories* by T. King]

- A. It is a child's description of what he or she likes.
- B. It is an adult's memory of what he or she liked as a child.
- C. The child in the passage read stories about interplanetary travel only in parts.
- D. It teaches us that stories are good for children.

gateece-2023 verbal-aptitude passage-reading

Answer key 

#### 11.10.21 Passage Reading: GATE Electrical 2023 | GA Question: 8



Which one of the options does NOT describe the passage below or follow from it?

We tend to think of cancer as a 'modern' illness because its metaphors are so modern. It is a disease of overproduction, of sudden growth, a growth that is unstoppable, tipped into the abyss of no control. Modern cell biology encourages us to imagine the cell as a molecular machine. Cancer is that machine unable to quench its initial command (to grow) and thus transform into an indestructible, self-propelled automaton.

[Adapted from *The Emperor of All Maladies* by Siddhartha Mukherjee]

- A. It is a reflection of why cancer seems so modern to most of us.
- B. It tells us that modern cell biology uses and promotes metaphors of machinery.
- C. Modern cell biology encourages metaphors of machinery, and cancer is often imagined as a machine.
- D. Modern cell biology never uses figurative language, such as metaphors, to describe or explain anything.

gate2023-ee verbal-aptitude passage-reading

Answer key 

### 11.10.22 Passage Reading: GATE Mechanical 2022 Set 1 | GA Question: 6



Humans are naturally compassionate and honest. In a study using strategically placed wallets that appear "lost", it was found that wallets with money are more likely to be returned than wallets without money. Similarly, wallets that had a key and money are more likely to be returned than wallets with the same amount of money alone. This suggests that the primary reason for this behavior is compassion and empathy.

Which one of the following is the CORRECT logical inference based on the information in the above passage?

- A. Wallets with a key are more likely to be returned because people do not care about money
- B. Wallets with a key are more likely to be returned because people relate to suffering of others
- C. Wallets used in experiments are more likely to be returned than wallets that are really lost
- D. Money is always more important than keys

gateme-2022-set1 verbal-aptitude passage-reading

Answer key

### 11.10.23 Passage Reading: GATE Mechanical 2022 Set 2 | GA Question: 6



Fish belonging to species S in the deep sea have skins that are extremely black (ultra-black skin). This helps them not only to avoid predators but also sneakily attack their prey. However, having this extra layer of black pigment results in lower collagen on their skin, making their skin more fragile.

Which one of the following is the CORRECT logical inference based on the information in the above passage?

- A. Having ultra-black skin is only advantageous to species S
- B. Species S with lower collagen in their skin are at an advantage because it helps them avoid predators
- C. Having ultra-black skin has both advantages and disadvantages to species S
- D. Having ultra-black skin is only disadvantageous to species S but advantageous only to their predators

gateme-2022-set2 verbal-aptitude passage-reading

Answer key

### 11.10.24 Passage Reading: GATE2010 MN: GA-6



The ban on smoking in designated public places can save a large number of people from the well-known effects of environmental tobacco smoke. Passive smoking seriously impairs respiratory health. The ban rightly seeks to protect non-smokers from its ill effects.

Which of the following statements best sums up the meaning of the above passage:

- A. Effects of environmental tobacco are well known.
- B. The ban on smoking in public places protects the non-smokers.
- C. Passive smoking is bad for health.
- D. The ban on smoking in public places excludes passive smoking.

passage-reading verbal-aptitude gate2010-mn

Answer key

### 11.10.25 Passage Reading: GATE2010 TF: GA-6



It has taken fifty-six long and frustrating, years to turn bronze, into gold for India's Olympics aspirations. Beijing 2008 marks a defining moment in India's Olympic history. From Delhi to Beijing is a long journey but one that our Olympians have undertaken with courage.

Which of the following statement best sums up the meaning of the above passage:

- A. India's participation in Olympics has been frustrating.
- B. Beijing Olympics was a landmark in India's Olympic history.
- C. Our Olympians have undertaken a long journey to Beijing.
- D. India's bronze medal turned into gold at Beijing.

general-aptitude verbal-aptitude gate2010-tf passage-reading

Answer key

#### 11.10.26 Passage Reading: GATE2011 AG: GA-10

The horse has played a little known but very important role in the field of medicine. Horses were injected with toxins of diseases until their blood built up immunities. Then a serum was made from their blood. Serums to fight with diphtheria and tetanus were developed this way.

It can be inferred from the passage, that horses were

- A. given immunity to diseases
- B. generally quite immune to diseases
- C. given medicines to fight toxins
- D. given diphtheria and tetanus serums

general-aptitude verbal-aptitude gate2011-ag passage-reading

Answer key 

#### 11.10.27 Passage Reading: GATE2011 GG: GA-10

In order to develop to full potential, a baby needs to be physically able to respond to the environment.

It can be inferred from the passage that

- A. Full physical potential is needed in order for a baby to be able to respond to the environment.
- B. It is necessary for a baby to be able to physically respond to the environment for it to develop its full potential.
- C. Response to the environment of physically able babies needs to be developed to its full potential.
- D. A physically able baby needs to develop its full potential in order to respond to its environment.

gate2011-gg logical-reasoning passage-reading

Answer key 

#### 11.10.28 Passage Reading: GATE2011 MN: GA-65

Nimbus clouds are dark and ragged, stratus clouds appear dull in colour and cover the entire sky. Cirrus clouds are thin and delicate, whereas cumulus clouds look like cotton balls.

It can be inferred from the passage that

- A. A cumulus cloud on the ground is called fog
- B. It is easy to predict the weather by studying clouds
- C. Clouds are generally of very different shapes, sizes and mass
- D. There are four basic cloud types: stratus, nimbus, cumulus and cirrus

gate2011-mn verbal-aptitude passage-reading

Answer key 

#### 11.10.29 Passage Reading: GATE2012 AE: GA-10

In the early nineteenth century, theories of social evolution were inspired less by Biology than by the conviction of social scientists that there was a growing improvement in social institutions. Progress was taken for granted and social scientists attempted to discover its laws and phases.

Which one of the following inferences may be drawn with the greatest accuracy from the above passage?  
Social scientists

- A. did not question that progress was a fact.
- B. did not approve of Biology.
- C. framed the laws of progress.
- D. emphasized Biology over Social Sciences.

gate2012-ae verbal-aptitude passage-reading

Answer key 

#### 11.10.30 Passage Reading: GATE2012 AR: GA-10

The documents expose the cynicism of the government officials – and yet as the media website reflects, not a single newspaper has reported on their existence.

Which one of the following inferences may be drawn with the greatest accuracy from the above passage?

- A. Nobody other than the government officials knew about the existence of the documents.  
B. Newspapers did report about the documents but nobody cared.  
C. Media reports did not show the existence of the documents.  
D. The documents reveal the attitude of the government officials.

gate2012-ar verbal-aptitude passage-reading

Answer key 

#### 11.10.31 Passage Reading: GATE2012 CY: GA-6

**One of the legacies of the Roman legions was discipline. In the legions, military law prevailed and discipline was brutal. Discipline on the battlefield kept units obedient, intact and fighting, even when the odds and conditions were against them.**



Which one of the following statements best sums up the meaning of the above passage?

- A. Thorough regimentation was the main reason for the efficiency of the Roman legions even in adverse circumstances.  
B. The legions were treated inhumanly as if the men were animals.  
C. Discipline was the armies' inheritance from their seniors.  
D. The harsh discipline to which the legions were subjected led to the odds and conditions being against them.

gate2012-cy verbal-aptitude passage-reading

Answer key 

#### 11.10.32 Passage Reading: GATE2014 AE: GA-3

Rajan was not happy that Sajan decided to do the project on his own. On observing his unhappiness, Sajan explained to Rajan that he preferred to work independently.



Which one of the statements below is logically valid and can be inferred from the above sentences?

- A. Rajan has decided to work only in a group.  
B. Rajan and Sajan were formed into a group against their wishes.  
C. Sajan had decided to give in to Rajan's request to work with him.  
D. Rajan had believed that Sajan and he would be working together.

gate2014-ae passage-reading logical-reasoning

Answer key 

#### 11.10.33 Passage Reading: GATE2014 AG: GA-7

Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and thus great care was taken to avoid letting any point bias the analysis. From "BIG DATA" Viktor Mayer-Schonberger and Kenneth Cukier. The main point of the paragraph is:

- A. The twenty-first century is a digital world  
B. Big data is obsessed with exactness  
C. Exactitude is not critical in dealing with big data  
D. Sparse data leads to a bias in the analysis

gate2014-ag verbal-aptitude passage-reading normal

Answer key 

#### 11.10.34 Passage Reading: GATE2014 EC-1: GA-7

For submitting tax returns, all resident males with annual income below Rs 10 lakh should fill up Form *P* and all resident females with income below Rs 8 lakh should fill up Form *Q*. All people with incomes above Rs 10 lakh should fill up Form *R*, except non residents with income above Rs 15 lakhs, who should fill up Form *S*. All others should fill Form *T*. An example of a person who should fill Form *T* is

- A. A resident male with annual income Rs 9 lakh



- B. A resident female with annual income Rs 9 lakh
- C. A non-resident male with annual income Rs 16 lakh
- D. A non-resident female with annual income Rs 16 lakh

gate2014-ec-1 verbal-aptitude passage-reading normal

Answer key 



#### 11.10.35 Passage Reading: GATE2015 EC-1: GA-7

Read the following paragraph and choose the correct statement.

Climate change has reduced human security and threatened human well being. An ignored reality of human progress is that human security largely depends upon environmental security. But on the contrary, human progress seems contradictory to environmental security. To keep up both at the required level is a challenge to be addressed by one and all. One of the ways to curb the climate change may be suitable scientific innovations, while the other may be the Gandhian perspective on small scale progress with focus on sustainability.

- A. Human progress and security are positively associated with environmental security.
- B. Human progress is contradictory to environmental security.
- C. Human security is contradictory to environmental security.
- D. Human progress depends upon environmental security

gate2015-ec-1 general-aptitude verbal-aptitude passage-reading

Answer key 



#### 11.10.36 Passage Reading: GATE2015 EC-3: GA-10

Ms. *X* will be in Bagdogra from 01/05/2014 to 20/05/2014 and from 22/05/2014 to 31/05/2014. On the morning of 21/05/2014, she will reach Kochi via Mumbai.

Which one of the statements below is logically valid and can be inferred from the above sentences?

- A. Ms. *X* will be in Kochi for one day, only in May.
- B. Ms. *X* will be in Kochi for only one day in May.
- C. Ms. *X* will be only in Kochi for one day in May.
- D. Only Ms. *X* will be in Kochi for one day in May.

gate2015-ec-3 verbal-aptitude passage-reading

Answer key 



#### 11.10.37 Passage Reading: GATE2016 CE-2: GA-7

Today, we consider Ashoka as a great ruler because of the copious evidence he left behind in the form of stone carved edicts. Historians tend to correlate greatness of a king at his time with the availability of evidence today.

Which of the following can be logically inferred from the above sentences?

- A. Emperors who do not leave significant sculpted evidence are completely forgotten.
- B. Ashoka produced stone carved edicts to ensure that later historians will respect him.
- C. Statues of kings are a reminder of their greatness.
- D. A king's greatness, as we know him today, is interpreted by historians.

gate2016-ce-2 passage-reading verbal-aptitude

Answer key 



#### 11.10.38 Passage Reading: GATE2016 EC-2: GA-7

Social science disciplines were in existence in an amorphous form until the colonial period when they were institutionalized. In varying degrees, they were intended to further the colonial interest. In the time of globalization and the economic rise of postcolonial countries like India, conventional ways of Knowledge production have become obsolete.

Which of the following can be logically inferred from the above statements?

- (i) Social science disciplines have become obsolete.
- (ii) Social science disciplines had a pre-colonial origin.



(iii) Social science disciplines always promote colonialism.

(iv) Social science must maintain disciplinary boundaries.

A. (ii) only

C. (ii) and (iv) only.

B. (i) and (iii) only.

D. (iii) and (iv) only.

gate2016-ec-2 logical-reasoning passage-reading

Answer key 

#### 11.10.39 Passage Reading: GATE2016 EC-3: GA-7

The overwhelming number of people infected with rabies in India has been flagged by the World Health Organization as a source of concern. It is estimated that inoculating 70% of pets and stray dogs against rabies can lead to a significant reduction in the number of people infected with rabies.

Which of the following can be logically inferred from the above sentences?

A. The number of people in India infected with rabies is high.

B. The number of people in other parts of the world who are infected with rabies is low.

C. Rabies can be eradicated in India by vaccinating 70% of stray dogs.

D. Stray dogs are the main source of rabies worldwide.

gate2016-ec-3 verbal-aptitude passage-reading

Answer key 

#### 11.10.40 Passage Reading: GATE2017 CE-1: GA-6

The old concert hall was demolished because of fears that the foundation would be affected by the construction of the new metro line in the area. Modern technology for underground metro construction tried to mitigate the impact of pressurized air pockets created by the excavation of large amounts of soil. But even with these safeguards, it was feared the soil below the concert hall would not be stable.

From this, one can infer that

- A. the foundations of old buildings create pressurized air pockets underground, which are difficult to handle during metro construction.
- B. metro construction has to be done carefully considering its impact on the foundations of existing buildings.
- C. old buildings in an area from an impossible hurdle to metro construction in that area.
- D. pressurized air can be used to excavate large amount of soil from underground areas.

gate2017-ce-1 general-aptitude verbal-aptitude passage-reading

Answer key 

#### 11.10.41 Passage Reading: GATE2017 CE-2: GA-6

Bhaichung was observing the pattern of people entering and leaving a car service centre. There was a single window where customers were being served. He saw that people inevitably came out of the centre in the order that they went in. However, the time they spent inside seemed to vary a lot: some people came out in a matter of minutes while for others it took much longer.

From this, what can conclude?

- A. The centre operators on a first-come-first-served basis, but with variable service times, depending on specific customer needs.
- B. Customers were served in an arbitrary order, since they took varying amounts of time for service completion in the centre.
- C. Since some people came out within a few minutes of entering the centre, the system is likely to operate on a last-come-first-served basis.
- D. Entering the centre early ensured that one would have shorter service times and most people attempted to do this.

gate2017-ce-2 verbal-aptitude passage-reading

Answer key 

#### 11.10.42 Passage Reading: GATE2017 CE-2: GA-7

A map shows the elevations of Darjeeling, Gangtok, Kalimpong, Pelling, and Siliguri. Kalimpong is at a lower

elevation than Gangtok, Pelling is at a lower elevation than Gantok. Pelling is at a higher elevation than Siliguri. Darjeeling is at a higher elevation than Gangtok.

Which of the following statement can be inferred from the paragraph above?

- i. Pelling is at a higher elevation than Kalimpong
- ii. Kalimpong is at a lower elevation than Darjeeling
- iii. Kalimpong is at a higher elevation than Siliguri
- iv. Siliguri is at a lower elevation than Gangtok

- A. Only ii      B. Only ii and iii      C. Only ii and iv      D. Only iii and iv

gate2017-ce-2   verbal-aptitude   passage-reading   logical-reasoning

[Answer key](#) 

#### 11.10.43 Passage Reading: GATE2017 EC-2: GA-6

"If you are looking for a history of India, or for an account of the rise and fall of the British Raj, or for all reason of the cleaving of the subcontinent into two mutually antagonistic parts and the effects this mutilation will have in the respective sections, and ultimately on Asia, you will not find it in these pages; for though I have spent a lifetime in the country, I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for impartial recording of these matters".

Which of the following statements best reflects the author's opinion?

- A. An intimate association does not allow for the necessary perspective.
- B. Matters are recorded with an impartial perspective.
- C. An intimate association offers an impartial perspective.
- D. Actors are typically associated with the impartial recording of matters.

gate2017-ec-2   general-aptitude   verbal-aptitude   passage-reading

[Answer key](#) 

#### 11.10.44 Passage Reading: GATE2017 ME-1: GA-6

"Here, throughout the early 1820s, Stuart continued to fight his losing battle to allow his sepoys to wear their caste-marks and their own choice of facial hair on parade, being again reprimanded by the commander-in-chief. His retort that 'A stronger instance than this of European prejudice with relation to this country has never come under my observations' had no effect on his superiors."

According to this paragraph, which of the statements below is most accurate?

- A. Stuart's commander-in-chief was moved by this demonstration of his prejudice.
- B. The Europeans were accommodating of the sepoy's desire to wear their caste-marks.
- C. Stuart's 'losing-battle' refers to his inability to succeed in enabling sepoys to wear caste-marks.
- D. The commander-in-chief was exempt from the Europeans prejudice that dictated how the sepoys were to dress.

gate2017-me-1   general-aptitude   verbal-aptitude   passage-reading   easy

[Answer key](#) 

#### 11.10.45 Passage Reading: GATE2017 ME-2: GA-6

"If you are looking for a history of India, or for an account of the rise and fall of the British Raj, or for the reason of the cleaving of the subcontinent into two mutually antagonistic parts and the effects this mutilation will have in the respective sections, and ultimately on Asia, you will not find it in these pages; for though I have spent lifetime in the country, I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for the impartial recording of these matters."

Which of the following is closest in meaning to 'cleaving' ?

- A. deteriorating      B. arguing      C. departing      D. splitting

gate2017-me-2   general-aptitude   verbal-aptitude   passage-reading

[Answer key](#) 

#### 11.10.46 Passage Reading: GATE2018 EC: GA-10



A coastal region with unparalleled beauty is home to many species of animals. It is dotted with coral reefs and unspoilt white sandy beaches. It has remained inaccessible to tourists due to poor connectivity and lack of accommodation. A company has spotted the opportunity and is planning to develop a luxury resort with helicopter service to the nearest major city airport. Environmentalists are upset that this would lead to the region becoming crowded and polluted like any other major beach resorts.

Which one of the following statements can be logically inferred from the information given in the above paragraph?

- A. The culture and tradition of the local people will be influenced by the tourists.
- B. The region will become crowded and polluted due to tourism.
- C. The coral reefs are on the decline and could soon vanish.
- D. Helicopter connectivity would lead to an increase in tourists coming to the region.

gate2018-ec general-aptitude verbal-aptitude normal passage-reading

**Answer key**

#### 11.10.47 Passage Reading: GATE2018 EC: GA-8



The Cricket Board has long recognized John's potential as a leader of the team. However, his on-field temper has always been a matter of concern for them since his junior days. While this aggression has filled stadia with die-hard fans, it has taken a toll on his own batting. Until recently, it appeared that he found it difficult to convert his aggression into big scores. Over the past three seasons though, that picture of John has been replaced by a cerebral, calculative and successful batsman-captain. After many years, it appears that the team has finally found a complete captain.

Which of the following statements can be logically inferred from the above paragraph?

- i. Even as a junior cricketer, John was considered a good captain.
- ii. Finding a complete captain is a challenge.
- iii. Fans and the Cricket Board have differing views on what they want in a captain.
- iv. Over the past three seasons, John has accumulated big scores.

A. (i), (ii) and (iii) only  
B. (iii) and (iv) only  
C. (ii) and (iv) only  
D. (i), (ii), (iii) and (iv)

gate2018-ec general-aptitude verbal-aptitude normal passage-reading

**Answer key**

#### 11.10.48 Passage Reading: GATE2019 CE-1: GA-6



The new cotton technology, Bollgard-II, with herbicide-tolerant traits has developed into a thriving business in India. However, the commercial use of this technology is not legal in India. Notwithstanding that, reports indicate that the herbicide tolerant Bt cotton had been purchased by farmers at an average of Rs 200 more than the control price of ordinary cotton, and planted in 15% of the cotton growing area in the 2017 Kharif season.

Which one of the following statements can be inferred from the given passage?

- A. Farmers want to access the new technology if India benefits from it
- B. Farmers want to access the new technology even if it is not legal
- C. Farmers want to access the new technology for experimental purposes
- D. Farmers want to access the new technology by paying high price

gate2019-ce-1 general-aptitude verbal-aptitude passage-reading

**Answer key**

#### 11.10.49 Passage Reading: GATE2019 CE-2: GA-10



"Popular Hindi fiction, despite - or perhaps because of - its wide reach, often does not appear in our cinema. As ideals that viewers are meant to look up to rather identify with, Hindi film protagonists usually read books of aspirational value: textbook, English books, or high-value literature."

Which one of the following CANNOT be inferred from the paragraph above?

- A. Though popular Hindi fiction has wide reach, it often does not appear in the movies
- B. Protagonists in Hindi movies, being ideals for viewers, read only books of aspirational value

- C. Textbooks, English books or high literature have aspirational value, but not popular Hindi fiction
  - D. People do not look up to writers of textbook, English books or high-value literature

gate2019-ce-2 general-aptitude verbal-aptitude passage-reading

Answer key

### 11.10.50 Passage Reading: GATE2019 CE-2: GA-8



*The Newspaper* reports that over 500 hectares of tribal land spread across 28 tribal settlements in Mohinitampuram forest division have already been "alienated". A top forest official said, "First the tribals are duped out of their land holdings. Second, the families thus rendered landless are often forced to encroach further into the forests".

On the basis of the information available in the paragraph, \_\_\_\_\_ is /are responsible for duping the tribals.



gate2019-ce-2 general-aptitude verbal-aptitude passage-reading

Answer key

11.10.51 Passage Reading: GATE2019 EC: GA-8



"Indian history was written by British historians-extremely well documented and researched, but not always impartial. History had to serve its purpose: Everything was made subservient to the glory of the Union Jack. Latter-day Indian scholars presented a contrary picture."

From the text above, we can infer that:

## India history written by British historians \_\_\_\_\_

- A. was well documented and not researched but was always biased
  - B. was not well documented and researched and was always biased
  - C. was well documented and researched but was sometimes biased
  - D. was not well documented and researched and was sometimes biased

gate2019-ec general-aptitude verbal-aptitude easy passage-reading

Answer key 

### 11.10.52 Passage Reading: GATE2019 EE: GA-8



An award-winning study by a group of researchers suggests that men are as prone to buying on impulse as women but women feel more guilty about shopping.

Which one of the following statements can be inferred from the given text?

- A. Some men and women indulge in buying on impulse
  - B. All men and women indulge in buying on impulse
  - C. Few men and women indulge in buying on impulse
  - D. Many men and women indulge in buying on impulse

gate2019-ee general-aptitude verbal-aptitude passage-reading

## Answer key

11.10.53 Passage Reading: GATE2019 IN: GA-10



"I read somewhere that in ancient times the prestige of a kingdom depended upon the number of taxes that it was able to levy on its people. It was very much like the prestige of a head-hunter in his own community."

Based on the paragraph above, the prestige of a head-hunter depended upon \_\_\_\_\_

- A. the prestige of the kingdom  
B. the prestige of the heads  
C. the number of taxes he could levy  
D. the number of heads he could gather

gate2019-in general-aptitude verbal-aptitude passage-reading

## Answer key

#### 11.10.54 Passage Reading: GATE2019 IN: GA-8

The nomenclature of Hindustani music has changed over the centuries. Since the medieval period, *dhrupad* styles were identified as *baanis*. Terms like *gayaki* and *baaj* were used to refer to vocal and instrumental styles, respectively. With the institutionalization of music education, the term *gharana* became acceptable. *Gharana* originally referred to hereditary musicians from a particular lineage, including disciples and grand disciples.

Which one of the following pairings is NOT correct?

- A. *dhrupad, baani*
- B. *gayaki, vocal*
- C. *baaj, institution*
- D. *gharana, lineage*

gate2019-in general-aptitude verbal-aptitude passage-reading

Answer key 

#### 11.10.55 Passage Reading: GATE2019 ME-1: GA-8

Congo was named by Europeans, Congo's dictator Mobuto later changed the name of the country and the river to Zaire with the objective of Africanising names of persons and spaces. However, the name Zaire was a Portuguese alteration of *Nzadi o Nzere*, a local African term meaning 'River that swallows Rivers'. Zaire was the Portuguese name for the Congo river in the 16th and 17th centuries.

Which one of the following statements can be inferred from the paragraph above?

- A. Mobuto was not entirely successful in Africanising the name of his country
- B. The term *Nzadi o Nzere* was of Portuguese origin
- C. Mobuto's desire to Africanise names was prevented by the Portuguese
- D. As a dictator Mobuto ordered the Portuguese to alter the name of the river to Zaire

gate2019-me-1 general-aptitude verbal-aptitude passage-reading

Answer key 

#### 11.10.56 Passage Reading: GATE2019 ME-2: GA-10

*X* is an online media provider. By offering unlimited and exclusive online content at attractive prices for a loyalty membership, *X* is almost forcing its customers towards its loyalty membership. If its royalty membership continues to grow at its current rate, within the next eight years more households will be watching *X* than cable television.

Which one of the following statements can be inferred from the above paragraph?

- A. Most households that subscribe to *X's* loyalty membership discontinue watching cable television
- B. Non-members prefer to watch cable television
- C. Cable television operators don't subscribe to *X's* loyalty members
- D. The *X* is cancelling accounts of non-members

gate2019-me-2 general-aptitude verbal-aptitude passage-reading

Answer key 

#### 11.10.57 Passage Reading: GATE2019 ME-2: GA-8

While teaching a creative writing class in India, I was surprised at receiving stories from the students that were all set in distant places: in the American West with cowboys and in Manhattan penthouses with clinking ice cubes. This was, till an eminent Caribbean writer gave the writers in the once-colonised countries the confidence to see the shabby lives around them as worthy being "told".

The writer of this passage is surprised by the creative writing assignments of his students, because \_\_\_\_\_

- A. Some of the students had written stories set in foreign places
- B. None of the students had written stories set in India
- C. None of the students had written about ice cubes and cowboys
- D. Some of the students had written about ice cubes and cowboys

gate2019-me-2 general-aptitude verbal-aptitude passage-reading

Answer key 

## 11.11.1 Phrasal Verb: GATE2016 CE-2: GA-2



He turned a deaf ear to my request.

What does the underlined phrasal verb mean?

- A. Ignored
- B. Appreciated
- C. Twisted
- D. Returned

gate2016-ce-2 general-aptitude english-grammar phrasal-verb

[Answer key](#)

## 11.11.2 Phrasal Verb: GATE2016 EC-2: GA-3



After India's cricket world cup victory in 1985, Shrotria who was playing both tennis and cricket till then, decided to concentrate only on cricket. And the rest is history.

What does the underlined phrase mean in this context?

- A. History will rest in peace
- B. Rest is recorded in history books
- C. Rest is well known
- D. Rest is archaic

gate2016-ec-2 verbal-aptitude phrasal-verb

[Answer key](#)

## 11.12.1 Phrase Meaning: GATE CSE 2014 Set 1 | Question: GA-1



Which of the following options is the closest in meaning to the phrase in bold in the sentence below?

It is fascinating to see life forms **cope with** varied environmental conditions.

- A. Adopt to
- B. Adapt to
- C. Adept in
- D. Accept with

verbal-aptitude gatecse-2014-set1 phrase-meaning easy

[Answer key](#)

## 11.12.2 Phrase Meaning: GATE CSE 2014 Set 1 | Question: GA-3



In a press meet on the recent scam, the minister said, "The buck stops here". What did the minister convey by the statement?

- A. He wants all the money
- B. He will return the money
- C. He will assume final responsibility
- D. He will resist all enquiries

gatecse-2014-set1 verbal-aptitude normal phrase-meaning

[Answer key](#)

## 11.12.3 Phrase Meaning: GATE CSE 2015 Set 1 | Question: GA-2



Which of the following options is the closest in meaning of the sentence below?

She enjoyed herself immensely at the party.

- A. She had a terrible time at the party
- B. She had a horrible time at the party
- C. She had a terrific time at the party
- D. She had a terrifying time at the party

gatecse-2015-set1 verbal-aptitude easy phrase-meaning

[Answer key](#)

## 11.12.4 Phrase Meaning: GATE CSE 2015 Set 1 | Question: GA-7



Select the alternative meaning of the underlined part of the sentence.

The chain snatchers took when the police party arrived.

to  
their  
heels

- A. Took shelter in a thick jungle
- B. Open indiscriminate fire
- C. Took to flight
- D. Unconditionally surrendered

**Answer key****11.12.5 Phrase Meaning: GATE CSE 2016 Set 2 | Question: GA-02**

Nobody knows how the Indian cricket team is going to cope with the difficult and seamer-friendly wickets in Australia.

Choose the option which is closest in meaning to the underlined phrase in the above sentence.

- |                 |                    |
|-----------------|--------------------|
| A. Put up with. | B. Put in with.    |
| C. Put down to. | D. Put up against. |

**Answer key****11.12.6 Phrase Meaning: GATE Mechanical 2020 Set 1 | GA Question: 4**

I do not think you know the case well enough to have opinions. Having said that, I agree with your other point.

What does the phrase “having said that” mean in the given text?

- |                                    |                                 |
|------------------------------------|---------------------------------|
| A. as opposed to what I have said  | B. despite what I have said     |
| C. in addition to what I have said | D. contrary to what I have said |

**Answer key****11.12.7 Phrase Meaning: GATE2015 EC-3: GA- 2**

Choose the most suitable one word substitute for the following expression:

Connotation of a road or way

- |                 |             |                |             |
|-----------------|-------------|----------------|-------------|
| A. Pertinacious | B. Viaticum | C. Clandestine | D. Ravenous |
|-----------------|-------------|----------------|-------------|

**Answer key****11.12.8 Phrase Meaning: GATE2015 ME-3: GA-6**

Select the appropriate option in place of underlined part of the sentence.

Increased productivity necessary reflects greater efforts made by the employees.

- |   |                                       |
|---|---------------------------------------|
| A. Increase in productivity necessary   | B. Increase productivity is necessary |
| C. Increase in productivity necessarily | D. No improvement required            |

**Answer key****11.13****Prepositions (8)****11.13.1 Prepositions: GATE Civil 2020 Set 2 | GA Question: 1**

Rescue teams deployed \_\_\_\_\_ disaster hit areas combat \_\_\_\_\_ a lot of difficulties to save the people.

- |             |             |               |           |
|-------------|-------------|---------------|-----------|
| A. with, at | B. in, with | C. with, with | D. to, to |
|-------------|-------------|---------------|-----------|

**Answer key****11.13.2 Prepositions: GATE Civil 2023 Set 2 | GA Question: 1**

The line ran \_\_\_\_\_ the page, right through the centre, and divided the page into two.

- |           |       |            |          |
|-----------|-------|------------|----------|
| A. across | B. of | C. between | D. about |
|-----------|-------|------------|----------|

**Answer key**

### 11.13.3 Prepositions: GATE IN 2023 | GA Question: 1



The village was nestled in a green spot, \_\_\_\_\_ the ocean and the hills.

- A. through      B. in      C. at      D. between

gatein-2023 verbal-aptitude prepositions

Answer key

### 11.13.4 Prepositions: GATE Mechanical 2020 Set 2 | GA Question: 1



While I agree \_\_\_\_\_ his proposal this time, I do not often agree \_\_\_\_\_ him.

- A. to, with      B. with, to      C. with, with      D. to, to

gateme-2020-set2 general-aptitude verbal-aptitude english-grammar prepositions

Answer key

### 11.13.5 Prepositions: GATE2019 CE-2: GA-2



The growth rate of ABC Motors in 2017 was the same \_\_\_\_\_ XYZ Motors in 2016.

- A. as off      B. as those of  
C. as that off      D. as that of

gate2019-ce-2 general-aptitude verbal-aptitude prepositions most-appropriate-word

Answer key

### 11.13.6 Prepositions: GATE2019 CE-2: GA-5



Hema Das was \_\_\_\_\_ only Indian athlete to win \_\_\_\_\_ gold for India.

- A. the , many      B. the, a      C. an, a      D. an , the

gate2019-ce-2 general-aptitude verbal-aptitude english-grammar prepositions

Answer key

### 11.13.7 Prepositions: GATE2019 EC: GA-2



The boat arrived \_\_\_\_\_ dawn.

- A. in      B. at      C. on      D. under

gate2019-ec general-aptitude verbal-aptitude prepositions

Answer key

### 11.13.8 Prepositions: GATE2019 EE: GA-2



The passengers were angry \_\_\_\_\_ the airline staff about the delay.

- A. on      B. about      C. with      D. towards

gate2019-ee general-aptitude verbal-aptitude prepositions

Answer key

## 11.14

### Pronouns (4)

#### 11.14.1 Pronouns: GATE CH 2023 | GA Question: 1



"You are delaying the completion of the task. Send \_\_\_\_\_ contributions at the earliest."

- A. you are      B. your      C. you're      D. yore

gatech-2023 verbal-aptitude english-grammar pronouns

Answer key

#### 11.14.2 Pronouns: GATE Electrical 2021 | GA Question: 1



The people \_\_\_\_\_ were at the demonstration were from all sections of society.

- A. whose      B. which      C. who      D. whom

gateee-2021 verbal-aptitude english-grammar pronouns easy

[Answer key](#)



### 11.14.3 Pronouns: GATE2019 CE-1: GA-5

The CEO's decision to quit was as shocking to the Board as it was to \_\_\_\_\_.

- A. I      B. me      C. my      D. myself

gate2019-ce-1 general-aptitude verbal-aptitude pronouns

[Answer key](#)



### 11.14.4 Pronouns: GATE2019 IN: GA-1

The fisherman, \_\_\_\_\_ the flood victims owed their lives, were rewarded by the government.

- A. whom      B. to which      C. to whom      D. that

gate2019-in general-aptitude verbal-aptitude english-grammar pronouns

[Answer key](#)

## 11.15

### Sentence Ordering (5)



#### 11.15.1 Sentence Ordering: GATE CSE 2023 | GA Question: 8

Which one of the following sentence sequences creates a coherent narrative?

- i. Once on the terrace, on her way to her small room in the corner, she notices the man right away.
- ii. She begins to pant by the time she has climbed all the stairs.
- iii. Mina has bought vegetables and rice at the market, so her bags are heavy.
- iv. He was leaning against the parapet, watching the traffic below.

- A. (i), (ii), (iv), (iii)  
C. (iv), (ii), (i), (iii)

- B. (ii), (iii), (i), (iv)  
D. (iii), (ii), (i), (iv)

gatecse-2023 verbal-aptitude sentence-ordering two-marks

[Answer key](#)



#### 11.15.2 Sentence Ordering: GATE CSE 2024 | Set 2 | GA Question: 6

Sequence the following sentences in a coherent passage.

P: This fortuitous geological event generated a colossal amount of energy and heat that resulted in the rocks rising to an average height of 4 km across the contact zone.

Q: Thus, the geophysicists tend to think of the Himalayas as an active geological event rather than as a static geological feature.

R : The natural process of the cooling of this massive edifice absorbed large quantities of atmospheric carbon dioxide, altering the earth's atmosphere and making it better suited for life.

S: Many millennia ago, a breakaway chunk of bedrock from the Antarctic Plate collided with the massive Eurasian Plate.

- A. QPSR      B. QSPR      C. SPRQ      D. SRPQ

gatecse2024-set2 verbal-aptitude sentence-ordering two-marks

[Answer key](#)



#### 11.15.3 Sentence Ordering: GATE ECE 2024 | GA Question: 6

Sequence the following sentences (P, Q, R, S) in a coherent passage:

P: Shifu's student exclaimed, "Why do you run since the bull is an illusion?"

**Q:** Shifu said, "Surely my running away from the bull is also an illusion."

**R :** Shifu once proclaimed that all life is illusion.

**S:** One day, when a bull gave him chase, Shifu began running for his life.

A. SPRQ

B. SRPQ

C. RSPQ

D. RPQS

gateece-2024 verbal-aptitude sentence-ordering

**Answer key** 



#### 11.15.4 Sentence Ordering: GATE Mechanical 2023 | GA Question: 8

Which one of the sentence sequences in the given options creates a coherent narrative?

- i. I could not bring myself to knock.
- ii. There was a murmur of unfamiliar voices coming from the big drawing room and the door was firmly shut.
- iii. The passage was dark for a bit, but then it suddenly opened into a bright kitchen.
- iv. I decided I would rather wander down the passage.

A. (iv), (i), (iii), (ii)

C. (ii), (i), (iv), (iii)

B. (iii), (i), (ii), (iv)

D. (i), (iii), (ii), (iv)

gateme-2023 verbal-aptitude sentence-ordering

**Answer key** 



#### 11.15.5 Sentence Ordering: GATE2015 EC-3: GA-7

In the following question, the first and the last sentence of the passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered as 2, 3, 4, and 5. These 4 parts are not arranged in proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given options.

1. On Diwali, the family rises early in the morning.
2. The whole family, including the young and the old enjoy doing this.
3. Children let off fireworks later in the night with their friends.
4. At sunset, the lamps are lit and the family performs various rituals.
5. Father, mother, and children visit relatives and exchange gifts and sweets.
6. Houses look so pretty with lighted lamps all around.

A. 2,5,3,4

B. 5,2,4,3

C. 3,5,4,2

D. 4,5,2,3

gate2015-ec-3 verbal-aptitude sentence-ordering

**Answer key** 

#### 11.16

#### Statement Sufficiency (2)



##### 11.16.1 Statement Sufficiency: GATE CSE 2015 Set 1 | Question: GA-4

Based on the given statements, select the most appropriate option to solve the given question.

If two floors in a certain building are 9 feet apart, how many steps are there in a set of stairs that extends from the first floor to the second floor of the building?

Statements:

- I. Each step is  $\frac{3}{4}$  foot high.
- II. Each step is 1 foot wide.

A. Statements I alone is sufficient, but statement II alone is not sufficient.

B. Statements II alone is sufficient, but statement I alone is not sufficient.

C. Both statements together are sufficient, but neither statement alone is sufficient.

D. Statements I and II together are not sufficient.

gatetcse-2015-set1 verbal-aptitude easy statement-sufficiency

**Answer key** 



## 11.18.2 Synonyms: GATE CSE 2011 | Question: 56



Which of the following options is the closest in the meaning to the word below:

### Inexplicable

- A. Incomprehensible  
C. Inextricable
- B. Indelible  
D. Infallible

gatecse-2011 verbal-aptitude synonyms normal

[Answer key](#)

## 11.18.3 Synonyms: GATE CSE 2012 | Question: 58



Which one of the following options is the closest in meaning to the word given below?

### Mitigate

- A. Diminish      B. Divulge      C. Dedicate      D. Denote

gatecse-2012 verbal-aptitude synonyms easy

[Answer key](#)

## 11.18.4 Synonyms: GATE CSE 2013 | Question: 56



Which one of the following options is the closest in meaning to the word given below?

### Nadir

- A. Highest      B. Lowest      C. Medium      D. Integration

gatecse-2013 verbal-aptitude synonyms normal

[Answer key](#)

## 11.18.5 Synonyms: GATE CSE 2017 Set 2 | Question: GA-1



Choose the option with words that are not synonyms.

- A. aversion, dislike  
C. plunder, loot
- B. luminous, radiant  
D. yielding, resistant

gatecse-2017-set2 verbal-aptitude synonyms

[Answer key](#)

## 11.18.6 Synonyms: GATE2010 MN: GA-1



Which of the following options is the closest in meaning to the word below:

### Exhort

- A. urge      B. condemn      C. restrain      D. scold

general-aptitude verbal-aptitude gate2010-mn synonyms

[Answer key](#)

## 11.18.7 Synonyms: GATE2010 TF: GA-1



Which of the following options is the closest in meaning to the word below:

### Ephemeral

- A. effeminate      B. ghostlike      C. soft      D. short-lived

general-aptitude verbal-aptitude gate2010-tf synonyms

[Answer key](#)

## 11.18.8 Synonyms: GATE2012 AR: GA-1



Which one of the following options is the closest in meaning to the word given below?

### Pacify

- A. Excite      B. Soothe      C. Deplete      D. Tire

gate2012-ar verbal-aptitude synonyms

[Answer key](#)

### 11.18.9 Synonyms: GATE2012 CY: GA-3



Which one of the following options is the closest in meaning to the word given below?

**Latitude**

- A. Eligibility      B. Freedom      C. Coercion      D. Meticulousness

gate2012-cy    verbal-aptitude    synonyms

[Answer key](#)

### 11.18.10 Synonyms: GATE2013 CE: GA-3



Which of the following options is the closest in meaning to the word given below: **Primeval**

- A. Modern      B. Historic      C. Primitive      D. Antique

gate2013-ce    synonyms    most-appropriate-word

[Answer key](#)

### 11.18.11 Synonyms: GATE2013 EE: GA-1



They were requested not to **quarrel** with others.

Which one of the following options is the closest in meaning to the word **quarrel**?

- A. make out      B. call out      C. dig out      D. fall out

gate2013-ee    verbal-aptitude    synonyms

[Answer key](#)

### 11.18.12 Synonyms: GATE2014 AE: GA-1



A student is required to demonstrate a high level of comprehension of the subject, especially in the social sciences.

The word closest in meaning to **comprehension** is

- A. understanding      B. meaning      C. concentration      D. stability

gate2014-ae    synonyms    verbal-aptitude

[Answer key](#)

### 11.18.13 Synonyms: GATE2014 EC-4: GA-1



Which of the following options is the closest in meaning to the word underlined in the sentence below?

In a democracy, everybody has the freedom to **disagree** with the government.

- A. Dissent      B. Descent      C. Decent      D. Decadent

gate2014-ec-4    verbal-aptitude    synonyms    normal

[Answer key](#)

### 11.18.14 Synonyms: GATE2014 EC-4: GA-3



While receiving the award, the scientist said, "I feel vindicated". Which of the following is closest in meaning to the word 'vindicated'?

- A. Punished      B. Substantiated  
C. Appreciated      D. Chastened

gate2014-ec-4    verbal-aptitude    synonyms    normal

[Answer key](#)

### 11.18.15 Synonyms: GATE2015 CE-2: GA-3



Which word is not a synonym for the word **vernacular**?

- A. regional      B. indigenous      C. indigent      D. colloquial

**Answer key****11.18.16 Synonyms: GATE2015 CE-2: GA-6**

The word similar in meaning to 'drearly' is

- A. cheerful      B. dreamy      C. hard      D. dismal

**Answer key****11.18.17 Synonyms: GATE2015 EC-1: GA-3**

Choose the word most similar in meaning to the given word:

Educe

- A. Exert      B. Educate      C. Extract      D. Extend

**Answer key****11.18.18 Synonyms: GATE2015 EC-2: GA- 2**

Choose the word most similar in meaning to the given word:

Awkward

- A. Inept      B. Graceful      C. Suitable      D. Dreadful

**Answer key****11.18.19 Synonyms: GATE2017 CE-2: GA-2**

There was no doubt that their work was thorough.

Which of the words below is closest in meaning to the underlined word above?

- A. pretty      B. complete      C. sloppy      D. haphazard

**Answer key****11.19****Tenses (25)****11.19.1 Tenses: GATE CSE 2013 | Question: 59**

Were you a bird, you \_\_\_\_\_ in the sky.

- A. would fly      B. shall fly      C. should fly      D. shall have flown

**Answer key****11.19.2 Tenses: GATE CSE 2014 Set 2 | Question: GA-2**

Who \_\_\_\_\_ was coming to see us this evening?

- A. you said      B. did you say      C. did you say that      D. had you said

**Answer key****11.19.3 Tenses: GATE CSE 2014 Set 3 | Question: GA-2**

If she \_\_\_\_\_ how to calibrate the instrument, she \_\_\_\_\_ done the experiment.

- A. knows, will have      B. knew, had

C. had known, could have

D. should have known, would have

gatecse-2014-set3 verbal-aptitude easy english-grammar tenses

Answer key 

#### 11.19.4 Tenses: GATE CSE 2017 Set 1 | Question: GA-1



After Rajendra Chola returned from his voyage to Indonesia, he \_\_\_\_\_ to visit the temple in Thanjavur.

- A. was wishing      B. is wishing      C. wished      D. had wished

gatecse-2017-set1 general-aptitude verbal-aptitude tenses english-grammar normal

Answer key 

#### 11.19.5 Tenses: GATE DA 2025 | GA Question: 2



We \_\_\_\_\_ tennis in the lawn when it suddenly started to rain.

Select the most appropriate option to complete the above sentence.

- A. have been playing      B. had been playing  
C. would have been playing      D. could be playing

gateda-2025 verbal-aptitude tenses easy one-mark

Answer key 

#### 11.19.6 Tenses: GATE ECE 2021 | GA Question: 5



Consider the following sentences:

- i. I woke up from sleep.  
ii. I woked up from sleep.  
iii. I was woken up from sleep.  
iv. I was wokened up from sleep.

Which of the above sentences are grammatically CORRECT?

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

gateec-2021 verbal-aptitude english-grammar tenses

Answer key 

#### 11.19.7 Tenses: GATE Electrical 2020 | GA Question: 1



This book, including all its chapters, \_\_\_\_\_ interesting. The students as well as the instructor \_\_\_\_\_ in agreement about it.

- A. is, was      B. are, are      C. is, are      D. were, was

gate2020-ee verbal-aptitude english-grammar tenses

Answer key 

#### 11.19.8 Tenses: GATE Electrical 2023 | GA Question: 1



Rafi told Mary, "I am thinking of watching a film this weekend." The following reports the above statement in indirect speech:

Rafi told Mary that he \_\_\_\_\_ of watching a film that weekend.

- A. thought      B. is thinking  
C. am thinking      D. was thinking

gate2023-ee verbal-aptitude english-grammar tenses

Answer key 

#### 11.19.9 Tenses: GATE Mechanical 2023 | GA Question: 1



He did not manage to fix the car himself, so he \_\_\_\_\_ in the garage.

- A. got it fixed      B. getting it fixed      C. gets fixed      D. got fixed

gateme-2023 verbal-aptitude english-grammar tenses

[Answer key](#)

### 11.19.10 Tenses: GATE2012 AE: GA-1



Choose the most appropriate alternative from the options given below to complete the following sentence:

**I \_\_\_ to have bought a diamond ring.**

- A. have a liking      B. should have liked      C. would like      D. may like

gate2012-ae    tenses    verbal-aptitude

[Answer key](#)

### 11.19.11 Tenses: GATE2012 AE: GA-2



Choose the most appropriate alternative from the options given below to complete the following sentence:

**Food prices \_\_\_ again this month.**

- A. have raised      B. have been raising  
C. have been rising      D. have arose

gate2012-ae    verbal-aptitude    tenses

[Answer key](#)

### 11.19.12 Tenses: GATE2012 CY: GA-5



Choose the most appropriate alternative from the options given below to complete the following sentence:

**If the tired soldier wanted to lie down, he \_\_\_ the mattress out on the balcony.**

- A. should take      B. shall take  
C. should have taken      D. will have taken

gate2012-cy    tenses    verbal-aptitude

[Answer key](#)

### 11.19.13 Tenses: GATE2013 AE: GA-2



The Headmaster \_\_\_\_\_ to speak to you. Which of the following options is incorrect to complete the above sentence?

- A. is wanting      B. wants  
C. want      D. was wanting

gate2013-ae    verbal-aptitude    english-grammar    tenses

[Answer key](#)

### 11.19.14 Tenses: GATE2014 EC-1: GA-1



Choose the most appropriate phrase from the options given below to complete the following sentence.

The aircraft \_\_\_\_\_ take off as soon as its flight plan was filed.

- A. Is allowed to      B. Will be allowed to  
C. Was allowed to      D. Has been allowed to

gate2014-ec-1    verbal-aptitude    tenses    easy

[Answer key](#)

### 11.19.15 Tenses: GATE2014 EC-2: GA-2



Which of the options given below best completes the following sentence?

She will feel much better if she \_\_\_\_\_.

- A. Will get some rest      B. Gets some rest  
C. Will be getting some rest      D. Is getting some rest

gate2014-ec-2    verbal-aptitude    english-grammar    normal    tenses

[Answer key](#)

### 11.19.16 Tenses: GATE2015 EC-2: GA-6



In the following sentence certain parts are underlined and marked P, Q, and R. One of the parts may contain certain error or may not be acceptable in standard written communication. Select the part containing an error. Choose D as your answer if there is no error.

The student corrected all the errors that the instructor marked on the answer book.

- A. P      B. Q      C. R      D. No error

gate2015-ec-2 verbal-aptitude english-grammar tenses

[Answer key](#)

### 11.19.17 Tenses: GATE2015 EC-3: GA-1



Choose the most appropriate word from the options given below to complete the following sentence.

If the athlete had wanted to come first in the race, he \_\_\_\_\_ several hours every day.

- A. should practise      B. should have practised  
C. practised      D. should be practising

gate2015-ec-3 general-aptitude verbal-aptitude tenses

[Answer key](#)

### 11.19.18 Tenses: GATE2017 CE-1: GA-1



The bacteria in milk are destroyed when it \_\_\_\_\_ heated to 80 degree Celsius.

- A. would be      B. will be      C. is      D. was

gate2017-ce-1 verbal-aptitude tenses

[Answer key](#)

### 11.19.19 Tenses: GATE2017 CE-2: GA-1



The event would have been successful if you\_\_\_\_\_ able to come.

- A. are      B. had been      C. have been      D. would have been

gate2017-ce-2 verbal-aptitude tenses

[Answer key](#)

### 11.19.20 Tenses: GATE2017 EC-1: GA-2



I \_\_\_\_\_ made arrangements had I \_\_\_\_\_ informed earlier.

- A. could have, been      B. would have, being  
C. had, have      D. had been, been

gate2017-ec-1 verbal-aptitude tenses

[Answer key](#)

### 11.19.21 Tenses: GATE2017 ME-2: GA-1



The ways in which this game can be played \_\_\_\_\_ potentially infinite.

- A. is      B. is being      C. are      D. are being

gate2017-me-2 general-aptitude verbal-aptitude english-grammar tenses

[Answer key](#)

### 11.19.22 Tenses: GATE2019 EC: GA-1



The strategies that the company \_\_\_\_\_ to sell its products \_\_\_\_\_ house-to-house marketing.

- A. use, includes      B. uses, include  
C. used, includes      D. uses, including

gate2019-ec general-aptitude verbal-aptitude english-grammar tenses

[Answer key](#)

### 11.19.23 Tenses: GATE2019 IN: GA-5



Until Iran came along, India had never been \_\_\_\_\_ in Kabaddi.

- A. defeated      B. defeating      C. defeat      D. defeatist

gate2019-in general-aptitude verbal-aptitude english-grammar tenses

[Answer key](#)

### 11.19.24 Tenses: GATE2019 ME-1: GA-2



\_\_\_\_ I permitted him to leave, I wouldn't have had any problem with him being absent, \_\_\_\_ I?

- A. Had, wouldn't      B. Have, would  
C. Had, would      D. Have, wouldn't

gate2019-me-1 general-aptitude verbal-aptitude tenses

[Answer key](#)

### 11.19.25 Tenses: GATE2019 ME-2: GA-1



Once the team of analysis identify the problem, we \_\_\_\_ in a better position to comment on the issue.

Which of the following choices CANNOT fill the given blank?

- A. will be      B. were to be      C. are going to be      D. might be

gate2019-me-2 general-aptitude verbal-aptitude tenses

[Answer key](#)

11.20

Verbal Reasoning (40)



### 11.20.1 Verbal Reasoning: GATE CSE 2012 | Question: 61



**Wanted Temporary, Part-time persons for the post of Field Interviewer to conduct personal interviews to collect and collate economic data. Requirements: High School-pass, must be available for Day, Evening and Saturday work. Transportation paid, expenses reimbursed.**

Which one of the following is the best inference from the above advertisement?

- A. Gender-discriminatory      B. Xenophobic  
C. Not designed to make the post attractive      D. Not gender-discriminatory

gatecse-2012 verbal-aptitude verbal-reasoning normal

[Answer key](#)

### 11.20.2 Verbal Reasoning: GATE CSE 2014 Set 1 | Question: GA-7



Geneticists say that they are very close to confirming the genetic roots of psychiatric illnesses such as depression and schizophrenia, and consequently, that doctors will be able to eradicate these diseases through early identification and gene therapy.

On which of the following assumptions does the statement above rely?

Select one:

- A. Strategies are now available for eliminating psychiatric illnesses  
B. Certain psychiatric illnesses have a genetic basis  
C. All human diseases can be traced back to genes and how they are expressed  
D. In the future, genetics will become the only relevant field for identifying psychiatric illnesses

gatecse-2014-set1 verbal-aptitude verbal-reasoning normal

[Answer key](#)

### 11.20.3 Verbal Reasoning: GATE CSE 2015 Set 3 | Question: GA-6



Alexander turned his attention towards India, since he had conquered Persia.

Which one of the statements below is logically valid and can be inferred from the above sentence?

- A. Alexander would not have turned his attention towards India had he not conquered Persia.
  - B. Alexander was not ready to rest on his laurels, and wanted to march to India.
  - C. Alexander was not completely in control of his army and could command it to move towards India.
  - D. Since Alexander's kingdom extended to Indian borders after the conquest of Persia, he was keen to move further.

gatecse-2015-set3 verbal-aptitude normal verbal-reasoning

Answer key

11.20.4 Verbal Reasoning: GATE CSE 2016 Set 1 | Question: GA07



Indian currency notes show the denomination indicated in at least seventeen languages. If this is not an indication of the nation's diversity, nothing else is.

Which of the following can be logically inferred from the above sentences?

- A. India is a country of exactly seventeen languages.
  - B. Linguistic pluralism is the only indicator of a nation's diversity.
  - C. Indian currency notes have sufficient space for all the Indian languages.
  - D. Linguistic pluralism is strong evidence of India's diversity.

gatecse-2016-set1 verbal-aptitude verbal-reasoning normal

Answer key

11.20.5 Verbal Reasoning: GATE CSE 2017 Set 2 | Question: GA-6



"We lived in a culture that denied any merit to literary works, considering them important only when they were handmaidens to something seemingly more urgent – namely ideology. This was a country where all gestures, even the most private, were interpreted in political terms."

The author's belief that ideology is not as important as literature is revealed by the word:

- A. 'culture'
  - B. 'seemingly'
  - C. 'urgent'
  - D. 'political'

gatecse-2017-set2 passage-reading verbal-reasoning

## Answer key

11.20.6 Verbal Reasoning: GATE CSE 2019 | Question: GA-6



The police arrested four criminals –  $P, Q, R$  and  $S$ . The criminals knew each other. They made the following statements:

- $P$  says “ $Q$  committed the crime.”
  - $Q$  says “ $S$  committed the crime.”
  - $R$  says “I did not do it.”
  - $S$  says “What  $Q$  said about me is false”.

Assume only one of the arrested four committed the crime and only one of the statements made above is true. Who committed the crime?



gatecse-2019 verbal-aptitude verbal-reasoning two-marks

Answer key

11.20.7 Verbal Reasoning: GATE CSE 2019 | Question: GA-8



"A recent High Court judgement has sought to dispel the idea of begging as a disease – which leads to its stigmatization and criminalization – and to regard it as a symptom. The underlying disease is the failure of the state to protect citizens who fall through the social security net."

Which one of the following statements can be inferred from the given passage?

- A. Beggars are lazy people who beg because they are unwilling to work
  - B. Beggars are created because of the lack of social welfare schemes
  - C. Begging is an offence that has to be dealt with firmly
  - D. Begging has to be banned because it adversely affects the welfare of the state

**Answer key****11.20.8 Verbal Reasoning: GATE CSE 2020 | Question: GA-4**

The dawn of the 21st century witnessed the melting glaciers oscillating between giving too much and too little to billions of people who depend on them for fresh water. The UN climate report estimates that without deep cuts to man-made emissions, at least 30% of the northern hemisphere's surface permafrost could melt by the end of the century. Given this situation of imminent global exodus of billions of people displaced by rising seas, nation-states need to rethink their carbon footprint for political concerns, if not for environmental ones.

Which one of the following statements can be inferred from the given passage?

- A. Nation-states do not have environmental concerns.
- B. Nation-states are responsible for providing fresh water to billions of people.
- C. Billions of people are responsible for man-made emissions.
- D. Billions of people are affected by melting glaciers.

**Answer key****11.20.9 Verbal Reasoning: GATE CSE 2020 | Question: GA-6**

Goods and Services Tax (GST) is an indirect tax introduced in India in 2017 that is imposed on the supply of goods and services, and it subsumes all indirect taxes except few. It is a destination-based tax imposed on goods and services used, and it is not imposed at the point of origin from where goods come. GST also has a few components specific to state governments, central government and Union Territories (UTs).

Which one of the following statements can be inferred from the given passage?

- A. GST is imposed on the production of goods and services.
- B. GST includes all indirect taxes.
- C. GST does not have a component specific to UT.
- D. GST is imposed at the point of usage of goods and services.

**Answer key****11.20.10 Verbal Reasoning: GATE CSE 2021 Set 1 | GA Question: 10**

Some people suggest anti-obesity measures (AOM) such as displaying calorie information in restaurant menus. Such measures sidestep addressing the core problems that cause obesity: poverty and income inequality.

Which one of the following statements summarizes the passage?

- A. The proposed AOM addresses the core problems that cause obesity
- B. If obesity reduces, poverty will naturally reduce, since obesity causes poverty
- C. AOM are addressing the core problems and are likely to succeed
- D. AOM are addressing the problem superficially

**Answer key****11.20.11 Verbal Reasoning: GATE CSE 2021 Set 2 | GA Question: 6**

Listening to music during exercise improves performance and reduces discomfort. Scientists researched whether listening to music while studying can help students learn better and the results were inconclusive. Students who needed external stimulation for studying fared worse while students who did not need any external stimulation benefited from music.

Which one of the following statements is the CORRECT inference of the above passage?

- A. Listening to music has no effect on learning and a positive effect on physical exercise
- B. Listening to music has a clear positive effect both in physical exercise and on learning
- C. Listening to music has a clear positive effect on physical exercise. Music has a positive effect on learning only in some students

- D. Listening to music has a clear positive effect on learning in all students. Music has a positive effect only in some students who exercise

gatecse-2021-set2 verbal-aptitude verbal-reasoning passage-reading two-marks

Answer key 

#### 11.20.12 Verbal Reasoning: GATE Chemical 2020 | GA Question: 4

Hit by floods, the kharif (summer sown) crops in various parts of the country have been affected. Officials believe that the loss in production of the kharif crops can be recovered in the output of the rabi (winter sown) crops so that the country can achieve its food-grain production target of 291 million tons in the crop year 2019 – 20 (July – June). They are hopeful that good rains in July-August will help the soil retain moisture for a longer period, helping winter sown crops such as wheat and pulses during the November-February period.



Which of the following statements can be inferred from the given passage?

- A. Officials declared that the food-grain production target will be met due to good rains.
- B. Officials want the food-grain production target to be met by the November-February period.
- C. Officials feel that the food-grain production target cannot be met due to floods.
- D. Officials hope that the food-grain production target will be met due to a good rabi produce.

gate2020-ch verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.13 Verbal Reasoning: GATE Chemical 2020 | GA Question: 6

Repo rate is the rate at which Reserve Bank of India (RBI) lends commercial banks, and reverse repo rate is the rate at which (RBI) borrows money from commercial banks.



Which of the following statements can be inferred from the above passage?

- A. Decrease in repo rate will increase cost of borrowing and decrease lending by commercial banks.
- B. Increase in repo rate will decrease cost of borrowing and increase lending by commercial banks.
- C. Increase in repo rate will decrease cost of borrowing and decrease lending by commercial banks.
- D. Decrease in repo rate will decrease cost of borrowing and increase lending by commercial banks.

gate2020-ch verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.14 Verbal Reasoning: GATE Civil 2020 Set 1 | GA Question: 6

The American psychologist Howard Gardner expounds that human intelligence can be subcategorized into multiple kinds, in such a way that individuals differ with respect to their relative competence in each kind. Based on this theory, modern educationists insist on prescribing multi-dimensional curriculum and evaluation parameters that enable development and assessment of multiple intelligences.



Which of the following statements can be inferred from the given text ?

- A. Howard Gardner insists that the teaching curriculum and evaluation needs to be multi-dimensional.
- B. Howard Gardner wants to develop and assess the theory of multiple intelligences.
- C. Modern educationists want to develop and assess the theory of multiple intelligences.
- D. Modern educationists insist that the teaching curriculum and evaluation needs to be multi-dimensional.

gate2020-ce-1 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.15 Verbal Reasoning: GATE Civil 2020 Set 2 | GA Question: 6

Nominal interest rate is defined as the amount paid by the borrower to the lender for using the borrowed amount for a specific period of time. Real interest rate calculated on the basis of actual value (inflation-adjusted), is approximately equal to the difference between nominal rate and expected rate of inflation in the economy.



Which of the following assertions is best supported by the above information?

- A. Under high inflation, real interest rate is low and borrowers get benefited
- B. Under low inflation, real interest rate is high and borrowers get benefited

- C. Under high inflation, real interest rate is low and lenders get benefited  
D. Under low inflation, real interest rate is low and borrowers get benefited

gate2020-ce-2 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.16 Verbal Reasoning: GATE Civil 2021 Set 1 | GA Question: 10

Humans have the ability to construct worlds entirely in their minds, which don't exist in the physical world. So far as we know, no other species possesses this ability. This skill is so important that we have different words to refer to its different flavors, such as imagination, invention and innovation.

Based on the above passage, which one of the following is TRUE?

- A. No species possess the ability to construct worlds in their minds
- B. The terms imagination, invention and innovation refer to unrelated skills
- C. We do not know of any species other than humans who possess the ability to construct mental worlds
- D. Imagination, invention and innovation are unrelated to the ability to construct mental worlds

gatecivil-2021-set1 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.17 Verbal Reasoning: GATE Civil 2021 Set 2 | GA Question: 7

The author said, "Musicians rehearse before their concerts. Actors rehearse their roles before the opening of a new play. On the other hand, I find it strange that many public speakers think they can just walk onto the stage and start speaking. In my opinion, it is no less important for public speaker to rehearse their talks."

Based on the above passage, which one of the following is TRUE?

- A. The author is of the opinion that rehearsing is important for musicians, actors and public speakers
- B. The author is of the opinion that rehearsing is less important for public speakers than for musicians and actors
- C. The author is of the opinion that rehearsing is more important only for musicians than public speakers
- D. The author is of the opinion that rehearsal is more important for actors than musicians

gatecivil-2021-set2 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.18 Verbal Reasoning: GATE ECE 2020 | GA Question: 4

The Canadian constitution requires that equal importance be given to English and French. Last year, Air Canada lost a lawsuit, and had to pay a six-figure fine to a French-speaking couple after they filed complaints about formal in-flight announcements in English lasting 15 seconds, as opposed to informal 5 second messages in French.

The French-speaking couple were upset at \_\_\_\_\_.

- A. the in-flight announcements being made in English.
- B. the English announcements being clearer than the French ones.
- C. the English announcements being longer than the French ones.
- D. equal importance being given to English and French.

gate2020-ec verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.19 Verbal Reasoning: GATE ECE 2020 | GA Question: 6

The global financial crisis in 2008 is considered to be the most serious world-wide financial crisis, which started with the sub-prime lending crisis in USA in 2007. The sub-prime lending crisis led to the banking crisis in 2008 with the collapse of Lehman Brothers in 2008. The sub-prime lending refers to the provision of loans to those borrowers who may have difficulties in repaying loans, and it arises because of excess liquidity following the East Asian crisis.

Which one of the following sequences shows the correct precedence as per the given passage?

- A. East Asian crisis → subprime lending crisis → banking crisis → global financial crisis.
- B. Subprime lending crisis → global financial crisis → banking crisis → East Asian crisis.

- C. Banking crisis → subprime lending crisis → global financial crisis → East Asian crisis.  
D. Global financial crisis → East Asian crisis → banking crisis → subprime lending crisis.

gate2020-ec verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.20 Verbal Reasoning: GATE ECE 2021 | GA Question: 7

Computers are ubiquitous. They are used to improve efficiency in almost all fields from agriculture to space exploration. Artificial intelligence (AI) is currently a hot topic. AI enables computers to learn, given enough training data. For humans, sitting in front of a computer for long hours can lead to health issues.

Which of the following can be deduced from the above passage?

- i. Nowadays, computers are present in almost all places.
- ii. Computers cannot be used for solving problems in engineering
- iii. For humans, there are both positive and negative effects of using computers.
- iv. Artificial intelligence can be done without data.

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

gateec-2021 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.21 Verbal Reasoning: GATE Electrical 2021 | GA Question: 6

The importance of sleep is often overlooked by students when they are preparing for exams. Research has consistently shown that sleep deprivation greatly reduces the ability to recall the material learnt. Hence, cutting down on sleep to study longer hours can be counterproductive.

Which one of the following statements is the CORRECT inference from the above passage?

- A. Sleeping well alone is enough to prepare for an exam. Studying has lesser benefit.
- B. Students are efficient and are not wrong in thinking that sleep is a waste of time.
- C. If a student is extremely well prepared for an exam, he needs little or no sleep.
- D. To do well in an exam, adequate sleep must be part of the preparation.

gateee-2021 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.22 Verbal Reasoning: GATE Mechanical 2020 Set 1 | GA Question: 6

Crowd funding deals with mobilisation of funds for a project from a large number of people, who would be willing to invest smaller amounts through web-based platforms in the project.

Based on the above paragraph, which of the following is correct about crowd funding?

- A. Funds raised through unwilling contributions on web-based platforms
- B. Funds raised through large contributions on web-based platforms
- C. Funds raised through coerced contributions on web-based platforms
- D. Funds raised through voluntary contributions on web-based platforms

gateme-2020-set1 verbal-aptitude verbal-reasoning passage-reading

Answer key 

#### 11.20.23 Verbal Reasoning: GATE Mechanical 2020 Set 2 | GA Question: 2

The recent measures to improve the output would \_\_\_\_\_ the level of production to our satisfaction

- A. increase      B. decrease      C. speed      D. equalise

gateme-2020-set2 verbal-aptitude verbal-reasoning

Answer key 

#### 11.20.24 Verbal Reasoning: GATE Mechanical 2020 Set 2 | GA Question: 4



In one of the greatest innings ever seen in 142 years of Test history, Ben Stokes upped the tempo in a five-and-a-half hour long stay of 219 balls including 11 fours and 8 sixes that saw him finish on a 135 not out as England squared the five-match series.

Based on their connotations in the given passage, which one of the following meanings DOES NOT match?

- A. upped = increased
- B. squared = lost
- C. tempo = enthusiasm
- D. saw = resulted in

gateme-2020-set2 verbal-aptitude verbal-reasoning passage-reading

Answer key

#### 11.20.25 Verbal Reasoning: GATE Mechanical 2020 Set 2 | GA Question: 6



Climate change and resilience deal with two aspects – reduction of sources of non-renewable energy resources and reducing vulnerability of climate change aspects. The terms ‘mitigation’ and ‘adaptation’ are used to refer to these aspects, respectively.

Which of the following assertions is best supported by the above information?

- A. Mitigation deals with consequences of climate change
- B. Adaptation deals with causes of climate change
- C. Mitigation deals with actions taken to reduce the use of fossil fuels.
- D. Adaptation deals with actions taken to combat green-house gas emissions

gateme-2020-set2 verbal-aptitude verbal-reasoning passage-reading

Answer key

#### 11.20.26 Verbal Reasoning: GATE Mechanical 2021 Set 1 | GA Question: 6



Oxpeckers and rhinos manifest a symbiotic relationship in the wild. The oxpeckers warn the rhinos about approaching poachers, thus possibly saving the lives of the rhinos. Oxpeckers also feed on the parasitic ticks found on rhinos.

In the symbiotic relationship described above, the primary benefits for oxpeckers and rhinos respectively are,

- A. Oxpeckers get a food source, rhinos have no benefit
- B. Oxpeckers save their habitat from poachers while the rhinos have no benefit
- C. Oxpeckers get a food source, rhinos may be saved from the poachers
- D. Oxpeckers save the lives of poachers, rhinos save their own lives

gateme-2021-set1 verbal-aptitude easy verbal-reasoning passage-reading

Answer key

#### 11.20.27 Verbal Reasoning: GATE Mechanical 2021 Set 2 | GA Question: 10



The world is going through the worst pandemic in the past hundred years. The air travel industry is facing a crisis, as the resulting quarantine requirement for travelers led to weak demand.

In relation to the first sentence above, what does the second sentence do?

- A. Restates an idea from the first sentence
- B. Second sentence entirely contradicts the first sentence
- C. The two statements are unrelated
- D. States an effect of the first sentence

gateme-2021-set2 verbal-aptitude verbal-reasoning

Answer key

#### 11.20.28 Verbal Reasoning: GATE Mechanical 2023 | GA Question: 6



In a recently held parent-teacher meeting, the teachers had very few complaints about Ravi. After all, Ravi was a hardworking and kind student. Incidentally, almost all of Ravi's friends at school were hardworking and kind too. But the teachers drew attention to Ravi's complete lack of interest in sports. The teachers believed that, along with some of his friends who showed similar disinterest in sports, Ravi needed to engage in some sports for his overall development.

Based only on the information provided above, which one of the following statements can be logically inferred with *certainty*?

- A. All of Ravi's friends are hardworking and kind.
- B. No one who is not a friend of Ravi is hardworking and kind.
- C. None of Ravi's friends are interested in sports.
- D. Some of Ravi's friends are hardworking and kind.

gateme-2023 verbal-aptitude verbal-reasoning

[Answer key](#)



#### 11.20.29 Verbal Reasoning: GATE2013 AE: GA-3

Mahatama Gandhi was known for his humility as

- A. he played an important role in humiliating exit of British from India.
- B. he worked for humanitarian causes.
- C. he displayed modesty in his interactions.
- D. he was a fine human being

gate2013-ae verbal-aptitude verbal-reasoning

[Answer key](#)



#### 11.20.30 Verbal Reasoning: GATE2013 EE: GA-5

**Statement:** You can always give me a ring whenever you need.

Which one of the following is the best inference from the above statement?

- A. Because I have a nice caller tune.
- B. Because I have a better telephone facility.
- C. Because a friend in need is a friend indeed.
- D. Because you need not pay towards the telephone bills when you give me a ring.

gate2013-ee verbal-reasoning verbal-aptitude

[Answer key](#)



#### 11.20.31 Verbal Reasoning: GATE2013 EE: GA-7

**Statement:** There were different streams of freedom movements in colonial India carried out by the moderates, liberals, radicals, socialists, and so on.

Which one of the following is the best inference from the above statement?

- A. The emergence of nationalism in colonial India led to our Independence.
- B. Nationalism in India emerged in the context of colonialism.
- C. Nationalism in India is homogeneous.
- D. Nationalism in India is heterogeneous

gate2013-ee passage-reading verbal-aptitude verbal-reasoning

[Answer key](#)



#### 11.20.32 Verbal Reasoning: GATE2014 AG: GA-3

Which of the following options is the closest in meaning to the sentence below?

“As a woman, I have no country.”

- A. Women have no country.
- B. Women are not citizens of any country.
- C. Women's solidarity knows no national boundaries.
- D. Women of all countries have equal legal rights.

gate2014-ag general-aptitude verbal-aptitude verbal-reasoning normal

[Answer key](#)

### 11.20.33 Verbal Reasoning: GATE2014 EC-3: GA-1



"India is a country of rich heritage and cultural diversity." Which one of the following facts best supports the claim made in the above sentence?

- A. India is a union of 28 states and 7 union territories.
- B. India has a population of over 1.1 billion.
- C. India is home to 22 official languages and thousands of dialects.
- D. The Indian cricket team draws players from over ten states.

gate2014-ec-3 verbal-reasoning verbal-aptitude

[Answer key](#)

### 11.20.34 Verbal Reasoning: GATE2015 EC-2: GA-10



Lamenting the gradual sidelining of the arts in school curricula, a group of prominent artists wrote to the Chief Minister last year, asking him to allocate more funds to support arts education in schools. However, no such increase has been announced in this year's Budget. The artists expressed their deep anguish at their request not being approved, but many of them remain optimistic about funding in the future.

Which of the statement(s) below is/are logically valid and can be inferred from the above statements?

- i. The artists expected funding for the arts to increase this year.
- ii. The Chief Minister was receptive to the idea of increasing funding for the arts.
- iii. The Chief Minister is a prominent artist.
- iv. Schools are giving less importance to arts education nowadays.

A. (iii) and (iv)      B. (i) and (iv)      C. (i), (ii) and (iv)      D. (i) and (iii)

gate2015-ec-2 passage-reading verbal-reasoning verbal-aptitude

[Answer key](#)

### 11.20.35 Verbal Reasoning: GATE2016 EC-1: GA-7



In a world filled with uncertainty, he was glad to have many good friends. He had always assisted them in times of need and was confident that they would reciprocate. However, the events of the last week proved him wrong.

Which of the following inference(s) is/are logically valid and can be inferred from the above passage?

- i. His friends were always asking him to help them.
- ii. He felt that when in need of help, his friends would let him down.
- iii. He was sure that his friends would help him when in need.
- iv. His friends did not help him last week.

A. (i) and (ii)      B. (iii) and (iv)      C. (iii) only      D. (iv) only

gate2016-ec-1 passage-reading verbal-reasoning

[Answer key](#)

### 11.20.36 Verbal Reasoning: GATE2016 EC-1: GA-8



Leela is older than her cousin Pavithra. Pavithra's brother Shiva is older than Leela. When Pavithra and Shiva are visiting Leela, all three like to play chess. Pavithra wins more often than Leela does.

Which one of the following statements must be TRUE based on the above?

- A. When Shiva plays chess with Leela and Pavithra, he often loses.
- B. Leela is the oldest of the three.
- C. Shiva is a better chess player than Pavithra.
- D. Pavithra is the youngest of the three.

gate2016-ec-1 verbal-aptitude passage-reading verbal-reasoning

[Answer key](#)

### 11.20.37 Verbal Reasoning: GATE2016 ME-2: GA-7

A smart city integrates all modes of transport, uses clean energy and promotes sustainable use of resources. It also uses technology to ensure safety and security of the city, something which critics argue, will lead to a surveillance state. Which of the following can be logically inferred from the above paragraph?

- i. All smart cities encourage the formation of surveillance states.
- ii. Surveillance is an integral part of a smart city.
- iii. Sustainability and surveillance go hand in hand in a smart city.
- iv. There is a perception that smart cities promote surveillance.

A. (i) and (iv) only      B. (ii) and (iii) only      C. (iv) only      D. (i) only

gate2016-me-2    passage-reading    verbal-reasoning

Answer key 

### 11.20.38 Verbal Reasoning: GATE2017 ME-1: GA-9

Two very famous sportsmen Mark and Steve happened to be brothers and played for country *K*. Mark teased James, an opponent from country *E*, "There is no way you are good enough to play for your country." James replied, "Maybe not, but at least I am the best player in my own family."

Which one of the following can be inferred from this conversation?

- A. Mark was known to play better than James.
- B. Steve was known to play better than Mark.
- C. James and Steve were good friends.
- D. James played better than Steve.

gate2017-me-1    general-aptitude    verbal-aptitude    verbal-reasoning

Answer key 

### 11.20.39 Verbal Reasoning: GATE2019 IN: GA-6

Since the last one year after a 125 basis point reduction in repo rate by the Reserve Bank of India, banking institutions have been making a demand to reduce interest rates on small saving schemes. Finally, the government announced yesterday a reduction in interest rates on small saving schemes to bring them on par with fixed deposit interest rates.

Which one of the following statements can be inferred from the given passage?

- A. Whenever the Reserve Bank of India reduces the repo rate, the interest rates on small saving schemes are also reduced
- B. Interest rates on small saving schemes are always maintained on par with fixed deposit interest rates
- C. The government sometimes takes into consideration the demands of banking institutions before reducing the interest rates on small saving scheme
- D. A reduction in interest rates on small savings scheme follow only after a reduction in repo rate by the Reserve Bank Of India

gate2019-in    general-aptitude    verbal-aptitude    passage-reading    verbal-reasoning

Answer key 

### 11.20.40 Verbal Reasoning: GATE2019 ME-1: GA-6

Under a certain legal system, prisoners are allowed to make one statement. If their statements turns out to be true then they are hanged. If the statements turns to be false then they are shot. One prisoner made a statement and the judge had no option but to set him free. Which one of the following could be that statement?

- A. I did not commit the crime
- B. I committed the crime
- C. I will be shot
- D. You committed the crime

gate2019-me-1    general-aptitude    verbal-aptitude    verbal-reasoning

Answer key 

## 11.21

### Word Meaning (17)

#### 11.21.1 Word Meaning: GATE CSE 2014 Set 2 | Question: GA-3

Match the columns.



Column 1	Column 2
1. eradicate	P. misrepresent
2. distort	Q. soak completely
3. saturate	R. use
4. utilize	S. destroy utterly

A. 1:S, 2:P, 3:Q, 4:R

C. 1:Q, 2:R, 3:S, 4:P

gatecse-2014-set2 verbal-aptitude word-meaning normal

[Answer key](#)

B. 1:P, 2:Q, 3:R, 4:S

D. 1:S, 2:P, 3:R, 4:Q



#### 11.21.2 Word Meaning: GATE CSE 2015 Set 2 | Question: GA-2

Choose the statement where underlined word is used correctly.

- A. The industrialist had a personnel jet.
- B. I write my experience in my personnel diary.
- C. All personnel are being given the day off.
- D. Being religious is a personnel aspect.

gatecse-2015-set2 verbal-aptitude word-meaning normal

[Answer key](#)



#### 11.21.3 Word Meaning: GATE CSE 2016 Set 1 | Question: GA02

A rewording of something written or spoken is a \_\_\_\_\_.

- A. paraphrase
- B. paradox
- C. paradigm
- D. paraffin

gatecse-2016-set1 verbal-aptitude word-meaning normal

[Answer key](#)



#### 11.21.4 Word Meaning: GATE CSE 2016 Set 2 | Question: GA-03

Find the odd one in the following group of words.

mock, deride, praise, jeer

- A. Mock
- B. Deride
- C. Praise
- D. Jeer

gatecse-2016-set2 verbal-aptitude word-meaning easy

[Answer key](#)



#### 11.21.5 Word Meaning: GATE CSE 2020 | Question: GA-2

His knowledge of the subject was excellent but his classroom performance was \_\_\_\_\_.

- A. extremely poor
- B. good
- C. desirable
- D. praiseworthy

gatecse-2020 verbal-aptitude english-grammar word-meaning one-mark

[Answer key](#)



#### 11.21.6 Word Meaning: GATE2014 EC-4: GA-2

After the discussion, Tom said to me, 'Please revert!'. He expects me to \_\_\_\_\_.

- A. Retract
- B. Get back to him
- C. Move in reverse
- D. Retreat

gate2014-ec-4 verbal-aptitude word-meaning easy

[Answer key](#)



#### 11.21.7 Word Meaning: GATE2015 CE-2: GA-2

Choose the statement where underlined word is used correctly.

- A. The minister insured the victims that everything would be all right.



country, I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for impartial recording of these matters".

Here, the word 'antagonistic' is closest in meaning to,

- A. Impartial      B. Argumentative      C. Separated      D. Hostile

gate2017-ec-1 verbal-aptitude word-meaning

[Answer key](#)



#### 11.21.14 Word Meaning: GATE2017 EC-2: GA-1

The ninth and the tenth of this month are Monday and Tuesday \_\_\_\_\_.

- A. figuratively      B. retrospectively      C. respectively      D. rightfully

gate2017-ec-2 general-aptitude verbal-aptitude word-meaning

[Answer key](#)



#### 11.21.15 Word Meaning: GATE2017 ME-1: GA-2

As the two speakers became increasingly agitated, the debate became \_\_\_\_\_.

- A. lukewarm      B. poetic      C. forgiving      D. heated

gate2017-me-1 general-aptitude verbal-aptitude word-meaning

[Answer key](#)



#### 11.21.16 Word Meaning: GATE2017 ME-2: GA-2

If you choose plan *P*, you will have to \_\_\_\_\_ plan *Q*, as these two are mutually \_\_\_\_\_.

- A. forgo, exclusive      B. forget, inclusive  
C. accept, exhaustive      D. adopt, intrusive

gate2017-me-2 general-aptitude verbal-aptitude word-meaning

[Answer key](#)



#### 11.21.17 Word Meaning: GATE2019 CE-1: GA-8

"The increasing interest in tribal characters might be a mere coincidence, but the timing is of interest. None of this, though, is to say that the tribal hero has arrived in Hindi cinema, or that the new crop of characters represents the acceptance of the tribal character in the industry. The films and characters are too few to be described as a pattern."

What does the word 'arrived' mean in the paragraph above?

- A. reached a terminus      B. came to a conclusion  
C. attained a status      D. went to a place

gate2019-ce-1 general-aptitude verbal-aptitude passage-reading word-meaning

[Answer key](#)

### 11.22

#### Word Pairs (30)



##### 11.22.1 Word Pairs: GATE CH 2023 | GA Question: 2

References : \_\_\_\_\_ : : Guidelines : Implement  
(By word meaning)

- A. Sight      B. Site      C. Cite      D. Plagiarise

gatech-2023 verbal-aptitude word-pairs

[Answer key](#)



##### 11.22.2 Word Pairs: GATE CSE 2010 | Question: 60

The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair.

**Unemployed : Worker**

- A. fallow : land      B. unaware : sleeper



C. wit : jester

gatecse-2010 verbal-aptitude word-pairs normal

Answer key 

D. renovated : house

### 11.22.3 Word Pairs: GATE CSE 2013 | Question: 57



Complete the sentence:

Universalism is to particularism as diffuseness is to \_\_\_\_\_.

A. specificity

B. neutrality

C. generality

D. adaptation

gatecse-2013 verbal-aptitude normal word-pairs

Answer key 

### 11.22.4 Word Pairs: GATE CSE 2015 Set 1 | Question: GA-5



Which one of the following combinations is incorrect?

A. Acquiescence - Submission

C. Flippancy - Lightness

B. Wheedle - Roundabout

D. Profligate - Extravagant

gatecse-2015-set1 verbal-aptitude difficult word-pairs

Answer key 

### 11.22.5 Word Pairs: GATE CSE 2015 Set 3 | Question: GA-4



Select the pair of best expresses a relationship similar to that expressed in the pair:

**Children : Pediatrician**

A. Adult : Orthopaedist

C. Kidney : Nephrologist

B. Females : Gynaecologist

D. Skin : Dermatologist

gatecse-2015-set3 verbal-aptitude easy word-pairs

Answer key 

### 11.22.6 Word Pairs: GATE CSE 2020 | Question: GA-3



Select the word that fits the analogy:

Cook : Cook :: Fly : \_\_\_\_\_

A. Flyer

B. Flying

C. Flew

D. Flighter

gatecse-2020 verbal-aptitude word-pairs one-mark

Answer key 

### 11.22.7 Word Pairs: GATE CSE 2021 Set 1 | GA Question: 5



\_\_\_\_\_ is to surgery as writer is to \_\_\_\_\_

Which one of the following options maintains a similar logical relation in the above sentence?

A. Plan, outline

C. Doctor, book

B. Hospital, library

D. Medicine, grammar

gatecse-2021-set1 verbal-aptitude word-pairs one-mark

Answer key 

### 11.22.8 Word Pairs: GATE CSE 2021 Set 2 | GA Question: 5



Pen : Write :: Knife : \_\_\_\_\_

Which one of the following options maintains a similar logical relation in the above?

A. Vegetables

B. Sharp

C. Cut

D. Blunt

gatecse-2021-set2 verbal-aptitude word-pairs one-mark easy

Answer key 

### 11.22.9 Word Pairs: GATE CSE 2023 | GA Question: 2



Kind : \_\_\_\_\_ :: Often : Frequently (By word meaning)

- A. Mean      B. Type      C. Cruel      D. Kindly

gatecse-2023 verbal-aptitude word-pairs one-mark

Answer key

### 11.22.10 Word Pairs: GATE CSE 2025 | Set 2 | GA Question: 2



Bird : Nest :: Bee : \_\_\_\_\_

- A. Kennel      B. Hammock      C. Hive      D. Lair

gatecse2025-set2 verbal-aptitude word-pairs easy one-mark

Answer key

### 11.22.11 Word Pairs: GATE Chemical 2020 | GA Question: 3



Select the word that fits the analogy:

Cover : Uncover :: Associate : \_\_\_\_\_

- A. Unassociate      B. Inassociate      C. Misassociate      D. Dissociate

gate2020-ch verbal-aptitude word-pairs

Answer key

### 11.22.12 Word Pairs: GATE Civil 2020 Set 1 | GA Question: 3



Select the word that fits the analogy:

Fuse : Fusion :: Use : \_\_\_\_\_

- A. Usage      B. User      C. Uses      D. Uson

gate2020-ce-1 verbal-aptitude word-pairs easy

Answer key

### 11.22.13 Word Pairs: GATE Civil 2020 Set 2 | GA Question: 3



Select the word that fits the analogy:

Partial : Impartial :: Popular: \_\_\_\_\_

- A. Impopular      B. Dispular      C. Mispular      D. Unpopular

gate2020-ce-2 verbal-aptitude word-pairs

Answer key

### 11.22.14 Word Pairs: GATE Civil 2023 Set 1 | GA Question: 2



Eject : Insert :: Advance : \_\_\_\_\_

(By word meaning)

- A. Advent      B. Progress      C. Retreat      D. Loan

gatecivil-2023-set1 verbal-aptitude word-pairs

Answer key

### 11.22.15 Word Pairs: GATE Civil 2023 Set 2 | GA Question: 2



Kind : \_\_\_\_\_ :: Often : Seldom

(By word meaning)

- A. Cruel      B. Variety      C. Type      D. Kindred

gatecivil-2023-set2 verbal-aptitude word-pairs

Answer key

### 11.22.16 Word Pairs: GATE ECE 2020 | GA Question: 3



Select the word that fits the analogy:

Explicit: Implicit :: Express: \_\_\_\_\_

- A. Impress      B. Repress      C. Compress      D. Suppress

gate2020-ec   verbal-aptitude   word-pairs

[Answer key](#)

### 11.22.17 Word Pairs: GATE ECE 2021 | GA Question: 4



*Nostalgia* is to *anticipation* as \_\_\_\_\_ is to \_\_\_\_\_

Which one of the following options maintains a similar logical relation in the above sentence?

- A. Present, past      B. Future, past  
C. Past, future      D. Future, present

gateec-2021   verbal-aptitude   word-pairs

[Answer key](#)

### 11.22.18 Word Pairs: GATE ECE 2023 | GA Question: 2



Courts : \_\_\_\_\_ : : Parliament : Legislature

(By word meaning)

- A. Judiciary      B. Executive      C. Governmental      D. Legal

gateece-2023   verbal-aptitude   word-pairs   easy

[Answer key](#)

### 11.22.19 Word Pairs: GATE Electrical 2020 | GA Question: 3



Select the word that fits the analogy:

Do : Undo :: Trust : \_\_\_\_\_

- A. Entrust      B. Intrust      C. Distrust      D. Untrust

gate2020-ee   verbal-aptitude   word-pairs

[Answer key](#)

### 11.22.20 Word Pairs: GATE Electrical 2021 | GA Question: 5



*Oasis* is to *sand* as *island* is to \_\_\_\_\_

Which one of the following options maintains a similar logical relation in the above sentence?

- A. Stone      B. Land      C. Water      D. Mountain

gateee-2021   verbal-aptitude   word-pairs

[Answer key](#)

### 11.22.21 Word Pairs: GATE Electrical 2023 | GA Question: 2



Permit : \_\_\_\_\_ :: Enforce : Relax

(By word meaning)

- A. Allow      B. Forbid      C. License      D. Reinforce

gate2023-ee   verbal-aptitude   word-pairs

[Answer key](#)

### 11.22.22 Word Pairs: GATE IN 2023 | GA Question: 2



Disagree : Protest: : Agree: \_\_\_\_\_

(By word meaning)

- A. Refuse      B. Pretext      C. Recommend      D. Refute

**Answer key****11.22.23 Word Pairs: GATE Mechanical 2020 Set 1 | GA Question: 3**

Select the word that fits the analogy:

Build : Building :: Grow : \_\_\_\_\_

- A. Grown      B. Grew      C. Growth      D. Growed

**Answer key****11.22.24 Word Pairs: GATE Mechanical 2020 Set 2 | GA Question: 3**

Select the word that fits the analogy:

White: Whitening :: Light : \_\_\_\_\_

- A. Lightning      B. Lightening      C. Lighting      D. Enlightening

**Answer key****11.22.25 Word Pairs: GATE Mechanical 2023 | GA Question: 2**

Planting : Seed :: Raising: \_\_\_\_\_

(By word meaning)

- A. Child      B. Temperature      C. Height      D. Lift

**Answer key****11.22.26 Word Pairs: GATE2010 MN: GA-2**

The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair.

**Preamble : Constitution**

- |                     |                    |
|---------------------|--------------------|
| A. amendment : law  | B. prologue : play |
| C. episode : serial | D. plot : story    |

**Answer key****11.22.27 Word Pairs: GATE2010 TF: GA-2**

The question below consists of a pair of related words followed by four pairs of words. Select the pair the best expresses the relation in the original pair.

**Erudition : Scholar**

- |                          |                        |
|--------------------------|------------------------|
| A. steadfast : mercurial | B. competence : strict |
| C. skill : craftsman     | D. nurse : doctor      |

**Answer key****11.22.28 Word Pairs: GATE2011 AG: GA-5**

The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair:

**Gladiator : Arena**

- |                        |                       |
|------------------------|-----------------------|
| A. dancer : stage      | B. commuter : train   |
| C. teacher : classroom | D. lawyer : courtroom |

**Answer key**

### 11.22.29 Word Pairs: GATE2013 AE: GA-5



Select the pair that best expresses a relationship similar to that expressed in the pair:

**water: pipe::**

- A. cart: road  
C. sea: beach

- B. electricity: wire  
D. music: instrument

gate2013-ae verbal-aptitude word-pairs

**Answer key**

### 11.22.30 Word Pairs: GATE2013 CE: GA-5



Select the pair that best expresses a relationship similar to that expressed in the pair:

**Medicine: Health**

- A. Science: Experiment  
C. Education: Knowledge

- B. Wealth: Peace  
D. Money: Happiness

gate2013-ce word-pairs verbal-aptitude

**Answer key**

## Answer Keys

11.1.1	B	11.1.2	A	11.2.1	A	11.2.2	A	11.2.3	D
11.2.4	A	11.2.5	C	11.2.6	C	11.2.7	A	11.3.1	C
11.3.2	C	11.3.3	D	11.3.4	B	11.3.5	D	11.3.6	C
11.3.7	B	11.3.8	A	11.3.9	A	11.3.10	A	11.3.11	A
11.3.12	C	11.4.1	D	11.4.2	C	11.4.3	A	11.4.4	D
11.4.5	B	11.4.6	D	11.4.7	A	11.4.8	D	11.4.9	D
11.5.1	D	11.5.2	D	11.5.3	B	11.5.4	D	11.5.5	B
11.6.1	A	11.6.2	C	11.6.3	C	11.6.4	C	11.6.5	D
11.6.6	C	11.6.7	B	11.6.8	B	11.6.9	A	11.6.10	C
11.6.11	A	11.6.12	D	11.6.13	B	11.6.14	A	11.6.15	B
11.6.16	A	11.6.17	C	11.6.18	A	11.6.19	D	11.6.20	D
11.6.21	B	11.6.22	A	11.6.23	C	11.6.24	C	11.6.25	B
11.6.26	C	11.6.27	C	11.6.28	B	11.6.29	B	11.6.30	C
11.6.31	A	11.6.32	D	11.6.33	C	11.6.34	C	11.6.35	B
11.6.36	D	11.6.37	A	11.6.38	D	11.6.39	A	11.6.40	D
11.6.41	A	11.6.42	C	11.6.43	C	11.6.44	A	11.6.45	B
11.6.46	B	11.6.47	D	11.6.48	C	11.6.49	D	11.6.50	B
11.6.51	A	11.6.52	B	11.6.53	C	11.6.54	D	11.6.55	A
11.6.56	C	11.6.57	D	11.6.58	C	11.6.59	C	11.6.60	C
11.6.61	D	11.6.62	B	11.6.63	C	11.6.64	C	11.6.65	D
11.6.66	A	11.6.67	A	11.6.68	D	11.6.69	B	11.6.70	A
11.6.71	B	11.6.72	D	11.6.73	A	11.6.74	B	11.6.75	B
11.6.76	C	11.6.77	B	11.6.78	B	11.6.79	B	11.6.80	A
11.6.81	B	11.6.82	B	11.6.83	A	11.6.84	C	11.6.85	C
11.6.86	C	11.6.87	A	11.6.88	B	11.6.89	B	11.6.90	A
11.6.91	C	11.6.92	A	11.6.93	A	11.6.94	A	11.6.95	A

11.6.96	A	11.6.97	C	11.6.98	B	11.6.99	A	11.6.100	A
11.6.101	D	11.6.102	C	11.6.103	D	11.6.104	A	11.6.105	A
11.6.106	C	11.6.107	D	11.6.108	D	11.6.109	D	11.6.110	C
11.6.111	B	11.6.112	A	11.6.113	D	11.7.1	B	11.8.1	B
11.8.2	C	11.8.3	D	11.9.1	D	11.9.2	C	11.9.3	B
11.9.4	B	11.9.5	D	11.10.1	D	11.10.2	C	11.10.3	D
11.10.4	C	11.10.5	D	11.10.6	C	11.10.7	B	11.10.8	D
11.10.9	B	11.10.10	D	11.10.11	B	11.10.12	D	11.10.13	B
11.10.14	B	11.10.15	C	11.10.16	B	11.10.17	B	11.10.18	D
11.10.19	D	11.10.20	B	11.10.21	D	11.10.22	B	11.10.23	C
11.10.24	B	11.10.25	B	11.10.26	A	11.10.27	B	11.10.28	D
11.10.29	A	11.10.30	D	11.10.31	A	11.10.32	D	11.10.33	C
11.10.34	B	11.10.35	B	11.10.36	B	11.10.37	D	11.10.38	A
11.10.39	A	11.10.40	B	11.10.41	A	11.10.42	C	11.10.43	A
11.10.44	C	11.10.45	D	11.10.46	D	11.10.47	C	11.10.48	B
11.10.49	B;D	11.10.50	D	11.10.51	C	11.10.52	A	11.10.53	D
11.10.54	C	11.10.55	A	11.10.56	A	11.10.57	B	11.11.1	A
11.11.2	C	11.12.1	B	11.12.2	C	11.12.3	C	11.12.4	C
11.12.5	A	11.12.6	B	11.12.7	B	11.12.8	C	11.13.1	B
11.13.2	A	11.13.3	D	11.13.4	A	11.13.5	D	11.13.6	B
11.13.7	B	11.13.8	C	11.14.1	B	11.14.2	C	11.14.3	B
11.14.4	C	11.15.1	D	11.15.2	C	11.15.3	C	11.15.4	C
11.15.5	B	11.16.1	A	11.16.2	C	11.17.1	A	11.17.2	C
11.18.1	B	11.18.2	A	11.18.3	A	11.18.4	B	11.18.5	D
11.18.6	A	11.18.7	D	11.18.8	B	11.18.9	B	11.18.10	C
11.18.11	D	11.18.12	A	11.18.13	A	11.18.14	B	11.18.15	C
11.18.16	D	11.18.17	C	11.18.18	A	11.18.19	B	11.19.1	A
11.19.2	B	11.19.3	C	11.19.4	C	11.19.5	B	11.19.6	B
11.19.7	C	11.19.8	D	11.19.9	A	11.19.10	C	11.19.11	C
11.19.12	A	11.19.13	C	11.19.14	C	11.19.15	B	11.19.16	B
11.19.17	B	11.19.18	C	11.19.19	B	11.19.20	A	11.19.21	C
11.19.22	B	11.19.23	A	11.19.24	C	11.19.25	B	11.20.1	D
11.20.2	B	11.20.3	A	11.20.4	D	11.20.5	B	11.20.6	B
11.20.7	B	11.20.8	D	11.20.9	D	11.20.10	D	11.20.11	C
11.20.12	D	11.20.13	D	11.20.14	D	11.20.15	A	11.20.16	C
11.20.17	A	11.20.18	C	11.20.19	A	11.20.20	D	11.20.21	D
11.20.22	D	11.20.23	A	11.20.24	B	11.20.25	C	11.20.26	C
11.20.27	D	11.20.28	D	11.20.29	C	11.20.30	C	11.20.31	D
11.20.32	C	11.20.33	C	11.20.34	B	11.20.35	B	11.20.36	D
11.20.37	C	11.20.38	B	11.20.39	C	11.20.40	C	11.21.1	A
11.21.2	C	11.21.3	A	11.21.4	C	11.21.5	A	11.21.6	B
11.21.7	B	11.21.8	B	11.21.9	B	11.21.10	C	11.21.11	D

11.21.12	A
11.21.17	C
11.22.5	B
11.22.10	C
11.22.15	A
11.22.20	C
11.22.25	A
11.22.30	C

11.21.13	D
11.22.1	C
11.22.6	A
11.22.11	D
11.22.16	B
11.22.21	B
11.22.26	B

11.21.14	C
11.22.2	A
11.22.7	C
11.22.12	A
11.22.17	C
11.22.22	C
11.22.27	C

11.21.15	D
11.22.3	A
11.22.8	C
11.22.13	D
11.22.18	A
11.22.23	C
11.22.28	D

11.21.16	A
11.22.4	B
11.22.9	B,D
11.22.14	C
11.22.19	C
11.22.24	B
11.22.29	B