Table of Contents

Contributors

User	👍, Answers
Arjun Suresh	9417, 127
Akash Kanase	1694, 32
Gate Keeda	1512, 35
Sachin Mittal	1346, 15
Rajesh Pradhan	1162, 22
Amar Vashishth	1142, 16
Digvijay	1098, 18
Bhagirathi Nayak	921, 17
Vikrant Singh	911, 11
Prashant Singh	835, 41
Rajarshi Sarkar	833, 26
gatecse	733, 10
Rishabh Gupta	659, 3
Ahwan Mishra	649, 8
Anu	613, 7
suraj	590, 9
Pragy Agarwal	553, 6
Deepak Poonia	534, 13
Sankaranarayanan P.N	509, 14
Ayush Upadhyaya	471, 8
Anurag Semwal	460, 7
Abhilash Panicker	443, 5
Happy Mittal	443, 10
Pooja Palod	411, 9
Sona Praneeth Akula	385, 7
Manali	375, 7
ankitgupta.1729	368, 27
Leen Sharma	355, 26
Shaik Masthan	354, 21
ryan sequeira	332, 3
Praveen Saini	329, 6
Akhil Nadh PC	327, 6
Ankit Rokde	326, 5
Manu Thakur	318, 7
Srinath Jayachandran	315, 5
Kalpish Singhal	310, 3
Keith Kr	300, 7
Shubham Srivastava	283, 5
Shyam Singh	279, 4
Manish Joshi	274, 3
Soumya Jain	270, 4
srestha	264, 9
dd	255, 6
Ashish Deshmukh	252, 1
Anoop Sonkar	251, 4
Sourav Basu	250, 1
Anurag Pandey	234, 2
Nikhil Dhama	230, 5
Madhur Rawat	219, 3
Ashwani Kumar	217, 6
Lakshman Patel (GATE And Tech)	212, 6
SAKET NANDAN	202, 4
Harsh181996	196, 1
arjuno	196, 1
minal	190, 2

User	?Added
GO Editor	352
Kathleen Bankson	294
Arjun Suresh	286
Misbah Ghaya	135
Ishrat Jahan	82
admin	47
gatecse	40
soujanyareddy13	24
Pooja Khatri	23
Rucha Shelke	22
Akash Kanase	19
Sandeep Singh	15
RISHABH KUMAR	12
khush tak	9
Madhav kumar	6
sanjay	5
shivani Sharma	5

User	Done
Lakshman Patel (GATE And Tech)	370
Arjun Suresh	304
kenzou	276
Milicevic3306	119
soujanyareddy13	116
Shubham Sharma	102
Pooja Khatri	92
gatecse	78
Hira	67
Misbah Ghaya	66
Naveen Kumar	57
V S Silpa	50
Shikha Mallick	47
sanjay	38
Shaik Masthan	29
GO Editor	20
Don't defeat anybody but yourself.	20
Krithiga2101	19
Pavan Singh	19
Prashant Singh	16
Akash Dinkar	15
SUJITH'	15
shadymademe	15
ankitgupta.1729	14
Deepak Poonia	12
VIPIN NARAYAN	12
Sankaranarayanan P.N	12
jothee_new	12
Leen Sharma	11
Ankit Singh	10
GO Classes for GATE CSE	10
srestha	9
NarutoUzumaki	9
Abhrajyoti Kundu	9
Pragy Agarwal	7
Ajay kumar soni	6
Subarna Das	6
Sachin Mittal	6
Sweta Kumari Rawani	6
Puja Mishra	6
RISHABH KUMAR	6
Ay_Kay_Ay	5
Jeet	5
Debasmita Bhoumik	5
꧁༒☬L·ọr̦ 🅷🅸🆅🅰☬༒꧂	5
Shiva Sagar Rao	5
shekhar chauhan	5
shivani Sharma	5
Sukanya Das	4
asutosh kumar Biswal	4
Manoj Kumar	4
Satbir Singh	4
Pooja Palod	4
Rajarshi Sarkar	4

1.0.1 UGC NET CSE | August 2016 | Part 3 | Question: 36

Match the following :

a.	Prim's algorithm	i.	$O(V^2E)$
b.	Bellman-Ford algorithm	ii.	$O(VElgV)$
c.	Floyd-Warshall algorithm	iii.	$O(ElgV)$
d.	Johnson's algorithm	iv.	$O(V^3)$

where V is the set of nodes and E is the set of edges in the graph.

Codes :

A. a-i, b-iii, c-iv, d-ii
B. a-i, b-iii, c-ii, d-iv
C. a-iii, b-i, c-iv, d-ii
D. a-iii, b-i, c-ii, d-iv

ugcnetcse-aug2016-paper3 algorithms

Answer key

1.0.2 UGC NET CSE | July 2018 | Part 2 | Question: 30

Consider a Boolean function of 'n' variables. The order of an algorithm that determines whether the Boolean function produces a output 1 is

A. Logarithmic B. Linear C. Quadratic D. Exponential

ugcnetcse-july2018-paper2 algorithms

Answer key

1.0.3 UGC NET CSE | July 2018 | Part 2 | Question: 27

Match the following with respect to algorithm paradigms :

	List-I		List-II
(a)	The 8-Queen's problem	(i)	Dynamic programming
(b)	Single-Source shortest paths	(ii)	Divide and Conquer
(c)	STRASSEN's Matrix multiplication	(iii)	Greedy approach
(d)	Optimal Binary search trees	(iv)	Back tracking

Code :

A. (a)-(iv), (b)-(i), (c)-(iii), (d)-(ii)
B. (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
C. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
D. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

ugcnetcse-july2018-paper2 algorithms

Answer key

1.0.4 UGC NET CSE | January 2017 | Part 3 | Question: 36

Match the following with respect to algorithm paradigms :

	List-I		List-II
a.	Merge sort	i.	Dynamic programming
b.	Huffman coding	ii.	Greedy approach
c.	Optimal polygon triangulation	iii.	Divide and conquer
d.	Subset sum problem	iv.	Back tracking

Codes :

A. a-iii, b-i, c-ii, d-iv
B. a-ii, b-i, c-iv, d-iii
C. a-ii, b-i, c-iii, d-iv
D. a-iii, b-ii, c-i, d-iv

ugcnetcse-jan2017-paper3 algorithms easy match-the-following

Answer key

1.0.5 UGC NET CSE | December 2004 | Part 2 | Question: 25

How much extra space is used by heapsort ?

A. $O(1)$
B. $O(\log n)$
C. $O(n)$
D. $O(n^2)$

algorithms heap-sort ugcnetcse-dec2004-paper2

Answer key

1.0.6 UGC NET CSE | October 2020 | Part 2 | Question: 90

Given below are two statements:

Statement I: A genetic algorithm is a stochastic hill-climbing search in which a large population of states is maintained

Statement II: In nondeterministic environments, agents can apply AND-OR search to generate contingent plans that reach the goal regardless of which outcomes occur during execution.

In the light of the above statements, choose the correct answer from the options given below

A. Both Statement I and Statement II are true
B. Both Statement I and Statement II are false
C. Statement I is correct but Statement II is false
D. Statement I is incorrect but Statement II is true

algorithms ugcnetcse-oct2020-paper2

Answer key

1.0.7 UGC NET CSE | October 2020 | Part 2 | Question: 69

Match List I with List II

With reference to CMM developed by Software Engineering Institute (SEI)

	List I		List II
(A)	Branch-and-bound	(I)	Keeps track of all partial paths which can be candidate for further exploration.
(B)	Steepest-accent hill climbing	(II)	Defects difference between current state and goal state
(C)	Constraint satisfaction	(III)	Discovers problem state(s) that satisfy a set of constraints
(D)	Means-end-analysis	(IV)	Considers all moves from current state and selects best move

Choose the correct answer from the options given below:

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

ugcnetcse-oct2020-paper2 non-gatecse algorithms

Answer key

1.1 Activity Selection Problem (1)

1.1.1 Activity Selection Problem: UGC NET CSE | December 2015 | Part 3 | Question: 16

In Activity-Selection problem, each activity i has a start time s_i and a finish time f_i where $s_i \leq f_i$. Activities i and j are compatible if

A. $s_i \geq f_j$
B. $s_j \geq f_i$
C. $s_i \geq f_j$ or $s_j \geq f_i$
D. $s_i \geq f_j$ and $s_j \geq f_i$

ugcnetcse-dec2015-paper3 algorithms activity-selection-problem

Answer key☟

1.2 Algorithm Design (17)

1.2.1 Algorithm Design: GATE CSE 1992 | Question: 8

Let T be a Depth First Tree of a undirected graph G. An array P indexed by the vertices of G is given. $P[V]$ is the parent of vertex V, in T. Parent of the root is the root itself.

Give a method for finding and printing the cycle formed if the edge (u, v) of G not in T (i.e., $e \in G - T$) is now added to T.

Time taken by your method must be proportional to the length of the cycle.

Describe the algorithm in a PASCAL (C) – like language. Assume that the variables have been suitably declared.

gate1992 algorithms descriptive algorithm-design

Answer key☟

1.2.2 Algorithm Design: GATE CSE 1994 | Question: 7

An array A contains n integers in locations $A[0], A[1], \dots A[n-1]$. It is required to shift the elements of the array cyclically to the left by K places, where $1 \leq K \leq n-1$. An incomplete algorithm for doing this in linear time, without using another array is given below. Complete the algorithm by filling in the blanks. Assume all variables are suitably declared.

```
min:=n;
i=0;
while _____ do
begin
   temp:=A[i];
   j:=i;
   while ____ do
   begin
      A[j]:=____;
      j:=(j+K) mod n;
     if j<min then
      min:=j;
   end;
   A[(n+i-K)mod n]:=____;
   i:=______;
end;
```

gate1994 algorithms normal algorithm-design fill-in-the-blanks

Answer key☟

1.2.3 Algorithm Design: GATE CSE 2006 | Question: 17

An element in an array X is called a leader if it is greater than all elements to the right of it in X. The best algorithm to find all leaders in an array

A. solves it in linear time using a left to right pass of the array
B. solves it in linear time using a right to left pass of the array
C. solves it using divide and conquer in time $\Theta(n \log n)$
D. solves it in time $\Theta(n^2)$

gatecse-2006 algorithms normal algorithm-design

Answer key

1.2.4 Algorithm Design: GATE CSE 2006 | Question: 54

Given two arrays of numbers $a_1, \dots, a_n$ and $b_1, \dots, b_n$ where each number is 0 or 1, the fastest algorithm to find the largest span (i, j) such that $a_i + a_{i+1} + \dots + a_j = b_i + b_{i+1} + \dots + b_j$ or report that there is not such span,

A. Takes $O(3^n)$ and $\Omega(2^n)$ time if hashing is permitted
B. Takes $O(n^3)$ and $\Omega(n^{2.5})$ time in the key comparison mode
C. Takes $\Theta(n)$ time and space
D. Takes $O(\sqrt{n})$ time only if the sum of the $2n$ elements is an even number

gatecse-2006 algorithms normal algorithm-design time-complexity

Answer key

1.2.5 Algorithm Design: GATE CSE 2014 Set 1 | Question: 37

There are 5 bags labeled 1 to 5. All the coins in a given bag have the same weight. Some bags have coins of weight 10 gm, others have coins of weight 11 gm. I pick $1, 2, 4, 8, 16$ coins respectively from bags 1 to 5 Their total weight comes out to 323 gm. Then the product of the labels of the bags having 11 gm coins is ___.

gatecse-2014-set1 algorithms numerical-answers normal algorithm-design

Answer key

1.2.6 Algorithm Design: GATE CSE 2019 | Question: 25

Consider a sequence of 14 elements: $A = [-5, -10, 6, 3, -1, -2, 13, 4, -9, -1, 4, 12, -3, 0]$. The sequence sum $S(i, j) = \Sigma_{k=i}^{j} A[k]$. Determine the maximum of $S(i, j)$, where $0 \leq i \leq j < 14$. (Divide and conquer approach may be used.)

Answer: ___________

gatecse-2019 numerical-answers algorithms algorithm-design one-mark

Answer key

1.2.7 Algorithm Design: GATE CSE 2021 Set 1 | Question: 40

Define R_n to be the maximum amount earned by cutting a rod of length n meters into one or more pieces of integer length and selling them. For $i > 0$, let $p[i]$ denote the selling price of a rod whose length is i meters. Consider the array of prices:

$$\mathrm{p}[1] = 1, \mathrm{p}[2] = 5, \mathrm{p}[3] = 8, \mathrm{p}[4] = 9, \mathrm{p}[5] = 10, \mathrm{p}[6] = 17, \mathrm{p}[7] = 18$$

Which of the following statements is/are correct about R_7?

A. $R_7 = 18$
B. $R_7 = 19$
C. R_7 is achieved by three different solutions
D. R_7 cannot be achieved by a solution consisting of three pieces

gatecse-2021-set1 multiple-selects algorithms algorithm-design two-marks

Answer key

1.2.8 Algorithm Design: GATE CSE 2024 | Set 2 | Question: 32

Consider an array X that contains n positive integers. A subarray of X is defined to be a sequence of array locations with consecutive indices.

The C code snippet given below has been written to compute the length of the longest subarray of X that contains at most two distinct integers. The code has two missing expressions labelled (P) and (Q).

```
int first=0, second=0, len1=0, len2=0, maxlen=0;
for (int i=0; i < n; i++) {
    if (X[i] == first) {
        len2++; len1++;
    } else if (X[i] == second) {
        len2++;
        len1 = ____(P)____;

        second = first;
    } else {
        len2 = ____(Q)____;

        len1 = 1; second = first;
    }
    if (len2 > maxlen) {
        maxlen = len2;
    }
    first = X[i];
}
```

Which one of the following options gives the CORRECT missing expressions?

(**Hint:** At the end of the i-th iteration, the value of $len1$ is the length of the longest subarray ending with $\mathrm{X}[i]$ that contains all equal values, and $len2$ is the length of the longest subarray ending with $\mathrm{X}[i]$ that contains at most two distinct values.)

A. $(\mathrm{P})\ \mathrm{len1}+1$ $\quad(\mathrm{Q})\ \mathrm{len2}+1$
B. $(\mathrm{P})\ 1$ $\quad(\mathrm{Q})\ \mathrm{len1}+1$
C. $(\mathrm{P})\ 1$ $\quad(\mathrm{Q})\ \mathrm{len2}+1$
D. $(\mathrm{P})\ \mathrm{len2}+1$ $\quad(\mathrm{Q})\ \mathrm{len1}+1$

gatecse2024-set2 algorithms algorithm-design two-marks

Answer key

1.2.9 Algorithm Design: UGC NET CSE | December 2018 | Part 2 | Question: 21

The solution of recurrence relation:

$T(n) = 2T(\sqrt{n}) + \lg(n)$ is

A. $O(\lg(n))$
B. $O(n\lg(n))$
C. $O(\lg(n)\lg(n))$
D. $O(\lg(n)\lg(\lg(n)))$

ugcnetcse-dec2018-paper2 recurrence-relation asymptotic-notations algorithm-design

Answer key

1.2.10 Algorithm Design: UGC NET CSE | December 2019 | Part 2 | Question: 39

Give asymptotic upper and lower bound for $T(n)$ given below. Assume $T(n)$ is constant for $n \leq 2$.
$T(n) = 4T(\sqrt{n}) + \lg^2 n$

A. $T(n) = \theta(\lg(\lg^2 n)\lg n)$
B. $T(n) = \theta(\lg^2 n\lg n)$
C. $T(n) = \theta(\lg^2 n\lg\lg n)$
D. $T(n) = \theta(\lg(\lg n)\lg n)$

ugcnetcse-dec2019-paper2 asymptotic-notations recurrence-relation algorithm-design

Answer key

1.2.11 Algorithm Design: UGC NET CSE | December 2019 | Part 2 | Question: 80

Consider the following:

a. Trapping at local maxima
b. Reaching a plateau
c. Traversal along the ridge

Which of the following option represents shortcomings of the hill climbing algorithm?

A. (a) and (b) only
B. (a) and (c) only
C. (b) and (c) only
D. (a), (b) and (c)

ugcnetcse-dec2019-paper2 artificial-intelligence algorithm-design

Answer key☟

1.2.12 Algorithm Design: UGC NET CSE | June 2005 | Part 2 | Question: 25

The algorithm that will efficiently sort an array that is nearly sorted except for the interchange of some adjacent pairs of numbers like $\{1, 3, 2, 5, 4, 6\}$ is :

A. Quick sort
B. Bubble sort
C. Merge sort
D. Selection sort

ugcnetcse-june2005-paper2 sorting algorithm-design data-structures

Answer key☟

1.2.13 Algorithm Design: UGC NET CSE | June 2007 | Part 2 | Question: 24

Which algorithm has some average, worst case and best case time:

A. Binary search
B. Maximum of n numbers
C. Quick sort
D. Fibonacci search

ugcnetcse-june2007-paper2 sorting algorithm-design time-complexity

1.2.14 Algorithm Design: UGC NET CSE | November 2017 | Part 2 | Question: 38

Suppose there are six files $F1, F2, F3, F4, F5, F6$ with corresponding sizes 150 KB, 225 KB, 75 KB 60 KB, 275 KB and 65 KB respectively. The files are to be stored on a sequential device in such a way that optimizes access time. In what order should the files be stored?

A. $F5, F2, F1, F3, F6, F4$
B. $F4, F6, F3, F1, F2, F5$
C. $F1, F2, F3, F4, F5, F6$
D. $F6, F5, F4, F3, F2, F1$

ugcnetcse-nov2017-paper2 data-structures algorithm-design sorting

Answer key☟

1.2.15 Algorithm Design: UGC NET CSE | November 2017 | Part 3 | Question: 32

You are given a sequence of n elements to sort. The input sequence consists of $\frac{n}{k}$ subsequences, each containing k elements. The elements in a given subsequence are all smaller than the elements in the succeeding subsequence and larger than the elements in the preceding subsequence. Thus, all that is needed to sort the whole sequence of length n is to sort the k elements in each of the $\frac{n}{k}$ subsequences.

The lower bound on the number of comparisons needed to solve this variant of the sorting problem is

A. $\Omega(n)$
B. $\Omega\left(\frac{n}{k}\right)$
C. $\Omega(n \lg k)$
D. $\Omega\left(\frac{n}{k} \lg \frac{n}{k}\right)$

ugcnetcse-nov2017-paper3 sorting time-complexity asymptotic-notations algorithm-design

Answer key☟

1.2.16 Algorithm Design: UGC NET CSE | November 2017 | Part 3 | Question: 33

Consider the recurrence relation:

$$\begin{aligned} T(n) &= 8T\left(\frac{n}{2}\right) + Cn, \text{if } n > 1 \\ &= b, \text{if } n = 1 \end{aligned}$$

Where b and c are constants.

The order of the algorithm corresponding to above recurrence relation is

A. n
B. n^2
C. $n \lg n$
D. n^3

ugcnetcse-nov2017-paper3 recurrence-relation asymptotic-notations algorithm-design

Answer key

1.2.17 Algorithm Design: UGC NET CSE | October 2022 | Part 1 | Question: 6

The solution of the recurrence relation $T(n) = 3T(n/4) + n \lg n$ is

A. $\theta\left(n^2 \lg n\right)$
B. $\theta(n \lg n)$
C. $\theta(n \lg n)^2$
D. $\theta(n \lg \lg n)$

ugcnetcse-oct2022-paper1 recurrence-relation asymptotic-notations algorithm-design

1.3 Algorithm Design Techniques (10)

1.3.1 Algorithm Design Techniques: GATE CSE 1990 | Question: 12b

Consider the following problem. Given n positive integers $a_1, a_2 \ldots a_n,$ it is required to partition them in to two parts A and B such that, $\left|\sum_{i \in A} a_i - \sum_{i \in B} a_i\right|$ is minimised

Consider a greedy algorithm for solving this problem. The numbers are ordered so that $a_1 \geq a_2 \geq \ldots a_n,$ and at i^{th} step, a_i is placed in that part whose sum in smaller at that step. Give an example with $n = 5$ for which the solution produced by the greedy algorithm is not optimal.

gate1990 descriptive algorithms algorithm-design-techniques

Answer key

1.3.2 Algorithm Design Techniques: GATE CSE 1990 | Question: 2-vii

Match the pairs in the following questions:

(a)	Strassen's matrix multiplication algorithm	(p)	Greedy method
(b)	Kruskal's minimum spanning tree algorithm	(q)	Dynamic programming
(c)	Biconnected components algorithm	(r)	Divide and Conquer
(d)	Floyd's shortest path algorithm	(s)	Depth-first search

gate1990 match-the-following algorithms algorithm-design-techniques easy

Answer key

1.3.3 Algorithm Design Techniques: GATE CSE 1994 | Question: 1.19, ISRO2016-31

Algorithm design technique used in quicksort algorithm is?

A. Dynamic programming
B. Backtracking
C. Divide and conquer
D. Greedy method

gate1994 algorithms algorithm-design-techniques quick-sort easy isro2016

Answer key

1.3.4 Algorithm Design Techniques: GATE CSE 1995 | Question: 1.5

Merge sort uses:

A. Divide and conquer strategy
B. Backtracking approach
C. Heuristic search
D. Greedy approach

gate1995 algorithms sorting easy algorithm-design-techniques merge-sort

Answer key

1.3.5 Algorithm Design Techniques: GATE CSE 1997 | Question: 1.5

The correct matching for the following pairs is

A.	All pairs shortest path	1.	Greedy
B.	Quick Sort	2.	Depth-First Search
C.	Minimum weight spanning tree	3.	Dynamic Programming
D.	Connected Components	4.	Divide and Conquer

A. A-2 B-4 C-1 D-3
B. A-3 B-4 C-1 D-2
C. A-3 B-4 C-2 D-1
D. A-4 B-1 C-2 D-3

gate1997 algorithms normal algorithm-design-techniques easy match-the-following

Answer key

1.3.6 Algorithm Design Techniques: GATE CSE 1998 | Question: 1.21, ISRO2008-16

Which one of the following algorithm design techniques is used in finding all pairs of shortest distances in a graph?

A. Dynamic programming
B. Backtracking
C. Greedy
D. Divide and Conquer

gate1998 algorithms algorithm-design-techniques easy isro2008

Answer key

1.3.7 Algorithm Design Techniques: GATE CSE 2015 Set 1 | Question: 6

Match the following:

P.	Prim's algorithm for minimum spanning tree	i.	Backtracking
Q.	Floyd-Warshall algorithm for all pairs shortest path	ii.	Greedy method
R.	Merge sort	iii.	Dynamic programming
S.	Hamiltonian circuit	iv.	Divide and conquer

A. P-iii, Q-ii, R-iv, S-i
B. P-i, Q-ii, R-iv, S-iii
C. P-ii, Q-iii, R-iv, S-i
D. P-ii, Q-i, R-iii, S-iv

gatecse-2015-set1 algorithms normal match-the-following algorithm-design-techniques

Answer key

1.3.8 Algorithm Design Techniques: GATE CSE 2015 Set 2 | Question: 36

Given below are some algorithms, and some algorithm design paradigms.

1.	Dijkstra's Shortest Path	i.	Divide and Conquer
2.	Floyd-Warshall algorithm to compute all pair shortest path	ii.	Dynamic Programming
3.	Binary search on a sorted array	iii.	Greedy design
4.	Backtracking search on a graph	iv.	Depth-first search
		v.	Breadth-first search

Match the above algorithms on the left to the corresponding design paradigm they follow.

A. 1-i, 2-iii, 3-i, 4-v
B. 1-iii, 2-iii, 3-i, 4-v
C. 1-iii, 2-ii, 3-i, 4-iv
D. 1-iii, 2-ii, 3-i, 4-v

gatecse-2015-set2 algorithms easy algorithm-design-techniques match-the-following

Answer key

1.3.9 Algorithm Design Techniques: GATE CSE 2017 Set 1 | Question: 05

Consider the following table:

	Algorithms		Design Paradigms
(P)	Kruskal	(i)	Divide and Conquer
(Q)	Quicksort	(ii)	Greedy
(R)	Floyd-Warshall	(iii)	Dynamic Programming

Match the algorithms to the design paradigms they are based on.

A. $(P) \leftrightarrow (ii), (Q) \leftrightarrow (iii), (R) \leftrightarrow (i)$
B. $(P) \leftrightarrow (iii), (Q) \leftrightarrow (i), (R) \leftrightarrow (ii)$
C. $(P) \leftrightarrow (ii), (Q) \leftrightarrow (i), (R) \leftrightarrow (iii)$
D. $(P) \leftrightarrow (i), (Q) \leftrightarrow (ii), (R) \leftrightarrow (iii)$

gatecse-2017-set1 algorithms algorithm-design-techniques easy match-the-following

Answer key☟

1.3.10 Algorithm Design Techniques: UGC NET CSE | December 2006 | Part 2 | Question: 22

Binary search tree is an example of :

A. Divide and conquer technique
B. Greedy algorithm
C. Back tracking
D. Dynamic Programming

ugcnetcse-dec2006-paper2 algorithms easy algorithm-design-techniques

Answer key☟

1.4 Algorithm Efficiency (1)

1.4.1 Algorithm Efficiency: UGC NET CSE | Junet 2015 | Part 2 | Question: 25

To determine the efficiency of an algorithm the time factor is measured by

A. Counting micro seconds
B. Counting number of key operations
C. Counting number of statements
D. Counting kilobytes of algorithm

ugcnetcse-june2015-paper2 algorithm-efficiency

Answer key☟

1.5 Array (2)

1.5.1 Array: UGC NET CSE | January 2017 | Part 2 | Question: 21

Which of the following is true for computation time in insertion, deletion and finding maximum and minimum element in a sorted array ?

A. Insertion – $0(1)$, Deletion – $0(1)$, Maximum – $0(1)$, Minimum – $0(1)$
B. Insertion – $0(1)$, Deletion – $0(1)$, Maximum – $0(n)$, Minimum – $0(n)$
C. Insertion – $0(n)$, Deletion – $0(n)$, Maximum – $0(1)$, Minimum – $0(1)$
D. Insertion – $0(n)$, Deletion – $0(n)$, Maximum – $0(n)$, Minimum – $0(n)$

ugcnetjan2017ii algorithms array

Answer key☟

1.5.2 Array: UGC NET CSE | July 2016 | Part 3 | Question: 32

Let $A[1, \dots, n]$ be an array of n distinct numbers. If $i < j$ and $A[i] > A[j]$, then the pair (i, j) is called an inversion of A. What is the expected number of inversions in any permutation on n elements?

A. $\theta(n)$
B. $\theta(lgn)$
C. $\theta(nlgn)$
D. $\theta(n^2)$

ugcnetcse-july2016-paper3 algorithms array

Answer key☟

1.6 Artificial Intelligence (3)

1.6.1 Artificial Intelligence: UGC NET CSE | December 2018 | Part 2 | Question: 93

Consider the following terminology and match List I with List II and choose the correct answer from the code given below.

- b = branching factor
- d = depth of the shallowest solution
- m = maximum depth of the search tree
- l = depth limit

List I	(Algorithms)	List II	(Space Complexity)
(a)	BFS search	(i)	$O(bd)$
(b)	DFS search	(ii)	$O(b^d)$
(c)	Depth-limited search	(iii)	$O(bm)$
(d)	Iterative deepening search	(iv)	$O(bl)$

Code:

A. (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)
B. (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)
C. (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)
D. (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)

ugcnetcse-dec2018-paper2 artificial-intelligence algorithms time-complexity

Answer key☟

1.6.2 Artificial Intelligence: UGC NET CSE | June 2014 | Part 3 | Question: 31

Consider $f(N) = g(N) + h(N)$ Where function g is a measure of the cost of getting from the start node to the current node. N and h is an estimate of the additional cost of getting from the current node N to the goal node. Then $f(N) = h(N)$ is used in which one of the following algorithms?

A. A^*algorithm
B. AO^* algorithm
C. Greedy best first search algorithm
D. Iterative A^* algorithm

ugcnetjune2014iii artificial-intelligence algorithms

Answer key☟

1.6.3 Artificial Intelligence: UGC NET CSE | June 2014 | Part 3 | Question: 33

________ is used in game trees to reduce the number of branches of the search tree to be traversed without affecting the solution.

A. Best first search
B. Goal stack planning
C. Alpha-beta pruning procedure
D. Min-max search

ugcnetjune2014iii artificial-intelligence algorithms

Answer key☟

1.7 Asymptotic Notations (29)

1.7.1 Asymptotic Notations: GATE CSE 1994 | Question: 1.23

Consider the following two functions:

$$g_1(n) = \begin{cases} n^3 \text{ for } 0 \leq n \leq 10,000 \\ n^2 \text{ for } n > 10,000 \end{cases}$$

$$g_2(n) = \begin{cases} n \text{ for } 0 \leq n \leq 100 \\ n^3 \text{ for } n > 100 \end{cases}$$

Which of the following is true?

A. $g_1(n)$ is $O(g_2(n))$

B. $g_1(n)$ is $O(n^3)$

C. $g_2(n)$ is $O(g_1(n))$

D. $g_2(n)$ is $O(n)$

gate1994 algorithms asymptotic-notations normal multiple-selects

Answer key☟

1.7.2 Asymptotic Notations: GATE CSE 1996 | Question: 1.11

Which of the following is false?

A. $100n\log n = O(\frac{n\log n}{100})$

B. $\sqrt{\log n} = O(\log\log n)$

C. If $0 < x < y$ then $n^x = O\left(n^y\right)$

D. $2^n \neq O\left(nk\right)$

gate1996 algorithms asymptotic-notations normal

Answer key☟

1.7.3 Asymptotic Notations: GATE CSE 1999 | Question: 2.21

If $T_1 = O(1)$, give the correct matching for the following pairs:

(M) $T_n = T_{n-1} + n$	(U) $T_n = O(n)$
(N) $T_n = T_{n/2} + n$	(V) $T_n = O(n\log n)$
(O) $T_n = T_{n/2} + n\log n$	(W) $T_n = O(n^2)$
(P) $T_n = T_{n-1} + \log n$	(X) $T_n = O(\log^2 n)$

A. M-W, N-V, O-U, P-X

B. M-W, N-U, O-X, P-V

C. M-V, N-W, O-X, P-U

D. M-W, N-U, O-V, P-X

gate1999 algorithms recurrence-relation asymptotic-notations normal match-the-following

Answer key☟

1.7.4 Asymptotic Notations: GATE CSE 2000 | Question: 2.17

Consider the following functions

- $f(n) = 3n^{\sqrt{n}}$
- $g(n) = 2^{\sqrt{n}\log_2 n}$
- $h(n) = n!$

Which of the following is true?

A. $h(n)$ is $O(f(n))$

B. $h(n)$ is $O(g(n))$

C. $g(n)$ is not $O(f(n))$

D. $f(n)$ is $O(g(n))$

gatecse-2000 algorithms asymptotic-notations normal

Answer key☟

1.7.5 Asymptotic Notations: GATE CSE 2001 | Question: 1.16

Let $f(n) = n^2\log n$ and $g(n) = n(\log n)^{10}$ be two positive functions of n. Which of the following statements is correct?

A. $f(n) = O(g(n))$ and $g(n) \neq O(f(n))$

B. $g(n) = O(f(n))$ and $f(n) \neq O(g(n))$

C. $f(n) \neq O(g(n))$ and $g(n) \neq O(f(n))$

D. $f(n) = O(g(n))$ and $g(n) = O(f(n))$

gatecse-2001 algorithms asymptotic-notations time-complexity normal

Answer key☟

1.7.6 Asymptotic Notations: GATE CSE 2003 | Question: 20

Consider the following three claims:

I. $(n+k)^m = \Theta(n^m)$ where k and m are constants

II. $2^{n+1} = O(2^n)$
III. $2^{2n+1} = O(2^n)$

Which of the following claims are correct?

A. I and II
B. I and III
C. II and III
D. I, II, and III

gatecse-2003 algorithms asymptotic-notations normal

Answer key

1.7.7 Asymptotic Notations: GATE CSE 2004 | Question: 29

The tightest lower bound on the number of comparisons, in the worst case, for comparison-based sorting is of the order of

A. n
B. n^2
C. $n \log n$
D. $n \log^2 n$

gatecse-2004 algorithms sorting asymptotic-notations easy

Answer key

1.7.8 Asymptotic Notations: GATE CSE 2005 | Question: 37

Suppose $T(n) = 2T(\frac{n}{2}) + n$, $T(0) = T(1) = 1$
Which one of the following is FALSE?

A. $T(n) = O(n^2)$
B. $T(n) = \Theta(n \log n)$
C. $T(n) = \Omega(n^2)$
D. $T(n) = O(n \log n)$

gatecse-2005 algorithms asymptotic-notations recurrence-relation normal

Answer key

1.7.9 Asymptotic Notations: GATE CSE 2008 | Question: 39

Consider the following functions:

- $f(n) = 2^n$
- $g(n) = n!$
- $h(n) = n^{\log n}$

Which of the following statements about the asymptotic behavior of $f(n)$, $g(n)$ and $h(n)$ is true?

A. $f(n) = O(g(n)); g(n) = O(h(n))$
B. $f(n) = \Omega(g(n)); g(n) = O(h(n))$
C. $g(n) = O(f(n)); h(n) = O(f(n))$
D. $h(n) = O(f(n)); g(n) = \Omega(f(n))$

gatecse-2008 algorithms asymptotic-notations normal

Answer key

1.7.10 Asymptotic Notations: GATE CSE 2011 | Question: 37

Which of the given options provides the increasing order of asymptotic complexity of functions f_1, f_2, f_3 and f_4?

- $f_1(n) = 2^n$
- $f_2(n) = n^{3/2}$
- $f_3(n) = n \log_2 n$
- $f_4(n) = n^{\log_2 n}$

A. f_3, f_2, f_4, f_1
B. f_3, f_2, f_1, f_4
C. f_2, f_3, f_1, f_4
D. f_2, f_3, f_4, f_1

gatecse-2011 algorithms asymptotic-notations normal

Answer key

1.7.11 Asymptotic Notations: GATE CSE 2012 | Question: 18

Let $W(n)$ and $A(n)$ denote respectively, the worst case and average case running time of an algorithm executed on an input of size n. Which of the following is **ALWAYS TRUE**?

A. $A(n) = \Omega(W(n))$
B. $A(n) = \Theta(W(n))$
C. $A(n) = \text{O}(W(n))$
D. $A(n) = \text{o}(W(n))$

gatecse-2012 algorithms easy asymptotic-notations

Answer key

1.7.12 Asymptotic Notations: GATE CSE 2015 Set 3 | Question: 4

Consider the equality $\sum_{i=0}^{n} i^3 = X$ and the following choices for X:

I. $\Theta(n^4)$
II. $\Theta(n^5)$
III. $O(n^5)$
IV. $\Omega(n^3)$

The equality above remains correct if X is replaced by

A. Only I
B. Only II
C. I or III or IV but not II
D. II or III or IV but not I

gatecse-2015-set3 algorithms asymptotic-notations normal

Answer key

1.7.13 Asymptotic Notations: GATE CSE 2015 Set 3 | Question: 42

Let $f(n) = n$ and $g(n) = n^{(1+\sin\ n)}$, where n is a positive integer. Which of the following statements is/are correct?

I. $f(n) = O(g(n))$
II. $f(n) = \Omega(g(n))$

A. Only I
B. Only II
C. Both I and II
D. Neither I nor II

gatecse-2015-set3 algorithms asymptotic-notations normal

Answer key

1.7.14 Asymptotic Notations: GATE CSE 2017 Set 1 | Question: 04

Consider the following functions from positive integers to real numbers:

$10, \sqrt{n}, n, \log_2 n, \frac{100}{n}$.
The CORRECT arrangement of the above functions in increasing order of asymptotic complexity is:

A. $\log_2 n, \frac{100}{n}, 10, \sqrt{n}, n$
B. $\frac{100}{n}, 10, \log_2 n, \sqrt{n}, n$
C. $10, \frac{100}{n}, \sqrt{n}, \log_2 n, n$
D. $\frac{100}{n}, \log_2 n, 10, \sqrt{n}, n$

gatecse-2017-set1 algorithms asymptotic-notations normal

Answer key

1.7.15 Asymptotic Notations: GATE CSE 2021 Set 1 | Question: 3

Consider the following three functions.

$$f_1 = 10^n \quad f_2 = n^{\log n} \quad f_3 = n^{\sqrt{n}}$$

Which one of the following options arranges the functions in the increasing order of asymptotic growth rate?

A. f_3, f_2, f_1
B. f_2, f_1, f_3
C. f_1, f_2, f_3
D. f_2, f_3, f_1

gatecse-2021-set1 algorithms asymptotic-notations one-mark

Answer key

1.7.16 Asymptotic Notations: GATE CSE 2022 | Question: 1

Which one of the following statements is TRUE for all positive functions $f(n)$?

A. $f(n^2) = \theta(f(n)^2)$, when $f(n)$ is a polynomial
B. $f(n^2) = o(f(n)^2)$
C. $f(n^2) = O(f(n)^2)$, when $f(n)$ is an exponential function
D. $f(n^2) = \Omega(f(n)^2)$

gatecse-2022 algorithms asymptotic-notations one-mark

Answer key

1.7.17 Asymptotic Notations: GATE CSE 2023 | Question: 19

Let f and g be functions of natural numbers given by $f(n) = n$ and $g(n) = n^2$. Which of the following statements is/are TRUE?

A. $f \in O(g)$
B. $f \in \Omega(g)$
C. $f \in o(g)$
D. $f \in \Theta(g)$

gatecse-2023 algorithms asymptotic-notations multiple-selects one-mark

Answer key

1.7.18 Asymptotic Notations: GATE CSE 2023 | Question: 44

Consider functions **Function_1** and **Function_2** expressed in pseudocode as follows:

```
Function_1
  while n>1 do
    for i=1 to n do
      x = x + 1;
    end for
    n = ⌊n/2⌋;
  end while
```

```
Function_2
  for i = 1 to 100 * n do
    x = x + 1;
  end for
```

Let $f_1(n)$ and $f_2(n)$ denote the number of times the statement "$\text{x} = \text{x} + 1$" is executed in **Function_1** and **Function_2**, respectively.

Which of the following statements is/are TRUE?

A. $f_1(n) \in \Theta(f_2(n))$
B. $f_1(n) \in o(f_2(n))$
C. $f_1(n) \in \omega(f_2(n))$
D. $f_1(n) \in O(n)$

gatecse-2023 algorithms asymptotic-notations multiple-selects two-marks

Answer key

1.7.19 Asymptotic Notations: GATE CSE 2024 | Set 2 | Question: 5

Let $\mathrm{T(n)}$ be the recurrence relation defined as follows:

$$T(0) = 1,$$
$$T(1) = 2, \text{ and}$$
$$T(n) = 5T(n-1) - 6T(n-2) \text{ for } n \geq 2$$

Which one of the following statements is TRUE?

A. $T(n) = \Theta(2^n)$
B. $T(n) = \Theta(n2^n)$
C. $T(n) = \Theta(3^n)$
D. $T(n) = \Theta(n3^n)$

gatecse2024-set2 algorithms recurrence-relation asymptotic-notations one-mark

Answer key☟

1.7.20 Asymptotic Notations: GATE IT 2004 | Question: 55

Let $f(n)$, $g(n)$ and $h(n)$ be functions defined for positive integers such that $f(n) = O(g(n))$, $g(n) \neq O(f(n))$, $g(n) = O(h(n))$, and $h(n) = O(g(n))$.
Which one of the following statements is FALSE?

A. $f(n) + g(n) = O(h(n) + h(n))$
B. $f(n) = O(h(n))$
C. $h(n) \neq O(f(n))$
D. $f(n)h(n) \neq O(g(n)h(n))$

gateit-2004 algorithms asymptotic-notations normal

Answer key☟

1.7.21 Asymptotic Notations: GATE IT 2008 | Question: 10

Arrange the following functions in increasing asymptotic order:

a. $n^{1/3}$
b. e^n
c. $n^{7/4}$
d. $n \log^9 n$
e. 1.0000001^n

A. a, d, c, e, b
B. d, a, c, e, b
C. a, c, d, e, b
D. a, c, d, b, e

gateit-2008 algorithms asymptotic-notations normal

Answer key☟

1.7.22 Asymptotic Notations: UGC NET CSE | December 2013 | Part 2 | Question: 35

Big-O estimate for $f(x) = (x+1)\log(x^2+1) + 3x^2$ is given as

A. $O(x \log x)$
B. $O(x^2)$
C. $O(x^3)$
D. $O(x^2 \log x)$

ugcnetcse-dec2013-paper2 algorithms easy asymptotic-notations

Answer key☟

1.7.23 Asymptotic Notations: UGC NET CSE | December 2013 | Part 3 | Question: 35

Let A and B be two $n \times n$ matrices. The efficient algorithm to multiply the two matrices has the time complexity

A. $O(n^3)$
B. $O(n^{2.81})$
C. $O(n^{2.67})$
D. $O(n^2)$

ugcnetcse-dec2013-paper3 algorithms asymptotic-notations

Answer key☟

1.7.24 Asymptotic Notations: UGC NET CSE | December 2013 | Part 3 | Question: 36

The recurrence relation $T(n) = mT(\frac{n}{2}) + tan^2$ is satisfied by

A. O(n^2)
B. O($n^{lg\,m}$)
C. O(n^2 $lg\,n$)
D. O(n lg n)

ugcnetcse-dec2013-paper3 algorithms asymptotic-notations recurrence-relation

Answer key☟

1.7.25 Asymptotic Notations: UGC NET CSE | January 2017 | Part 3 | Question: 31

The asymptotic upper bound solution of the recurrence relation given by $T(n) = 2T\left(\frac{n}{2}\right) + \frac{n}{\lg\, n}$ is

A. $O(n^2)$
B. $O(n \text{ lg } n)$
C. $O(n \text{ lg lg } n)$
D. $O(\text{lg lg } n)$

ugcnetcse-jan2017-paper3 algorithms asymptotic-notations recurrence-relation

Answer key☟

1.7.26 Asymptotic Notations: UGC NET CSE | June 2014 | Part 2 | Question: 24

Big-O estimates for the factorial function and the logarithm of the factorial function i.e. $n!$ and $\log n!$ is given by

A. $O(n!)$ and $O(n \log n)$
B. $O(n^n)$ and $O(n \log n)$
C. $O(n!)$ and $O(\log n!)$
D. $O(n^n)$ and $O(\log n!)$

ugcnetcse-june2014-paper2 algorithms time-complexity asymptotic-notations

Answer key☟

1.7.27 Asymptotic Notations: UGC NET CSE | June 2014 | Part 2 | Question: 39

An algorithm is made up of 2 modules M_1 and M_2 . If time complexity of modules M_1 and M_2 are $h(n)$ and $g(n)$ respectively, the time complexity of the algorithm is

A. $\min(h(n), g(n))$
B. $\max(h(n), g(n))$
C. $h(n) + g(n)$
D. $h(n) * g(n)$

ugcnetcse-june2014-paper2 algorithms time-complexity asymptotic-notations

Answer key☟

1.7.28 Asymptotic Notations: UGC NET CSE | June 2014 | Part 3 | Question: 61

Given the following equalities : $E_1 : n^{K+\in} + n^K \lg n = \theta(n^{K+\in})$ for all fixed K and $\in, K \geq 0$ and $\in > 0$. $E_2 : n^3 2^n + 6n^2 3^n = O(n^3 2^n)$. Which of the following is true ?

1. E_1 is correct and E_2 is correct.
2. E_1 is correct and E_2 is not correct.
3. E_1 is not correct and E_2 is correct.
4. E_1 is not correct and E_2 is not correct.

asymptotic-notations ugcnetjune2014iii

Answer key☟

1.7.29 Asymptotic Notations: UGC NET CSE | Junet 2015 | Part 3 | Question: 35

Let $f(n)$ and $g(n)$ be asymptotically non-negative functions. Which of the following is correct?

A. $\theta(f(n)^* g(n)) = min(f(n), g(n))$
B. $\theta(f(n)^* g(n)) = max(f(n), g(n))$
C. $\theta(f(n) + g(n)) = min(f(n), g(n))$
D. $\theta(f(n) + g(n)) = max(f(n), g(n))$

asymptotic-notations algorithms ugcnetcse-june2015-paper3

Answer key☟

1.8 B Tree (2)

1.8.1 B Tree: UGC NET CSE | December 2010 | Part 2 | Question: 21

What is the maximum number of nodes in a B-tree of order 10 of depth 3 (root at depth 0) ?

A. 111
B. 999
C. 9999
D. None of the above

ugcnetcse-dec2010-paper2 algorithms b-tree

Answer key☟

1.8.2 B Tree: UGC NET CSE | December 2013 | Part 2 | Question: 24

For any B-tree of minimum degree t $\geq$ 2, every node other than the root must have at least ____ keys and every node can have at most ____ keys.

A. t-1, 2t+1 B. t+1, 2t+1 C. t-1, 2t-1 D. t+1, 2t-1

ugcnetcse-dec2013-paper2 algorithms b-tree

Answer key

1.9 Bellman Ford (3)

1.9.1 Bellman Ford: GATE CSE 2009 | Question: 13

Which of the following statement(s) is/are correct regarding Bellman-Ford shortest path algorithm?

P: Always finds a negative weighted cycle, if one exists.

Q: Finds whether any negative weighted cycle is reachable from the source.

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

gatecse-2009 algorithms graph-algorithms normal bellman-ford

Answer key

1.9.2 Bellman Ford: GATE CSE 2013 | Question: 19

What is the time complexity of Bellman-Ford single-source shortest path algorithm on a complete graph of n vertices?

A. $\theta(n^2)$
B. $\theta(n^2 \log n)$
C. $\theta(n^3)$
D. $\theta(n^3 \log n)$

gatecse-2013 algorithms graph-algorithms normal bellman-ford

Answer key

1.9.3 Bellman Ford: UGC NET CSE | October 2020 | Part 2 | Question: 70

Match list I with List II

	List I		List II
(A)	Topological sort of DAG	(I)	$O(V+E)$
(B)	Kruskal's MST algorithm	(II)	$O(VE)$
(C)	Bellman-Ford's single-source shortest path algorithm	(III)	$\theta(V+E)$
(D)	Floyd-Warshall's all pair shortest path algorithm	(IV)	$\theta(V^3)$

Choose the correct answer from the options given below:

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

ugcnetcse-oct2020-paper2 topological-sort bellman-ford algorithms match-the-following

Answer key

1.10 Binary Heap (2)

1.10.1 Binary Heap: UGC NET CSE | December 2012 | Part 3 | Question: 51

Suppose there are $\log_n$ sorted lists of $n \log_n$ element each. The time complexity of producing a sorted list of all these elements is (use heap data structure)

A. $O(n \log \log_n)$
B. $\theta(n \log_n)$
C. $\Omega(n \log_n)$
D. $\Omega(n^{3/2})$

ugcnetcse-dec2012-paper3 algorithms time-complexity binary-heap

Answer key

1.10.2 Binary Heap: UGC NET CSE | June 2023 | Part 2: 21

Consider the following statements about heap sort algorithm:

A. The MAX-HEAPIFY procedure which runs in $\mathrm{O}\lg(n)$ time, is the key to maintaining the max heap property
B. The BUILD-MAX-HEAP procedure, which runs in $\mathrm{O}\lg(n)$ time, produces max-heap from an unordered input array
C. The MAX-HEAP-INSERT, which runs in $\mathrm{O}\ (\lg n)$ time, implements the insertion operation
D. The HEAP-INCREASE-KEY procedure runs in $\mathrm{O}\ (\mathrm{n}\lg n)$ time , to set the key of new node of its correct value

Choose the correct answer from the options given below:

A. A, B only
B. A, C only
C. B, D only
D. $\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}$

ugcnetcse-june2023-paper2 binary-heap algorithms heap-sort sorting array time-complexity

Answer key

1.11 Binary Search (3)

1.11.1 Binary Search: GATE CSE 2021 Set 2 | Question: 8

What is the worst-case number of arithmetic operations performed by recursive binary search on a sorted array of size n?

A. $\Theta(\sqrt{n})$
B. $\Theta(\log_2(n))$
C. $\Theta(n^2)$
D. $\Theta(n)$

gatecse-2021-set2 algorithms binary-search time-complexity one-mark

Answer key

1.11.2 Binary Search: GATE DA 2025 | Question: 17

For which of the following inputs does binary search take time $O(\log n)$ in the worst case?

A. An array of n integers in any order
B. A linked list of n integers in any order
C. An array of n integers in increasing order
D. A linked list of n integers in increasing order

gateda-2025 algorithms binary-search multiple-selects one-mark

Answer key

1.11.3 Binary Search: GATE DS&AI 2024 | Question: 30

Let $F(n)$ denote the maximum number of comparisons made while searching for an entry in a sorted array of size n using binary search.

Which ONE of the following options is TRUE?

A. $F(n) = F(\lfloor n/2 \rfloor) + 1$
B. $F(n) = F(\lfloor n/2 \rfloor) + F(\lceil n/2 \rceil)$
C. $F(n) = F(\lfloor n/2 \rfloor)$
D. $F(n) = F(n-1) + 1$

gate-ds-ai-2024 algorithms binary-search two-marks

Answer key

1.12 Binary Search Tree (1)

1.12.1 Binary Search Tree: UGC NET CSE | January 2017 | Part 2 | Question: 25

Which of the following statements is false?

A. Optimal binary search tree construction can be performed efficiently using dynamic programming.

B. Breadth-first search cannot be used to find connected components of a graph.
C. Given the prefix and postfix walks of a binary tree, the tree cannot be reconstructed uniquely.
D. Depth-first-search can be used to find the connected components of a graph.

ugcnetjan2017ii algorithms binary-tree binary-search-tree

Answer key

1.13 Binary Tree (7)

1.13.1 Binary Tree: UGC NET CSE | December 2010 | Part 2 | Question: 22

A binary tree with 27 nodes has _______ null branches.

A. 54
B. 27
C. 26
D. None of the above

ugcnetcse-dec2010-paper2 algorithms binary-tree

Answer key

1.13.2 Binary Tree: UGC NET CSE | December 2011 | Part 2 | Question: 19

The post order traversal of a binary tree is DEBFCA. Find out the preorder traversal.

A. ABFCDE
B. ADBFEC
C. ABDECF
D. ABDCEF

ugcnetcse-dec2011-paper2 algorithms binary-tree

Answer key

1.13.3 Binary Tree: UGC NET CSE | December 2011 | Part 2 | Question: 50

The number of nodes in a complete binary tree of height h (with roots at level 0) is equal to

A. $2^0 + 2^1 + \dots\dots 2^h$
B. $2^0 + 2^1 + \dots\dots 2^{h-1}$
C. $2^0 + 2^1 + \dots\dots 2^{h+1}$
D. $2^1 + \dots\dots 2^{h+1}$

ugcnetcse-dec2011-paper2 algorithms binary-tree

Answer key

1.13.4 Binary Tree: UGC NET CSE | December 2014 | Part 2 | Question: 25

A full binary tree with n leaves contains

A. n nodes
B. $\log_2 n$ nodes
C. $2n-1$ nodes
D. 2^n nodes

ugcnetcse-dec2014-paper2 algorithms binary-tree

Answer key

1.13.5 Binary Tree: UGC NET CSE | June 2011 | Part 2 | Question: 22

Given a binary tree whose inorder and preorder traversal are given by

Inorder : EICFBGDJHK

Preorder : BCEIFDGHJK

The post order traversal of the above binary tree is

A. I E F C G J K H D B
B. I E F C J G K H D B
C. I E F C G K J H D B
D. I E F C G J K D B H

ugcnetcse-june2011-paper2 algorithms binary-tree

Answer key

1.13.6 Binary Tree: UGC NET CSE | June 2012 | Part 2 | Question: 2

The post order traversal of a binary tree is DEBFCA. Find out the pre-order traversal

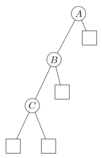
A. ABFCDE B. ADBFEC C. ABDECF D. None of the above

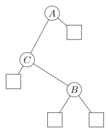
ugcnetcse-june2012-paper2 algorithms binary-tree

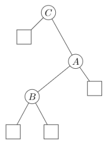
Answer key☟

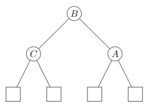
1.13.7 Binary Tree: UGC NET CSE | June 2012 | Part 3 | Question: 42

Which of the following binary tree is optimal, if probabilities of successful search and unsuccessful search are same?

A. 

B. 

C. 

D. 

ugcnetcse-june2012-paper3 binary-tree algorithms

Answer key☟

1.14 Bitonic Array (1)

1.14.1 Bitonic Array: GATE CSE 2025 | Set 2 | Question: 31

An array A of length n with distinct elements is said to be bitonic if there is an index $1 \leq i \leq n$ such that $A[1..i]$ is sorted in the non-decreasing order and $A[i+1...n]$ is sorted in the non-increasing order.

Which ONE of the following represents the best possible asymptotic bound for the worst-case number of comparisons by an algorithm that searches for an element in a bitonic array A ?

A. $\Theta(n)$
B. $\Theta(1)$
C. $\Theta\left(\log^2 n\right)$
D. $\Theta(\log n)$

gatecse2025-set2 algorithms searching bitonic-array time-complexity two-marks

Answer key☟

1.15 Branch and Bound (1)

1.15.1 Branch and Bound: GATE CSE 1990 | Question: 12a

Consider the following instance of the $0-1$ Knapsack problem:

- $\max\ 6X_1 + 11X_2 + 16X_3 + 21X_4 + 26X_5$
- Subject to $4X_1 + 8X_2 + 12X_3 + 16X_4 + 20X_5 < 32$
- and $X_i = 0$ or 1 for $i = 1, \ldots, 5$.

It is required to find all the optimal solutions to this instance using the branch and bound technique.

i. State what method you would use to compute bounds on the partial solutions.
ii. Using a suitable branching technique, generate the entire search tree for this instance of the problem and find all the optimal solutions. Number the nodes in the tree in the order in which they are expanded and for each node show the bound on the partial solutions and the decision which leads to that node.

gate1990 descriptive algorithms branch-and-bound unsolved

1.16 Cryptography (3)

1.16.1 Cryptography: UGC NET CSE | December 2019 | Part 2 | Question: 25

Which of the following is not needed by an encryption algorithm used in Cryptography?

A. KEY B. Message C. Ciphertext D. User details

ugcnetcse-dec2019-paper2 cryptography computer-networks

Answer key☟

1.16.2 Cryptography: UGC NET CSE | June 2008 | Part 2 | Question: 29

An example of a public key encryption algorithm is :

A. Caesar cipher algorithm
B. DES algorithm
C. AES algorithm
D. Knapsack algorithm

ugcnetcse-june2008-paper2 cryptography algorithms

Answer key☟

1.16.3 Cryptography: UGC NET CSE | October 2022 | Part 1 | Question: 3

Using 'RSA' algorithm, if $p=13, q=5$ and $e=7$. the value of d and cipher value of $'6'$ with (e,n) key are

A. $7,4$ B. $7,1$ C. $7,46$ D. $55,1$

ugcnetcse-oct2022-paper1 cryptography number-theory

1.17 Data Compression (1)

1.17.1 Data Compression: UGC NET CSE | November 2017 | Part 3 | Question: 35

A text is made up of the characters a, b, c, d, e each occuring with the probability $0.11, 0.40, 0.16, 0.09$ and 0.24 respectively. The optimal Huffman coding technique will have the average length of

A. 2.40 B. 2.16 C. 2.26 D. 2.15

ugcnetcse-nov2017-paper3 probability huffman-code data-compression

Answer key☟

1.18 Decision Trees (1)

1.18.1 Decision Trees: UGC NET CSE | December 2014 | Part 3 | Question: 31

Any decision tree that sorts n elements has height

A. $\Omega(n)$ B. $\Omega(\lg n)$ C. $\Omega(n \lg n)$ D. $\Omega(n^2)$

ugcnetcse-dec2014-paper3 algorithms decision-trees

Answer key☟

1.19 Depth First Search (5)

1.19.1 Depth First Search: GATE DS&AI 2024 | Question: 34

Consider a state space where the start state is number 1. The successor function for the state numbered n returns two states numbered $n+1$ and $n+2$. Assume that the states in the unexpanded state list are expanded in the ascending order of numbers and the previously expanded states are not added to the unexpanded state list.

Which ONE of the following statements about breadth-first search (BFS) and depth-first search (DFS) is true, when reaching the goal state number 6?

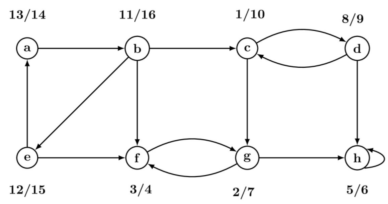
A. BFS expands more states than DFS.
B. DFS expands more states than BFS.
C. Both BFS and DFS expand equal number of states.
D. Both BFS and DFS do not reach the goal state number 6.

gate-ds-ai-2024 algorithms breadth-first-search depth-first-search two-marks

Answer key

1.19.2 Depth First Search: UGC NET CSE | December 2015 | Part 2 | Question: 36

In the following graph, discovery time stamps and finishing time stamps of Depth First Search (DFS) are shown as x/y, where x is discovery time stamp and y is finishing time stamp.



It shows which of the following depth first forest?

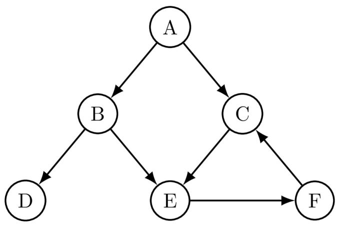
A. {a,b,e} {c,d,f,g,h}
B. {a,b,e} {c,d,h} {f,g}
C. {a,b,e} {f,g} {c,d} {h}
D. {a,b,c,d} {e,f,g} {h}

ugcnetcse-dec2015-paper2 algorithms depth-first-search

Answer key

1.19.3 Depth First Search: UGC NET CSE | June 2007 | Part 2 | Question: 2

Depth ion travels of the following directed graph is:



A. $\mathrm{A\,B\,C\,D\,E\,F}$
B. $\mathrm{A\,B\,D\,E\,F\,C}$
C. $\mathrm{A\,C\,E\,B\,D\,F}$
D. None of the above

ugcnetcse-june2007-paper2 graph-algorithms depth-first-search

1.19.4 Depth First Search: UGC NET CSE | June 2013 | Part 3 | Question: 68

Which one of the following is not an informed search technique?

A. Hill climbing search
B. Best first search
C. A* search
D. Depth first search

ugcnetcse-june2013-paper3 algorithms depth-first-search

Answer key☟

1.19.5 Depth First Search: UGC NET CSE | June 2019 | Part 2 | Question: 65

Which of the following is application of depth-first search?

A. Only topological sort
B. Only strongly connected components
C. Both topological sort and strongly connected components
D. Neither topological sort nor strongly connected components

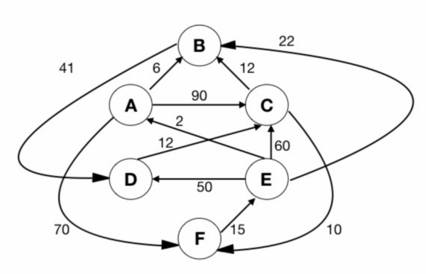
ugcnetcse-june2019-paper2 depth-first-search

Answer key☟

1.20 Dijkstras Algorithm (8)

1.20.1 Dijkstras Algorithm: GATE CSE 1996 | Question: 17

Let G be the directed, weighted graph shown in below figure



We are interested in the shortest paths from A.

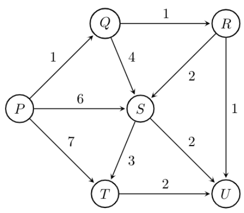
a. Output the sequence of vertices identified by the Dijkstra's algorithm for single source shortest path when the algorithm is started at node A
b. Write down sequence of vertices in the shortest path from A to E
c. What is the cost of the shortest path from A to E?

gate1996 algorithms graph-algorithms normal dijkstras-algorithm descriptive

Answer key☟

1.20.2 Dijkstras Algorithm: GATE CSE 2004 | Question: 44

Suppose we run Dijkstra's single source shortest path algorithm on the following edge-weighted directed graph with vertex P as the source.



In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized?

A. P, Q, R, S, T, U B. P, Q, R, U, S, T C. P, Q, R, U, T, S D. P, Q, T, R, U, S

gatecse-2004 algorithms graph-algorithms normal dijkstras-algorithm

Answer key☟

1.20.3 Dijkstras Algorithm: GATE CSE 2005 | Question: 38

Let $G(V, E)$ be an undirected graph with positive edge weights. Dijkstra's single source shortest path algorithm can be implemented using the binary heap data structure with time complexity:

A. $O\left(|V|^2\right)$

B. $O\left(|E|+|V|\log|V|\right)$

C. $O\left(|V|\log|V|\right)$

D. $O\left((|E|+|V|)\log|V|\right)$

gatecse-2005 algorithms graph-algorithms normal dijkstras-algorithm

Answer key☟

1.20.4 Dijkstras Algorithm: GATE CSE 2006 | Question: 12

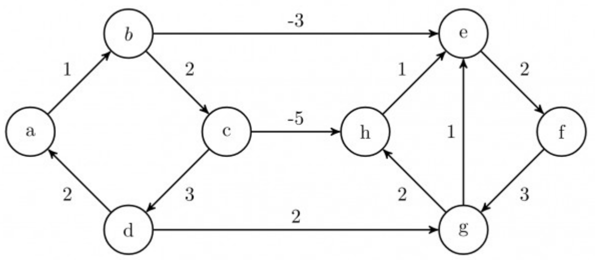
To implement Dijkstra’s shortest path algorithm on unweighted graphs so that it runs in linear time, the data structure to be used is:

A. Queue
B. Stack
C. Heap
D. B-Tree

gatecse-2006 algorithms graph-algorithms easy dijkstras-algorithm

Answer key☟

1.20.5 Dijkstras Algorithm: GATE CSE 2008 | Question: 45



Dijkstra's single source shortest path algorithm when run from vertex a in the above graph, computes the correct shortest path distance to

A. only vertex a

B. only vertices a, e, f, g, h

C. only vertices a, b, c, d

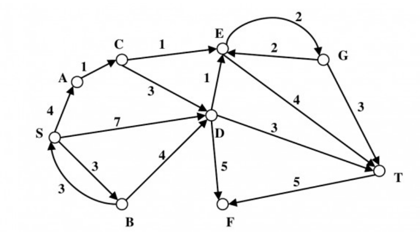
D. all the vertices

gatecse-2008 algorithms graph-algorithms normal dijkstras-algorithm

Answer key☟

1.20.6 Dijkstras Algorithm: GATE CSE 2012 | Question: 40

Consider the directed graph shown in the figure below. There are multiple shortest paths between vertices S and T. Which one will be reported by Dijkstra’s shortest path algorithm? Assume that, in any iteration, the shortest path to a vertex v is updated only when a strictly shorter path to v is discovered.



A. SDT
B. SBDT
C. SACDT
D. SACET

gatecse-2012 algorithms graph-algorithms normal dijkstras-algorithm

Answer key☟

1.20.7 Dijkstras Algorithm: UGC NET CSE | December 2019 | Part 2 | Question: 41

When using Dijkstra’s algorithm to find shortest path in a graph, which of the following statement is <u>not</u> true?

A. It can find shortest path within the same graph data structure
B. Every time a new node is visited, we choose the node with smallest known distance/ cost (weight) to visit first
C. Shortest path always passes through least number of vertices
D. The graph needs to have a non-negative weight on every edge

ugcnetcse-dec2019-paper2 shortest-path dijkstras-algorithm graph-algorithms

Answer key

1.20.8 Dijkstras Algorithm: UGC NET CSE | January 2017 | Part 3 | Question: 35

Dijkstra's algorithm is based on

A. Divide and conquer paradigm
B. Dynamic programming
C. Greedy approach
D. Backtracking paradigm

ugcnetcse-jan2017-paper3 algorithms dijkstras-algorithm

Answer key

1.21 Directed Graph (1)

1.21.1 Directed Graph: GATE DA 2025 | Question: 55

Consider a directed graph $G=(V,E)$, where $V=\{0,1,2,\ldots,100\}$ and $E=\{(i,j):0<j-i\leq 2,$ for all $i,j\in V\}$. Suppose the adjacency list of each vertex is in decreasing order of vertex number, and depth-first search (DFS) is performed at vertex 0. The number of vertices that will be discovered after vertex 50 is ____________ (Answer in integer)

gateda-2025 algorithms depth-first-search directed-graph numerical-answers two-marks

Answer key

1.22 Double Hashing (2)

1.22.1 Double Hashing: GATE CSE 2025 | Set 1 | Question: 55

In a double hashing scheme, $h_1(k)=k \bmod 11$ and $h_2(k)=1+(k \bmod 7)$ are the auxiliary hash functions. The size m of the hash table is 11. The hash function for the i-th probe in the open address table is $[h_1(k)+ih_2(k)] \bmod m$. The following keys are inserted in the given order: $63,50,25,79,67,24$.

The slot at which key 24 gets stored is ____________ . (Answer in integer)

gatecse2025-set1 algorithms hashing double-hashing numerical-answers easy two-marks

Answer key

1.22.2 Double Hashing: UGC NET CSE | June 2019 | Part 2 | Question: 66

Consider double hashing of the form

$h(k,i)=(h_1(k)+ih_2(k))\mathrm{mod\ m}$ where $h_1(k)=\mathrm{k\ mod\ m}$, $h_2(k)=1+(\mathrm{k\ mod\ n})$ where $n=m-1$ and $m=701$. For $k=123456$, what is the difference between first and second probes in terms of slots?

A. 255
B. 256
C. 257
D. 258

ugcnetcse-june2019-paper2 double-hashing

Answer key

1.23 Dynamic Programming (13)

1.23.1 Dynamic Programming: GATE CSE 2008 | Question: 80

The subset-sum problem is defined as follows. Given a set of n positive integers, $S=\{a_1,a_2,a_3,\ldots,a_n\}$, and positive integer W, is there a subset of S whose elements sum to W? A dynamic program for solving this problem uses a 2-dimensional Boolean array, X, with n rows and $W+1$ columns. $X[i,j],1\leq i\leq n,0\leq j\leq W$, is TRUE, if and only if there is a subset of $\{a_1,a_2,\ldots,a_i\}$ whose elements sum to j.

Which of the following is valid for $2\leq i\leq n$, and $a_i\leq j\leq W$?

A. $X[i,j]=X[i-1,j]\vee X[i,j-a_i]$

B. $X[i,j] = X[i-1,j] \vee X[i-1,j-a_i]$
C. $X[i,j] = X[i-1,j] \wedge X[i,j-a_i]$
D. $X[i,j] = X[i-1,j] \wedge X[i-1,j-a_i]$

gatecse-2008 algorithms normal dynamic-programming

Answer key

1.23.2 Dynamic Programming: GATE CSE 2008 | Question: 81

The subset-sum problem is defined as follows. Given a set of n positive integers, $S = \{a_1, a_2, a_3, \dots, a_n\}$, and positive integer W, is there a subset of S whose elements sum to W? A dynamic program for solving this problem uses a 2-dimensional Boolean array, X, with n rows and $W+1$ columns. $X[i,j], 1 \leq i \leq n, 0 \leq j \leq W$, is TRUE, if and only if there is a subset of $\{a_1, a_2, \dots, a_i\}$ whose elements sum to j.

Which entry of the array X, if TRUE, implies that there is a subset whose elements sum to W?

A. $X[1,W]$
B. $X[n,0]$
C. $X[n,W]$
D. $X[n-1,n]$

gatecse-2008 algorithms normal dynamic-programming

Answer key

1.23.3 Dynamic Programming: GATE CSE 2009 | Question: 53

A sub-sequence of a given sequence is just the given sequence with some elements (possibly none or all) left out. We are given two sequences $X[m]$ and $Y[n]$ of lengths m and n, respectively with indexes of X and Y starting from 0.

We wish to find the length of the longest common sub-sequence (LCS) of $X[m]$ and $Y[n]$ as $l(m,n)$, where an incomplete recursive definition for the function $I(i,j)$ to compute the length of the LCS of $X[m]$ and $Y[n]$ is given below:

```
l(i,j)  = 0, if either i = 0 or j = 0
        = expr1, if i,j > 0 and X[i-1] = Y[j-1]
        = expr2, if i,j > 0 and X[i-1] ≠ Y[j-1]
```

Which one of the following options is correct?

A. $\text{expr1} = l(i-1,j)+1$
B. $\text{expr1} = l(i,j-1)$
C. $\text{expr2} = \max(l(i-1,j), l(i,j-1))$
D. $\text{expr2} = \max(l(i-1,j-1), l(i,j))$

gatecse-2009 algorithms normal dynamic-programming recursion

Answer key

1.23.4 Dynamic Programming: GATE CSE 2009 | Question: 54

A sub-sequence of a given sequence is just the given sequence with some elements (possibly none or all) left out. We are given two sequences $X[m]$ and $Y[n]$ of lengths m and n, respectively with indexes of X and Y starting from 0.

We wish to find the length of the longest common sub-sequence (LCS) of $X[m]$ and $Y[n]$ as $l(m,n)$, where an incomplete recursive definition for the function $I(i,j)$ to compute the length of the LCS of $X[m]$ and $Y[n]$ is given below:

```
l(i,j)  = 0, if either i = 0 or j = 0
        = expr1, if i,j > 0  and  X[i-1] = Y[j-1]
        = expr2, if i,j > 0  and  X[i-1] ≠ Y[j-1]
```

The value of $l(i,j)$ could be obtained by dynamic programming based on the correct recursive definition of $l(i,j)$ of the form given above, using an array $L[M,N]$, where $M = m+1$ and $N = n+1$, such that $L[i,j] = l(i,j)$.

Which one of the following statements would be TRUE regarding the dynamic programming solution for the recursive definition of $l(i,j)$?

A. All elements of L should be initialized to 0 for the values of $l(i,j)$ to be properly computed.

B. The values of $l(i,j)$ may be computed in a row major order or column major order of $L[M,N]$.
C. The values of $l(i,j)$ cannot be computed in either row major order or column major order of $L[M,N]$.
D. $L[p,q]$ needs to be computed before $L[r,s]$ if either $p<r$ or $q<s$.

gatecse-2009 normal algorithms dynamic-programming recursion

Answer key☟

1.23.5 Dynamic Programming: GATE CSE 2010 | Question: 34

The weight of a sequence $a_0, a_1, \dots, a_{n-1}$ of real numbers is defined as $a_0 + a_1/2 + \dots + a_{n-1}/2^{n-1}$. A subsequence of a sequence is obtained by deleting some elements from the sequence, keeping the order of the remaining elements the same. Let X denote the maximum possible weight of a subsequence of $a_o, a_1, \dots, a_{n-1}$ and Y the maximum possible weight of a subsequence of $a_1, a_2, \dots, a_{n-1}$. Then X is equal to

A. $max(Y, a_0 + Y)$
B. $max(Y, a_0 + Y/2)$
C. $max(Y, a_0 + 2Y)$
D. $a_0 + Y/2$

gatecse-2010 algorithms dynamic-programming normal

Answer key☟

1.23.6 Dynamic Programming: GATE CSE 2011 | Question: 25

An algorithm to find the length of the longest monotonically increasing sequence of numbers in an array $A[0:n-1]$ is given below.

Let L_i, denote the length of the longest monotonically increasing sequence starting at index i in the array.

Initialize $L_{n-1} = 1$.

For all i such that $0 \leq i \leq n-2$

$$L_i = \begin{cases} 1 + L_{i+1} & \text{if A[i] < A[i+1]} \\ 1 & \text{Otherwise} \end{cases}$$

Finally, the length of the longest monotonically increasing sequence is $\max\left(L_0, L_1, \dots, L_{n-1}\right)$.

Which of the following statements is **TRUE**?

A. The algorithm uses dynamic programming paradigm
B. The algorithm has a linear complexity and uses branch and bound paradigm
C. The algorithm has a non-linear polynomial complexity and uses branch and bound paradigm
D. The algorithm uses divide and conquer paradigm

gatecse-2011 algorithms easy dynamic-programming

Answer key☟

1.23.7 Dynamic Programming: GATE CSE 2014 Set 2 | Question: 37

Consider two strings A = *"qpqrr"* and B = *"pqprqrp"*. Let x be the length of the longest common subsequence *(not necessarily contiguous)* between A and B and let y be the number of such longest common subsequences between A and B. Then $x + 10y =$ ___.

gatecse-2014-set2 algorithms normal numerical-answers dynamic-programming

Answer key☟

1.23.8 Dynamic Programming: GATE CSE 2014 Set 3 | Question: 37

Suppose you want to move from 0 to 100 on the number line. In each step, you either move right by a unit distance or you take a *shortcut*. A shortcut is simply a pre-specified pair of integers $i,\ j$ with $i<j$. Given a shortcut (i,j), if you are at position i on the number line, you may directly move to j. Suppose $T(k)$ denotes the smallest number of steps needed to move from k to 100. Suppose further that there is at most 1 shortcut involving any number, and in particular, from 9 there is a shortcut to 15. Let y and z be such that $T(9) = 1 + \min(T(y), T(z))$. Then the value of the product yz is _____.

gatecse-2014-set3 algorithms normal numerical-answers dynamic-programming

Answer key☟

1.23.9 Dynamic Programming: GATE CSE 2016 Set 2 | Question: 14

The Floyd-Warshall algorithm for all-pair shortest paths computation is based on

A. Greedy paradigm.
B. Divide-and-conquer paradigm.
C. Dynamic Programming paradigm.
D. Neither Greedy nor Divide-and-Conquer nor Dynamic Programming paradigm.

gatecse-2016-set2 algorithms dynamic-programming easy

Answer key☟

1.23.10 Dynamic Programming: UGC NET CSE | December 2013 | Part 3 | Question: 37

The longest common subsequence of the sequences $X =< A, B, C, B, D, A, B >$ and $Y =< B, D, C, A, B, A >$ has length

A. 2 B. 3 C. 4 D. 5

ugcnetcse-dec2013-paper3 algorithms dynamic-programming

Answer key☟

1.23.11 Dynamic Programming: UGC NET CSE | December 2018 | Part 2 | Question: 23

Consider two sequences X and Y :

$X =< 0, 1, 2, 1, 3, 0, 1 >$

$Y =< 1, 3, 2, 0, 1, 0 >$

The length of longest common subsequence between X and Y is

A. 2 B. 3 C. 4 D. 5

ugcnetcse-dec2018-paper2 algorithms dynamic-programming

Answer key☟

1.23.12 Dynamic Programming: UGC NET CSE | July 2016 | Part 3 | Question: 36

A triangulation of a polygon is a set of T chords that divide the polygon into disjoint triangles. Every triangulation of n vertex convex polygon has ____ chords and divides the polygon into ____ triangles

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

ugcnetcse-july2016-paper3 algorithms dynamic-programming

Answer key☟

1.23.13 Dynamic Programming: UGC NET CSE | June 2023 | Part 2: 57

Match **List I** with **List II**

List I	**List II**
A. The running time of straight forward recursive method to compute nth Fibonacci number Fn	I. $O(n^2)$
B. The running time to compute Fn using memoization	II. $\mathrm{O}\ (\lg \mathrm{n})$

C. The running time to compute Fibonacci number Fn using only integer addition and multiplication	III. $\mathrm{O}\,(\mathrm{n})$
D. The running time to determine an optimal bitonic tour	IV. $\Theta\,(\phi^n)$

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

ugcnetcse-june2023-paper2 recursion time-complexity functions dynamic-programming

1.24 Fast Fourier Transform (1)

1.24.1 Fast Fourier Transform: UGC NET CSE | December 2019 | Part 2 | Question: 42

The time complexity to multiply two polynomials of degree n using Fast Fourier transform method is:

A. $\theta(n \lg n)$ B. $\theta(n^2)$ C. $\theta(n)$ D. $\theta(\lg n)$

ugcnetcse-dec2019-paper2 algorithm-design time-complexity fast-fourier-transform polynomials

Answer key☟

1.25 Fuzzy Set (1)

1.25.1 Fuzzy Set: UGC NET CSE | December 2019 | Part 2 | Question: 62

A fuzzy conjuction operators, $t(x,y)$, and a fuzzy disjunction operator, $s(x,y)$, form a pair if they satisfy: $t(x,y) = 1 - s(1-x, 1-y)$.

If $t(x,y) = \dfrac{xy}{(x+y-xy)}$ then $s(x,y)$ is given by

A. $\dfrac{x+y}{1-xy}$

B. $\dfrac{x+y-2xy}{1-xy}$

C. $\dfrac{x+y-xy}{1-xy}$

D. $\dfrac{x+y-xy}{1+xy}$

ugcnetcse-dec2019-paper2 fuzzy-set

1.26 Genetic Algorithms (1)

1.26.1 Genetic Algorithms: UGC NET CSE | December 2019 | Part 2 | Question: 64

The order of schema $?10?101?$ and $???0??1$ are _______ and _______ respectively.

A. $5,3$ B. $5,2$ C. $7,5$ D. $8,7$

ugcnetcse-dec2019-paper2 genetic-algorithms

Answer key☟

1.27 Graph Algorithms (15)

1.27.1 Graph Algorithms: GATE CSE 1990 | Question: 14

The following algorithm (written in pseudo-pascal) work on an undirected graph G

```
program Explore (G)
 procedure Visit (u)
```

```
 begin
    if Adj (u) is not empty
      {comment:Adj (u) is the list of edges incident to u}
    then
        begin
            Select an edge from Adj (u);
            Let edge be e=(u, v)
            remove e from Adj (u) and Adj (v);
            Visit (v);
        end
    else
            mark u as a finished vertex and remove u from LIST
            {Comment: LIST is the set of vertices in the graph}
 end;
begin
   While LIST is not empty
     do
        begin
           Let v ∈ LIST;
           Visit (v);
  end
end.
```

Note: Initially $Adj(u)$ is the list of all edges incident to u and LIST is the set of all vertices in the graph. They are globally accessible.

a. What kind of subgraphs are obtained when this algorithm traverses the graphs G_1 and G_2 shown in Fig . (6) and Fig. (7) respectively?

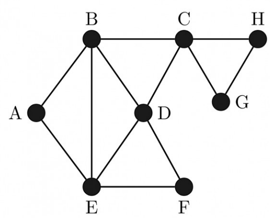


Fig.6

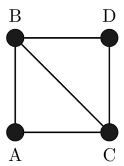


Fig.7

b. What is the commonly Known traversal of graphs that can be obtained from the subgraphs generated by Program Explore?
c. Show that the time complexity of the procedure is $O(v + e)$ for a graph with v vertices and e edges, given that each vertex can be accessed and removed from LIST in constant time. Also, show that all edges of the graph are traversed.

gate1990 descriptive graph-algorithms unsolved

1.27.2 Graph Algorithms: GATE CSE 1994 | Question: 1.22

Which of the following statements is false?

A. Optimal binary search tree construction can be performed efficiently using dynamic programming
B. Breadth-first search cannot be used to find connected components of a graph
C. Given the prefix and postfix walks over a binary tree, the binary tree cannot be uniquely constructed.
D. Depth-first search can be used to find connected components of a graph

gate1994 algorithms normal graph-algorithms

Answer key☟

1.27.3 Graph Algorithms: GATE CSE 2003 | Question: 70

Let $G = (V, E)$ be a directed graph with n vertices. A path from v_i to v_j in G is a sequence of vertices ($v_i, v_{i+1}, \dots, v_j$) such that $(v_k, v_{k+1}) \in E$ for all k in i through $j - 1$. A simple path is a path in which no vertex appears more than once.

Let A be an $n \times n$ array initialized as follows:

$$A[j,k] = \begin{cases} 1, & \text{if } (j,k) \in E \\ 0, & \text{otherwise} \end{cases}$$

Consider the following algorithm:

```
for i=1 to n
   for j=1 to n
      for k=1 to n
         A[j,k] = max(A[j,k], A[j,i] + A[i,k]);
```

Which of the following statements is necessarily true for all j and k after termination of the above algorithm?

A. $A[j,k] \leq n$
B. If $A[j,j] \geq n-1$ then G has a Hamiltonian cycle
C. If there exists a path from j to k, $A[j,k]$ contains the longest path length from j to k
D. If there exists a path from j to k, every simple path from j to k contains at most $A[j,k]$ edges

gatecse-2003 algorithms graph-algorithms normal

Answer key

1.27.4 Graph Algorithms: GATE CSE 2005 | Question: 82a

Let s and t be two vertices in a undirected graph $G=(V,E)$ having distinct positive edge weights. Let $[X,Y]$ be a partition of V such that $s \in X$ and $t \in Y$. Consider the edge e having the minimum weight amongst all those edges that have one vertex in X and one vertex in Y.

The edge e must definitely belong to:

A. the minimum weighted spanning tree of G
B. the weighted shortest path from s to t
C. each path from s to t
D. the weighted longest path from s to t

gatecse-2005 algorithms graph-algorithms normal

Answer key

1.27.5 Graph Algorithms: GATE CSE 2005 | Question: 82b

Let s and t be two vertices in a undirected graph $G=(V,E)$ having distinct positive edge weights. Let $[X,Y]$ be a partition of V such that $s \in X$ and $t \in Y$. Consider the edge e having the minimum weight amongst all those edges that have one vertex in X and one vertex in Y.

Let the weight of an edge e denote the congestion on that edge. The congestion on a path is defined to be the maximum of the congestions on the edges of the path. We wish to find the path from s to t having minimum congestion. Which of the following paths is always such a path of minimum congestion?

A. a path from s to t in the minimum weighted spanning tree
B. a weighted shortest path from s to t
C. an Euler walk from s to t
D. a Hamiltonian path from s to t

gatecse-2005 algorithms graph-algorithms normal

Answer key

1.27.6 Graph Algorithms: GATE CSE 2016 Set 2 | Question: 41

In an adjacency list representation of an undirected simple graph $G=(V,E)$, each edge (u,v) has two adjacency list entries: $[v]$ in the adjacency list of u, and $[u]$ in the adjacency list of v. These are called twins of each other. A twin pointer is a pointer from an adjacency list entry to its twin. If $|E|=m$ and $|V|=n$, and the memory size is not a constraint, what is the time complexity of the most efficient algorithm to set the twin pointer in each entry in each adjacency list?

A. $\Theta(n^2)$
B. $\Theta(n+m)$
C. $\Theta(m^2)$
D. $\Theta(n^4)$

gatecse-2016-set2 algorithms graph-algorithms normal

Answer key

1.27.7 Graph Algorithms: GATE CSE 2017 Set 1 | Question: 26

Let $G = (V, E)$ be any connected, undirected, edge-weighted graph. The weights of the edges in E are positive and distinct. Consider the following statements:

I. Minimum Spanning Tree of G is always unique.
II. Shortest path between any two vertices of G is always unique.

Which of the above statements is/are necessarily true?

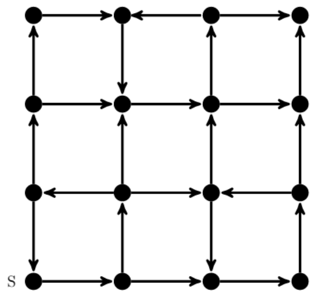
A. I only
B. II only
C. both I and II
D. neither I nor II

gatecse-2017-set1 algorithms graph-algorithms normal

Answer key☟

1.27.8 Graph Algorithms: GATE CSE 2021 Set 2 | Question: 46

Consider the following directed graph:



Which of the following is/are correct about the graph?

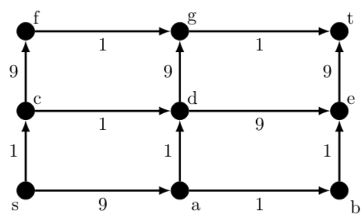
A. The graph does not have a topological order
B. A depth-first traversal starting at vertex S classifies three directed edges as back edges
C. The graph does not have a strongly connected component
D. For each pair of vertices u and v, there is a directed path from u to v

gatecse-2021-set2 multiple-selects algorithms graph-algorithms two-marks

Answer key☟

1.27.9 Graph Algorithms: GATE CSE 2021 Set 2 | Question: 55

In a directed acyclic graph with a source vertex **s**, the $quality\text{-}score$ of a directed path is defined to be the product of the weights of the edges on the path. Further, for a vertex v other than **s**, the quality-score of v is defined to be the maximum among the quality-scores of all the paths from **s** to v. The quality-score of **s** is assumed to be 1.



The sum of the quality-scores of all vertices on the graph shown above is _______

gatecse-2021-set2 algorithms graph-algorithms directed-acyclic-graph numerical-answers two-marks

Answer key☟

1.27.10 Graph Algorithms: GATE IT 2005 | Question: 15

In the following table, the left column contains the names of standard graph algorithms and the right column contains the time complexities of the algorithms. Match each algorithm with its time complexity.

1.	Bellman-Ford algorithm	A:	$O(m \log n)$
2.	Kruskal's algorithm	B:	$O(n^3)$
3.	Floyd-Warshall algorithm	C:	$O(nm)$
4.	Topological sorting	D:	$O(n+m)$

A. $1 \rightarrow \mathrm{C}, 2 \rightarrow \mathrm{A}, 3 \rightarrow \mathrm{B}, 4 \rightarrow \mathrm{D}$
B. $1 \rightarrow \mathrm{B}, 2 \rightarrow \mathrm{D}, 3 \rightarrow \mathrm{C}, 4 \rightarrow \mathrm{A}$
C. $1 \rightarrow \mathrm{C}, 2 \rightarrow \mathrm{D}, 3 \rightarrow \mathrm{A}, 4 \rightarrow \mathrm{B}$
D. $1 \rightarrow \mathrm{B}, 2 \rightarrow \mathrm{A}, 3 \rightarrow \mathrm{C}, 4 \rightarrow \mathrm{D}$

gateit-2005 algorithms graph-algorithms match-the-following easy

Answer key

1.27.11 Graph Algorithms: GATE IT 2005 | Question: 84a

A sink in a directed graph is a vertex i such that there is an edge from every vertex $j \neq i$ to i and there is no edge from i to any other vertex. A directed graph G with n vertices is represented by its adjacency matrix A, where $A[i][j] = 1$ if there is an edge directed from vertex i to j and 0 otherwise. The following algorithm determines whether there is a sink in the graph G.

```
i = 0;
do {
   j = i + 1;
   while ((j < n) && E1) j++;
   if (j < n) E2;
} while (j < n);
flag = 1;
for (j = 0; j < n; j++)
   if ((j! = i) && E3) flag = 0;
if (flag) printf("Sink exists");
else printf ("Sink does not exist");
```

Choose the correct expressions for E_1 and E_2

A. $E_1 : A[i][j]$ and $E_2 : i = j;$
B. $E_1 :\ !A[i][j]$ and $E_2 : i = j + 1;$
C. $E_1 :\ !A[i][j]$ and $E_2 : i = j;$
D. $E_1 : A[i][j]$ and $E_2 : i = j + 1;$

gateit-2005 algorithms graph-algorithms normal

Answer key

1.27.12 Graph Algorithms: GATE IT 2005 | Question: 84b

A sink in a directed graph is a vertex i such that there is an edge from every vertex $j \neq i$ to i and there is no edge from i to any other vertex. A directed graph G with n vertices is represented by its adjacency matrix A, where $A[i][j] = 1$ if there is an edge directed from vertex i to j and 0 otherwise. The following algorithm determines whether there is a sink in the graph G.

```
i = 0;
do {
   j = i + 1;
   while ((j < n) && E1) j++;
   if (j < n) E2;
} while (j < n);
flag = 1;
for (j = 0; j < n; j++)
   if ((j! = i) && E3) flag = 0;
if (flag) printf("Sink exists") ;
else printf ("Sink does not exist");
```

Choose the correct expression for E_3

A. $(A[i][j]\ \&\&\ !A[j][i])$
B. $(!A[i][j]\ \&\&\ A[j][i])$
C. $(!A[i][j]\ ||\ A[j][i])$
D. $(A[i][j]\ ||\ !A[j][i])$

gateit-2005 algorithms graph-algorithms normal

Answer key

1.27.13 Graph Algorithms: UGC NET CSE | December 2015 | Part 3 | Question: 20

Floyd-Warshall algorithm utilizes _____ to solve the all-pairs shortest paths problem on a directed graph in _____ time

A. Greedy algorithm, $\theta(V^3)$
B. Greedy algorithm, $\theta(V^2 lgn)$
C. Dynamic programming, $\theta(V^3)$
D. Dynamic programming, $\theta(V^2 lgn)$

ugcnetcse-dec2015-paper3 graph-algorithms algorithms

Answer key

1.27.14 Graph Algorithms: UGC NET CSE | December 2018 | Part 2 | Question: 27

Match List I with List II and choose the correct answer from the code given below.

	List I (Graph Algorithm)		**List II (Time Complexity)**
(a)	Dijkstra's algorithm	(i)	$O(E\,lg\,E)$
(b)	Kruskal's algorithm	(ii)	$\Theta(V^3)$
(c)	Floyd-Warshall algorithm	(iii)	$O(V^2)$
(d)	Topological sorting	(iv)	$\Theta(V+E)$

where V and E are the number of vertices and edged in graph respectively.

Code :

A. (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)
B. (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)
C. (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
D. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

ugcnetcse-dec2018-paper2 algorithms graph-algorithms time-complexity

Answer key

1.27.15 Graph Algorithms: UGC NET CSE | June 2019 | Part 2 | Question: 61

Match List-I with List-II:

	List-I		List-II
(a)	Prim's algorithm	(i)	$O(V^3 \log V)$
(b)	Dijkstra's algorithm	(ii)	$O(VE^2)$
(c)	Faster all-pairs shortest path	(iii)	$O(ElgV)$
(d)	Edmonds-Karp algorithm	(iv)	$O(V^2)$

Choose the correct option from those options given below:

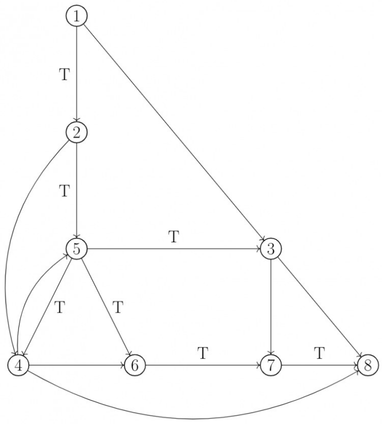
A. (a) – (ii); (b)-(iv); (c)-(i); (d)-(iii)
B. (a) – (iii); (b)-(iv); (c)-(i); (d)-(ii)
C. (a) – (ii); (b)-(i); (c)-(iv); (d)-(iii)
D. (a) – (iii); (b)-(i); (c)-(iv); (d)-(ii)

ugcnetcse-june2019-paper2 graph-algorithms

Answer key

1.28 Graph Search (24)

1.28.1 Graph Search: GATE CSE 1989 | Question: 4-vii



In the graph shown above, the depth-first spanning tree edges are marked with a $'T'$. Identify the forward, backward, and cross edges.

gate1989 descriptive algorithms graph-algorithms depth-first-search graph-search

Answer key

1.28.2 Graph Search: GATE CSE 2000 | Question: 1.13

The most appropriate matching for the following pairs

X: depth first search	1: heap
Y: breadth first search	2: queue
Z: sorting	3: stack

is:

A. X - 1, Y - 2, Z - 3
B. X - 3, Y - 1, Z - 2
C. X - 3, Y - 2, Z - 1
D. X - 2, Y - 3, Z - 1

gatecse-2000 algorithms easy graph-algorithms graph-search match-the-following

Answer key

1.28.3 Graph Search: GATE CSE 2000 | Question: 2.19

Let G be an undirected graph. Consider a depth-first traversal of G, and let T be the resulting depth-first search tree. Let u be a vertex in G and let v be the first new (unvisited) vertex visited after visiting u in the traversal. Which of the following statement is always true?

A. $\{u, v\}$ must be an edge in G, and u is a descendant of v in T
B. $\{u, v\}$ must be an edge in G, and v is a descendant of u in T
C. If $\{u, v\}$ is not an edge in G then u is a leaf in T
D. If $\{u, v\}$ is not an edge in G then u and v must have the same parent in T

gatecse-2000 algorithms graph-algorithms normal graph-search

Answer key

1.28.4 Graph Search: GATE CSE 2001 | Question: 2.14

Consider an undirected, unweighted graph G. Let a breadth-first traversal of G be done starting from a node r. Let $d(r, u)$ and $d(r, v)$ be the lengths of the shortest paths from r to u and v respectively in G. If u is visited before v during the breadth-first traversal, which of the following statements is correct?

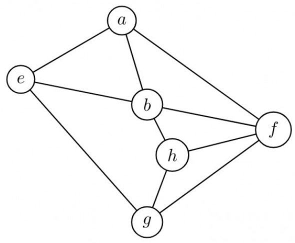
A. $d(r,u) < d(r,v)$
B. $d(r,u) > d(r,v)$
C. $d(r,u) \leq d(r,v)$
D. None of the above

gatecse-2001 algorithms graph-algorithms normal graph-search

Answer key

1.28.5 Graph Search: GATE CSE 2003 | Question: 21

Consider the following graph:



Among the following sequences:

I. abeghf
II. abfehg
III. abfhge
IV. afghbe

Which are the depth-first traversals of the above graph?

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

gatecse-2003 algorithms graph-algorithms normal graph-search

Answer key

1.28.6 Graph Search: GATE CSE 2006 | Question: 48

Let T be a depth first search tree in an undirected graph G. Vertices u and ν are leaves of this tree T. The degrees of both u and ν in G are at least 2. which one of the following statements is true?

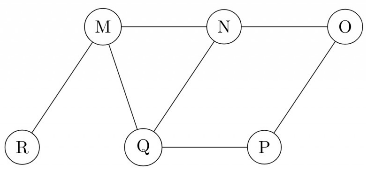
A. There must exist a vertex w adjacent to both u and ν in G
B. There must exist a vertex w whose removal disconnects u and ν in G
C. There must exist a cycle in G containing u and ν
D. There must exist a cycle in G containing u and all its neighbours in G

gatecse-2006 algorithms graph-algorithms normal graph-search

Answer key

1.28.7 Graph Search: GATE CSE 2008 | Question: 19

The Breadth First Search algorithm has been implemented using the queue data structure. One possible order of visiting the nodes of the following graph is:



A. MNOPQR
B. NQMPOR
C. QMNPRO
D. QMNPOR

gatecse-2008 normal algorithms graph-algorithms graph-search

Answer key

1.28.8 Graph Search: GATE CSE 2014 Set 1 | Question: 11

Let G be a graph with n vertices and m edges. What is the tightest upper bound on the running time of Depth First Search on G, when G is represented as an adjacency matrix?

A. $\Theta(n)$
B. $\Theta(n+m)$
C. $\Theta(n^2)$
D. $\Theta(m^2)$

gatecse-2014-set1 algorithms graph-algorithms normal graph-search

Answer key

1.28.9 Graph Search: GATE CSE 2014 Set 2 | Question: 14

Consider the tree arcs of a BFS traversal from a source node W in an unweighted, connected, undirected graph. The tree T formed by the tree arcs is a data structure for computing

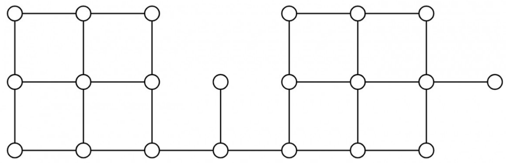
A. the shortest path between every pair of vertices.
B. the shortest path from W to every vertex in the graph.
C. the shortest paths from W to only those nodes that are leaves of T.
D. the longest path in the graph.

gatecse-2014-set2 algorithms graph-algorithms normal graph-search

Answer key

1.28.10 Graph Search: GATE CSE 2014 Set 3 | Question: 13

Suppose depth first search is executed on the graph below starting at some unknown vertex. Assume that a recursive call to visit a vertex is made only after first checking that the vertex has not been visited earlier. Then the maximum possible recursion depth (including the initial call) is _________.



gatecse-2014-set3 algorithms graph-algorithms numerical-answers normal graph-search

Answer key

1.28.11 Graph Search: GATE CSE 2015 Set 1 | Question: 45

Let $G = (V, E)$ be a simple undirected graph, and s be a particular vertex in it called the source. For $x \in V$, let $d(x)$ denote the shortest distance in G from s to x. A breadth first search (BFS) is performed starting at s. Let T be the resultant BFS tree. If (u, v) is an edge of G that is not in T, then which one of the following CANNOT be the value of $d(u) - d(v)$?

A. -1 B. 0 C. 1 D. 2

gatecse-2015-set1 algorithms graph-algorithms normal graph-search

Answer key

1.28.12 Graph Search: GATE CSE 2016 Set 2 | Question: 11

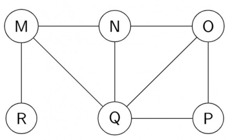
Breadth First Search (BFS) is started on a binary tree beginning from the root vertex. There is a vertex t at a distance four from the root. If t is the n^{th} vertex in this BFS traversal, then the maximum possible value of n is ___________

gatecse-2016-set2 algorithms graph-algorithms normal numerical-answers graph-search

Answer key

1.28.13 Graph Search: GATE CSE 2017 Set 2 | Question: 15

The Breadth First Search (BFS) algorithm has been implemented using the queue data structure. Which one of the following is a possible order of visiting the nodes in the graph below?



A. MNOPQR B. NQMPOR C. QMNROP D. POQNMR

gatecse-2017-set2 algorithms graph-algorithms graph-search

Answer key

1.28.14 Graph Search: GATE CSE 2018 | Question: 30

Let G be a simple undirected graph. Let T_D be a depth first search tree of G. Let T_B be a breadth first search tree of G. Consider the following statements.

I. No edge of G is a cross edge with respect to T_D. (A cross edge in G is between two nodes neither of which is an ancestor of the other in T_D).
II. For every edge (u, v) of G, if u is at depth i and v is at depth j in T_B, then $\mid i - j \mid = 1$.

Which of the statements above must necessarily be true?

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

gatecse-2018 algorithms graph-algorithms graph-search normal two-marks

Answer key

1.28.15 Graph Search: GATE CSE 2023 | Question: 46

Let $U = \{1, 2, 3\}$. Let 2^U denote the powerset of U. Consider an undirected graph G whose vertex set is 2^U. For any $A, B \in 2^U$, (A, B) is an edge in G if and only if (i) $A \neq B$, and (ii) either $A \subsetneq B$ or $B \subsetneq A$. For any vertex A in G, the set of all possible orderings in which the vertices of G can be visited in a Breadth First Search (BFS) starting from A is denoted by $\mathcal{B}(A)$.

If $\emptyset$ denotes the empty set, then the cardinality of $\mathcal{B}(\emptyset)$ is ______________.

gatecse-2023 algorithms breadth-first-search numerical-answers two-marks graph-search

Answer key

1.28.16 Graph Search: GATE CSE 2024 | Set 1 | Question: 35

Let G be a directed graph and T a depth first search (DFS) spanning tree in G that is rooted at a vertex v. Suppose T is also a breadth first search (BFS) tree in G, rooted at v. Which of the following statements is/are TRUE for *every* such graph G and tree T?

A. There are no back-edges in G with respect to the tree T
B. There are no cross-edges in G with respect to the tree T
C. There are no forward-edge in G with respect to the tree T
D. The only edges in G are the edges in T

gatecse2024-set1 algorithms multiple-selects graph-search two-marks

Answer key

1.28.17 Graph Search: GATE CSE 2024 | Set 1 | Question: 50

The number of edges present in the forest generated by the DFS traversal of an undirected graph G with 100 vertices is 40. The number of connected components in G is __________.

gatecse2024-set1 numerical-answers graph-search graph-algorithms two-marks

Answer key

1.28.18 Graph Search: GATE CSE 2025 | Set 2 | Question: 49

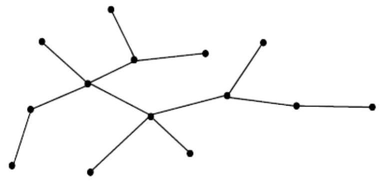
Consider the following algorithm **someAlgo** that takes an undirected graph G as input.

someAlgo (G)

1. Let v be any vertex in G. Run BFS on G starting at v. Let u be a vertex in G at maximum distance from v as given by the BFS.
2. Run BFS on G again with u as the starting vertex. Let z be the vertex at maximum distance from u as given by

the BFS.
3. Output the distance between u and z in G.

The output of **someAlgo** (T) for the tree shown in the given figure is ___________. (Answer in integer)



gatecse2025-set2 algorithms breadth-first-search graph-search numerical-answers two-marks

Answer key☟

1.28.19 Graph Search: GATE DS&AI 2024 | Question: 4

Consider performing depth-first search (DFS) on an undirected and unweighted graph G starting at vertex s. For any vertex u in $G, d[u]$ is the length of the shortest path from s to u. Let (u, v) be an edge in G such that $d[u] < d[v]$. If the edge (u, v) is explored first in the direction from u to v during the above DFS, then (u, v) becomes a _________ edge.

A. tree
B. cross
C. back
D. gray

gate-ds-ai-2024 graph-search depth-first-search algorithms one-mark

Answer key☟

1.28.20 Graph Search: GATE IT 2005 | Question: 14

In a depth-first traversal of a graph G with n vertices, k edges are marked as tree edges. The number of connected components in G is

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

gateit-2005 algorithms graph-algorithms normal graph-search

Answer key☟

1.28.21 Graph Search: GATE IT 2006 | Question: 47

Consider the depth-first-search of an undirected graph with 3 vertices P, Q, and R. Let discovery time $d(u)$ represent the time instant when the vertex u is first visited, and finish time $f(u)$ represent the time instant when the vertex u is last visited. Given that

$d(P) = 5$ units	$f(P) = 12$ units
$d(Q) = 6$ units	$f(Q) = 10$ units
$d(R) = 14$ unit	$f(R) = 18$ units

Which one of the following statements is TRUE about the graph?

A. There is only one connected component
B. There are two connected components, and P and R are connected
C. There are two connected components, and Q and R are connected
D. There are two connected components, and P and Q are connected

gateit-2006 algorithms graph-algorithms normal graph-search depth-first-search

Answer key☟

1.28.22 Graph Search: GATE IT 2007 | Question: 24

A depth-first search is performed on a directed acyclic graph. Let $d[u]$ denote the time at which vertex u is visited for the first time and $f[u]$ the time at which the DFS call to the vertex u terminates. Which of the following statements is always TRUE for all edges (u, v) in the graph ?

A. $d[u] < d[v]$
B. $d[u] < f[v]$
C. $f[u] < f[v]$
D. $f[u] > f[v]$

gateit-2007 algorithms graph-algorithms normal graph-search depth-first-search

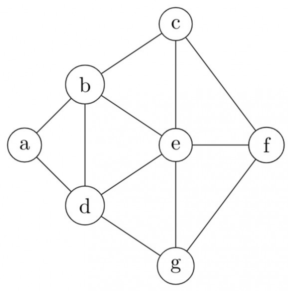
Answer key

1.28.23 Graph Search: GATE IT 2008 | Question: 47

Consider the following sequence of nodes for the undirected graph given below:

1. $a\ b\ e\ f\ d\ g\ c$
2. $a\ b\ e\ f\ c\ g\ d$
3. $a\ d\ g\ e\ b\ c\ f$
4. $a\ d\ b\ c\ g\ e\ f$

A Depth First Search (DFS) is started at node a. The nodes are listed in the order they are first visited. Which of the above is/are possible output(s)?



A. 1 and 3 only
B. 2 and 3 only
C. $2, 3$ and 4 only
D. $1, 2$ and 3 only

gateit-2008 algorithms graph-algorithms normal graph-search depth-first-search

Answer key

1.28.24 Graph Search: UGC NET CSE | June 2012 | Part 3 | Question: 51

The strategy used to reduce the number of tree branches and the number of static evaluations applied in case of a game tree is

A. Minmax strategy
B. Alpha-beta pruning strategy
C. Constraint satisfaction strategy
D. Static max strategy

ugcnetcse-june2012-paper3 algorithms graph-search tree-traversal

Answer key

1.29 Greedy Algorithms (5)

1.29.1 Greedy Algorithms: GATE CSE 1999 | Question: 2.20

The minimum number of record movements required to merge five files A (with 10 records), B (with 20 records), C (with 15 records), D (with 5 records) and E (with 25 records) is:

A. 165
B. 90
C. 75
D. 65

gate1999 algorithms normal greedy-algorithms

Answer key

1.29.2 Greedy Algorithms: GATE CSE 2003 | Question: 69

The following are the starting and ending times of activities A, B, C, D, E, F, G and H respectively in chronological order: "$a_s\ b_s\ c_s\ a_e\ d_s\ c_e\ e_s\ f_s\ b_e\ d_e\ g_s\ e_e\ f_e\ h_s\ g_e\ h_e$". Here, x_s denotes the starting time and x_e denotes the ending time of activity X. We need to schedule the activities in a set of rooms available to us. An activity can be scheduled in a room only if the room is reserved for the activity for its entire duration. What is the minimum number of rooms required?

A. 3 B. 4 C. 5 D. 6

gatecse-2003 algorithms normal greedy-algorithms

Answer key

1.29.3 Greedy Algorithms: GATE CSE 2005 | Question: 84a

We are given 9 tasks $T_1, T_2, \dots, T_9$. The execution of each task requires one unit of time. We can execute one task at a time. Each task T_i has a profit P_i and a deadline d_i. Profit P_i is earned if the task is completed before the end of the d_i^{th} unit of time.

Task	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Profit	15	20	30	18	18	10	23	16	25
Deadline	7	2	5	3	4	5	2	7	3

Are all tasks completed in the schedule that gives maximum profit?

A. All tasks are completed

B. T_1 and T_6 are left out

C. T_1 and T_8 are left out

D. T_4 and T_6 are left out

gatecse-2005 algorithms greedy-algorithms process-scheduling normal

Answer key

1.29.4 Greedy Algorithms: GATE CSE 2005 | Question: 84b

We are given 9 tasks $T_1, T_2, \dots, T_9$. The execution of each task requires one unit of time. We can execute one task at a time. Each task T_i has a profit P_i and a deadline d_i. Profit P_i is earned if the task is completed before the end of the d_i^{th} unit of time.

Task	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Profit	15	20	30	18	18	10	23	16	25
Deadline	7	2	5	3	4	5	2	7	3

What is the maximum profit earned?

A. 147 B. 165 C. 167 D. 175

gatecse-2005 algorithms greedy-algorithms process-scheduling normal

Answer key

1.29.5 Greedy Algorithms: GATE CSE 2018 | Question: 48

Consider the weights and values of items listed below. Note that there is only one unit of each item.

Item number	**Weight (in Kgs)**	**Value (in rupees)**
1	10	60
2	7	28
3	4	20
4	2	24

The task is to pick a subset of these items such that their total weight is no more than 11 Kgs and their total value is maximized. Moreover, no item may be split. The total value of items picked by an optimal algorithm is denoted by V_{opt}. A greedy algorithm sorts the items by their value-to-weight ratios in descending order and packs them greedily, starting from the first item in the ordered list. The total value of items picked by the greedy algorithm is denoted by V_{greedy}.

The value of $V_{opt} - V_{greedy}$ is _____ gatecse-2018 algorithms greedy-algorithms numerical-answers two-marks

Answer key

1.30 Hashing (8)

1.30.1 Hashing: GATE CSE 1989 | Question: 1-vii, ISRO2015-14

A hash table with ten buckets with one slot per bucket is shown in the following figure. The symbols $S1$ to $S7$ initially entered using a hashing function with linear probing. The maximum number of comparisons needed in searching an item that is not present is

0	S7
1	S1
2	
3	S4
4	S2
5	
6	S5
7	
8	S6
9	S3

A. 4 B. 5 C. 6 D. 3

hashing isro2015 gate1989 algorithms normal

Answer key

1.30.2 Hashing: GATE CSE 1990 | Question: 13b

Consider a hash table with chaining scheme for overflow handling:

i. What is the worst-case timing complexity of inserting n elements into such a table?
ii. For what type of instance does this hashing scheme take the worst-case time for insertion?

gate1990 hashing algorithms descriptive

Answer key

1.30.3 Hashing: GATE CSE 2020 | Question: 23

Consider a double hashing scheme in which the primary hash function is $h_1(k) = k \bmod 23$, and the secondary hash function is $h_2(k) = 1 + (k \bmod 19)$. Assume that the table size is 23. Then the address returned by probe 1 in the probe sequence (assume that the probe sequence begins at probe 0) for key value $k = 90$ is____________.

gatecse-2020 numerical-answers algorithms hashing one-mark

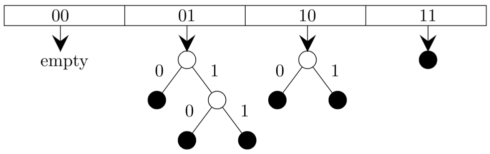
Answer key

1.30.4 Hashing: GATE CSE 2021 Set 1 | Question: 47

Consider a $dynamic$ hashing approach for 4-bit integer keys:

1. There is a main hash table of size 4.
2. The 2 least significant bits of a key is used to index into the main hash table.
3. Initially, the main hash table entries are empty.
4. Thereafter, when more keys are hashed into it, to resolve collisions, the set of all keys corresponding to a main hash table entry is organized as a binary tree that grows on demand.
5. First, the 3^{rd} least significant bit is used to divide the keys into left and right subtrees.
6. To resolve more collisions, each node of the binary tree is further sub-divided into left and right subtrees based on the 4^{th} least significant bit.
7. A split is done only if it is needed, i.e., only when there is a collision.

Consider the following state of the hash table.



Which of the following sequences of key insertions can cause the above state of the hash table (assume the keys are in decimal notation)?

A. $5, 9, 4, 13, 10, 7$
B. $9, 5, 10, 6, 7, 1$
C. $10, 9, 6, 7, 5, 13$
D. $9, 5, 13, 6, 10, 14$

gatecse-2021-set1 multiple-selects algorithms hashing two-marks

Answer key☟

1.30.5 Hashing: GATE CSE 2022 | Question: 6

Suppose we are given n keys, m hash table slots, and two simple uniform hash functions h_1 and h_2. Further suppose our hashing scheme uses h_1 for the odd keys and h_2 for the even keys. What is the expected number of keys in a slot?

A. $\frac{m}{n}$
B. $\frac{n}{m}$
C. $\frac{2n}{m}$
D. $\frac{n}{2m}$

gatecse-2022 algorithms hashing uniform-hashing one-mark

Answer key☟

1.30.6 Hashing: GATE CSE 2023 | Question: 10

An algorithm has to store several keys generated by an adversary in a hash table. The adversary is malicious who tries to maximize the number of collisions. Let k be the number of keys, m be the number of slots in the hash table, and $k > m$.

Which one of the following is the best hashing strategy to counteract the adversary?

A. Division method, i.e., use the hash function $h(k) = k \bmod m$.
B. Multiplication method, i.e., use the hash function $h(k) = \lfloor m(kA - \lfloor kA \rfloor) \rfloor$, where A is a carefully chosen constant.
C. Universal hashing method.
D. If k is a prime number, use Division method. Otherwise, use Multiplication method.

gatecse-2023 algorithms hashing one-mark

Answer key☟

1.30.7 Hashing: GATE IT 2005 | Question: 16

A hash table contains 10 buckets and uses linear probing to resolve collisions. The key values are integers and the hash function used is $\text{key}\%10$. If the values $43, 165, 62, 123, 142$ are inserted in the table, in what location would the key value 142 be inserted?

A. 2
B. 3
C. 4
D. 6

gateit-2005 algorithms hashing easy

Answer key☟

1.30.8 Hashing: UGC NET CSE | June 2013 | Part 2 | Question: 26

Given an open address hash table with load factor $\alpha < 1$, the expected number of probes in a successful search is

A. Atmost $\frac{1}{\alpha}$ ln $\left(\frac{1-\alpha}{\alpha}\right)$
B. Atmost $\frac{1}{\alpha}$ ln $\left(\frac{1}{1-\alpha}\right)$
C. Atleast $\frac{1}{\alpha}$ ln $\left(\frac{1}{1-\alpha}\right)$
D. Atleast $\frac{1}{\alpha}$ ln $\left(\frac{\alpha}{1-\alpha}\right)$

ugcnetcse-june2013-paper2 hashing data-structures

Answer key☟

1.31 Huffman Code (9)

1.31.1 Huffman Code: GATE CSE 1989 | Question: 13a

A language uses an alphabet of six letters, $\{a, b, c, d, e, f\}$. The relative frequency of use of each letter of the alphabet in the language is as given below:

LETTER	RELATIVE FREQUENCY OF USE
a	0.19
b	0.05
c	0.17
d	0.08
e	0.40
f	0.11

Design a prefix binary code for the language which would minimize the average length of the encoded words of the language.

descriptive gate1989 algorithms huffman-code

Answer key

1.31.2 Huffman Code: GATE CSE 2007 | Question: 76

Suppose the letters a, b, c, d, e, f have probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{32}$, respectively. Which of the following is the Huffman code for the letter a, b, c, d, e, f?

A. 0, 10, 110, 1110, 11110, 11111

B. 11, 10, 011, 010, 001, 000

C. 11, 10, 01, 001, 0001, 0000

D. 110, 100, 010, 000, 001, 111

gatecse-2007 algorithms greedy-algorithms normal huffman-code

Answer key

1.31.3 Huffman Code: GATE CSE 2007 | Question: 77

Suppose the letters a, b, c, d, e, f have probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{32}$, respectively.

What is the average length of the Huffman code for the letters a, b, c, d, e, f?

A. 3

B. 2.1875

C. 2.25

D. 1.9375

gatecse-2007 algorithms greedy-algorithms normal huffman-code

Answer key

1.31.4 Huffman Code: GATE CSE 2017 Set 2 | Question: 50

A message is made up entirely of characters from the set $X = \{P, Q, R, S, T\}$. The table of probabilities for each of the characters is shown below:

Character	Probability
P	0.22
Q	0.34
R	0.17
S	0.19
T	0.08
Total	1.00

If a message of 100 characters over X is encoded using Huffman coding, then the expected length of the encoded message in bits is ______.

gatecse-2017-set2 huffman-code numerical-answers algorithms

Answer key

1.31.5 Huffman Code: GATE CSE 2021 Set 2 | Question: 26

Consider the string abbccddeee. Each letter in the string must be assigned a binary code satisfying the following properties:

1. For any two letters, the code assigned to one letter must not be a prefix of the code assigned to the other letter.
2. For any two letters of the same frequency, the letter which occurs earlier in the dictionary order is assigned a code whose length is at most the length of the code assigned to the other letter.

Among the set of all binary code assignments which satisfy the above two properties, what is the minimum length of the encoded string?

A. 21 B. 23 C. 25 D. 30

gatecse-2021-set2 algorithms huffman-code two-marks

Answer key

1.31.6 Huffman Code: GATE IT 2006 | Question: 48

The characters a to h have the set of frequencies based on the first 8 Fibonacci numbers as follows

$a : 1, b : 1, c : 2, d : 3, e : 5, f : 8, g : 13, h : 21$

A Huffman code is used to represent the characters. What is the sequence of characters corresponding to the following code?

110111100111010

A. $fdheg$ B. $ecgdf$ C. $dchfg$ D. $fehdg$

gateit-2006 algorithms greedy-algorithms normal huffman-code

Answer key

1.31.7 Huffman Code: UGC NET CSE | July 2016 | Part 3 | Question: 34

Match the following :

(a)	Huffman Code	(i)	$O(n^2)$
(b)	Optical Polygon Triangulation	(ii)	$\theta(n^2)$
(c)	Activity Selection Problem	(iii)	$O(n \lg n)$
(d)	Quicksort	(iv)	$\theta(n)$

Codes :

A. (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)
B. (a)-(i), (b)-(iv), (c)-((ii), (d)-(iii)
C. (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
D. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

ugcnetcse-july2016-paper3 algorithms huffman-code

Answer key

1.31.8 Huffman Code: UGC NET CSE | July 2016 | Part 3 | Question: 59

Consider a source with symbols A, B, C, D with probabilities $1/2, 1/4, 1/8, 1/8$ respectively. What is the average number of bits per symbol for the Huffman code generated from above information?

A. 2 bits per symbol
B. 1.75 bits per symbol
C. 1.50 bits per symbol
D. 1.25 bits per symbol

ugcnetcse-july2016-paper3 algorithms huffman-code probability

Answer key

1.31.9 Huffman Code: UGC NET CSE | Junet 2015 | Part 3 | Question: 64

Given the symbols A, B, C, D, E, F, G and H with the probabilities $\frac{1}{30}, \frac{1}{30}, \frac{1}{30}, \frac{2}{30}, \frac{3}{30}, \frac{5}{30}, \frac{5}{30}$ and $\frac{12}{30}$

respectively. The average Huffman code size in bits per symbol is

A. $\frac{67}{30}$ B. $\frac{70}{34}$ C. $\frac{76}{30}$ D. $\frac{78}{30}$

ugcnetcse-june2015-paper3 algorithms greedy-algorithms huffman-code

Answer key

1.32 Identify Function (38)

1.32.1 Identify Function: GATE CSE 1989 | Question: 8a

What is the output produced by the following program, when the input is "HTGATE"

```
Function what (s:string): string;
var n:integer;
begin
    n = s.length
    if n <= 1
    then what := s
    else what :=contact (what (substring (s, 2, n)), s.C [1])
end;
```

Note

i. type string=record
   length:integer;
   C:array[1..100] of char
   end
ii. Substring (s, i, j): this yields the string made up of the i^{th} through j^{th} characters in s; for appropriately defined in i and j.
iii. Contact (s_1, s_2): this function yields a string of length s_1 length + s_2 - length obtained by concatenating s_1 with s_2 such that s_1 precedes s_2.

gate1989 descriptive algorithms identify-function

Answer key

1.32.2 Identify Function: GATE CSE 1990 | Question: 11b

The following program computes values of a mathematical function $f(x)$. Determine the form of $f(x)$.

```
main ()
{
    int m, n; float x, y, t;
    scanf ("%f%d", &x, &n);
    t = 1; y = 0; m = 1;
    do
    {
        t *= (-x/m);
        y += t;
    } while (m++ < n);
    printf ("The value of y is %f", y);
}
```

gate1990 descriptive algorithms identify-function

Answer key

1.32.3 Identify Function: GATE CSE 1991 | Question: 03-viii

Consider the following Pascal function:

```
Function X(M:integer):integer;
Var i:integer;
Begin
    i := 0;
    while i*i < M
    do i:= i+1
    X := i
 end
```

The function call $X(N)$, if N is positive, will return

A. $\lfloor\sqrt{N}\rfloor$
B. $\lfloor\sqrt{N}\rfloor+1$
C. $\lceil\sqrt{N}\rceil$
D. $\lceil\sqrt{N}\rceil+1$
E. None of the above

gate1991 algorithms easy identify-function multiple-selects

Answer key

1.32.4 Identify Function: GATE CSE 1993 | Question: 7.4

What does the following code do?

```
var a, b: integer;
begin
   a:=a+b;
   b:=a-b;
   a:=a-b;
end;
```

A. exchanges a and b
B. doubles a and stores in b
C. doubles b and stores in a
D. leaves a and b unchanged
E. none of the above

gate1993 algorithms identify-function easy

Answer key

1.32.5 Identify Function: GATE CSE 1994 | Question: 6

What function of x, n is computed by this program?

```
Function what(x, n:integer): integer:
Var
   value : integer
begin
   value := 1
   if n > 0 then
   begin
      if n mod 2 =1 then
         value := value * x;
      value := value * what(x*x, n div 2);
   end;
   what := value;
end;
```

gate1994 algorithms identify-function normal descriptive

Answer key

1.32.6 Identify Function: GATE CSE 1995 | Question: 1.4

In the following Pascal program segment, what is the value of X after the execution of the program segment?

```
X := -10; Y := 20;
If X > Y then if X < 0 then X := abs(X) else X := 2*X;
```

A. 10
B. -20
C. -10
D. None

gate1995 algorithms identify-function easy

Answer key

1.32.7 Identify Function: GATE CSE 1995 | Question: 2.3

Assume that X and Y are non-zero positive integers. What does the following Pascal program segment do?

```
while X <> Y do
if  X > Y then
   X := X - Y
else
   Y := Y - X;
write(X);
```

A. Computes the LCM of two numbers

B. Divides the larger number by the smaller number

C. Computes the GCD of two numbers

D. None of the above

gate1995 algorithms identify-function normal

Answer key

1.32.8 Identify Function: GATE CSE 1995 | Question: 4

A. Consider the following Pascal function where A and B are non-zero positive integers. What is the value of $\text{GET}(3, 2)$?

```
function GET(A,B:integer): integer;
begin
   if B=0 then
      GET:= 1
   else if A < B then
      GET:= 0
   else
      GET:= GET(A-1, B) + GET(A-1, B-1)
end;
```

B. The Pascal procedure given for computing the transpose of an $N \times N, (N > 1)$ matrix A of integers has an error. Find the error and correct it. Assume that the following declaration are made in the main program

```
const
   MAXSIZE=20;
type
   INTARR=array [1..MAXSIZE,1..MAXSIZE] of integer;
Procedure TRANSPOSE (var A: INTARR; N : integer);
var
   I, J, TMP: integer;
begin
   for I:=1 to N – 1 do
   for J:=1 to N do
   begin
      TMP:= A[I, J];
      A[I, J]:= A[J, I];
      A[J, I]:= TMP
   end
end;
```

gate1995 algorithms identify-function normal descriptive

Answer key

1.32.9 Identify Function: GATE CSE 1998 | Question: 2.12

What value would the following function return for the input $x = 95$?

```
Function fun (x:integer):integer;
Begin
   If x > 100 then fun = x – 10
   Else fun = fun(fun (x+11))
End;
```

A. 89

B. 90

C. 91

D. 92

gate1998 algorithms recursion identify-function normal

Answer key

1.32.10 Identify Function: GATE CSE 1999 | Question: 2.24

Consider the following C function definition

```
int Trial (int a, int b, int c)
{
   if ((a>=b) && (c<b)) return b;
   else if (a>=b) return Trial(a, c, b);
   else return Trial(b, a, c);
}
```

The functional Trial:

A. Finds the maximum of a, b, and c

B. Finds the minimum of a, b, and c

C. Finds the middle number of a, b, c

D. None of the above

gate1999 algorithms identify-function normal

Answer key

1.32.11 Identify Function: GATE CSE 2000 | Question: 2.15

Suppose you are given an array $s[1....n]$ and a procedure reverse (s,i,j) which reverses the order of elements in s between positions i and j (both inclusive). What does the following sequence do, where $1 \leqslant k \leqslant n$:

```
reverse (s, 1, k);
reverse (s, k+1, n);
reverse (s, 1, n);
```

A. Rotates s left by k positions

B. Leaves s unchanged

C. Reverses all elements of s

D. None of the above

gatecse-2000 algorithms normal identify-function

Answer key

1.32.12 Identify Function: GATE CSE 2003 | Question: 1

Consider the following C function.

For large values of y, the return value of the function f best approximates

```
float f,(float x, int y) {
   float p, s; int i;
   for (s=1,p=1,i=1; i<y; i++) {
      p *= x/i;
      s += p;
   }
   return s;
}
```

A. x^y

B. e^x

C. $\ln(1+x)$

D. x^x

gatecse-2003 algorithms identify-function normal

Answer key

1.32.13 Identify Function: GATE CSE 2003 | Question: 88

In the following C program fragment, j, k, n and TwoLog_n are integer variables, and A is an array of integers. The variable n is initialized to an integer $\geqslant 3$, and TwoLog_n is initialized to the value of $2^* \lceil \log_2(n) \rceil$

```
for (k = 3;  k <= n; k++)
      A[k] = 0;
for (k = 2; k <= TwoLog_n; k++)
   for (j = k+1; j <= n; j++)
      A[j] = A[j] || (j%k);
for (j = 3; j <= n; j++)
   if (!A[j]) printf("%d", j);
```

The set of numbers printed by this program fragment is

A. $\{m \mid m \leq n, (\exists i) \, [m = i!]\}$

B. $\{m \mid m \leq n, (\exists i) \, [m = i^2]\}$

C. $\{m \mid m \leq n, \text{m is prime}\}$

D. { }

gatecse-2003 algorithms identify-function normal

Answer key

1.32.14 Identify Function: GATE CSE 2004 | Question: 41

Consider the following C program

```
main()
```

```
{
    int x, y, m, n;
    scanf("%d %d", &x, &y);
    /* Assume x>0 and y>0*/
    m = x; n = y;
    while(m != n)
      {
        if (m > n)
          m = m-n;
        else
          n = n-m;
      }
    printf("%d", n);
}
```

The program computes

A. $x + y$ using repeated subtraction

B. $x \mod y$ using repeated subtraction

C. the greatest common divisor of x and y

D. the least common multiple of x and y

gatecse-2004 algorithms normal identify-function

Answer key

1.32.15 Identify Function: GATE CSE 2004 | Question: 42

What does the following algorithm approximate? (Assume $m > 1, \epsilon > 0$).

```
x = m;
y = 1;
While (x-y > ϵ)
{
    x = (x+y)/2;
    y = m/x;
}
print(x);
```

A. $\log m$

B. m^2

C. $m^{\frac{1}{2}}$

D. $m^{\frac{1}{3}}$

gatecse-2004 algorithms identify-function normal

Answer key

1.32.16 Identify Function: GATE CSE 2005 | Question: 31

Consider the following C-program:

```
void foo (int n, int sum) {
    int k = 0, j = 0;
    if (n == 0) return;
    k = n % 10; j = n/10;
    sum = sum + k;
    foo (j, sum);
    printf ("%d,",k);
}

int main() {
    int a = 2048, sum = 0;
    foo(a, sum);
    printf("%d\n", sum);
}
```

What does the above program print?

A. $8, 4, 0, 2, 14$

B. $8, 4, 0, 2, 0$

C. $2, 0, 4, 8, 14$

D. $2, 0, 4, 8, 0$

gatecse-2005 algorithms identify-function recursion normal

Answer key

1.32.17 Identify Function: GATE CSE 2006 | Question: 50

A set X can be represented by an array $x[n]$ as follows:

$$x[i] = \begin{cases} 1 & \text{if } i \in X \\ 0 & \text{otherwise} \end{cases}$$

Consider the following algorithm in which x, y, and z are Boolean arrays of size n:

```
algorithm zzz(x[], y[], z[]) {
int i;

for(i=0; i<n; ++i)
z[i] = (x[i] ∧ ~y[i]) ∨ (~x[i] ∧ y[i]);
}
```

The set Z computed by the algorithm is:

A. $(X \cup Y)$
B. $(X \cap Y)$
C. $(X - Y) \cap (Y - X)$
D. $(X - Y) \cup (Y - X)$

gatecse-2006 algorithms identify-function normal

Answer key

1.32.18 Identify Function: GATE CSE 2006 | Question: 53

Consider the following C-function in which $a[n]$ and $b[m]$ are two sorted integer arrays and $c[n+m]$ be another integer array,

```
void xyz(int a[], int b [], int c []){
   int i,j,k;
   i=j=k=0;
   while ((i<n) && (j<m))
      if (a[i] < b[j]) c[k++] = a[i++];
      else c[k++] = b[j++];
}
```

Which of the following condition(s) hold(s) after the termination of the while loop?

i. $j < m, k = n + j - 1$ and $a[n-1] < b[j]$ if $i = n$
ii. $i < n, k = m + i - 1$ and $b[m-1] \leq a[i]$ if $j = m$

A. only (i)
B. only (ii)
C. either (i) or (ii) but not both
D. neither (i) nor (ii)

gatecse-2006 algorithms identify-function normal

Answer key

1.32.19 Identify Function: GATE CSE 2009 | Question: 18

Consider the program below:

```
#include <stdio.h>
int fun(int n, int *f_p) {
   int t, f;
   if (n <= 1) {
      *f_p = 1;
      return 1;
   }
   t = fun(n-1, f_p);
   f = t + *f_p;
   *f_p = t;
   return f;
}

int main() {
   int x = 15;
   printf("%d/n", fun(5, &x));
   return 0;
}
```

The value printed is:

A. 6
B. 8
C. 14
D. 15

gatecse-2009 algorithms recursion identify-function normal

Answer key

1.32.20 Identify Function: GATE CSE 2010 | Question: 35

What is the value printed by the following C program?

```
#include<stdio.h>

int f(int *a, int n)
{
   if (n <= 0) return 0;
   else if (*a % 2 == 0) return *a+f(a+1, n-1);
   else return *a - f(a+1, n-1);
}

int main()
{
   int a[] = {12, 7, 13, 4, 11, 6};
   printf("%d", f(a, 6));
   return 0;
}
```

A. -9 B. 5 C. 15 D. 19

gatecse-2010 algorithms recursion identify-function normal

Answer key

1.32.21 Identify Function: GATE CSE 2011 | Question: 48

Consider the following recursive C function that takes two arguments.

```
unsigned int foo(unsigned int n, unsigned int r) {
   if (n>0) return ((n%r) + foo(n/r, r));
   else return 0;
}
```

What is the return value of the function foo when it is called as $\text{foo}(345, 10)$?

A. 345 B. 12 C. 5 D. 3

gatecse-2011 algorithms recursion identify-function normal

Answer key

1.32.22 Identify Function: GATE CSE 2011 | Question: 49

Consider the following recursive C function that takes two arguments.

```
unsigned int foo(unsigned int n, unsigned int r) {
   if (n>0) return ((n%r) + foo(n/r, r));
   else return 0;
}
```

What is the return value of the function foo when it is called as $\text{foo}(513, 2)$?

A. 9 B. 8 C. 5 D. 2

gatecse-2011 algorithms recursion identify-function normal

Answer key

1.32.23 Identify Function: GATE CSE 2013 | Question: 31

Consider the following function:

```
int unknown(int n){

int i, j, k=0;
for (i=n/2; i<=n; i++)
   for (j=2; j<=n; j=j*2)
      k = k + n/2;
 return (k);

}
```

The return value of the function is

A. $\Theta(n^2)$ B. $\Theta(n^2 \log n)$

C. $\Theta(n^3)$

D. $\Theta(n^3 \log n)$

gatecse-2013 algorithms identify-function normal

Answer key

1.32.24 Identify Function: GATE CSE 2014 Set 1 | Question: 41

Consider the following C function in which **size** is the number of elements in the array **E**:

```
int MyX(int *E, unsigned int size)
{
  int Y = 0;
  int Z;
  int i, j, k;

  for(i = 0; i< size; i++)
        Y = Y + E[i];

   for(i=0; i < size; i++)
      for(j = i; j < size; j++)
      {
         Z = 0;
         for(k = i; k <= j; k++)
            Z = Z + E[k];
         if(Z > Y)
            Y = Z;
      }
  return Y;
}
```

The value returned by the function **MyX** is the

A. maximum possible sum of elements in any sub-array of array **E**.
B. maximum element in any sub-array of array **E.**
C. sum of the maximum elements in all possible sub-arrays of array **E**.
D. the sum of all the elements in the array **E.**

gatecse-2014-set1 algorithms identify-function normal

Answer key

1.32.25 Identify Function: GATE CSE 2014 Set 2 | Question: 10

Consider the function func shown below:

```
int func(int num) {
  int count = 0;
  while (num) {
    count++;
    num>>= 1;
  }
  return (count);
}
```

The value returned by func(435) is ________

gatecse-2014-set2 algorithms identify-function numerical-answers easy

Answer key

1.32.26 Identify Function: GATE CSE 2014 Set 3 | Question: 10

Let A be the square matrix of size $n \times n$. Consider the following pseudocode. What is the expected output?

```
C=100;
for i=1 to n do
   for j=1 to n do
   {
      Temp = A[i][j]+C;
      A[i][j] = A[j][i];
      A[j][i] = Temp -C;
   }
for i=1 to n do
   for j=1 to n do
      output (A[i][j]);
```

A. The matrix A itself
B. Transpose of the matrix A
C. Adding 100 to the upper diagonal elements and subtracting 100 from lower diagonal elements of A
D. None of the above

gatecse-2014-set3 algorithms identify-function easy

Answer key

1.32.27 Identify Function: GATE CSE 2015 Set 1 | Question: 31

Consider the following C function.

```
int fun1 (int n) {
    int i, j, k, p, q = 0;
    for (i = 1; i < n; ++i)
    {
      p = 0;
     for (j = n; j > 1; j = j/2)
        ++p;
     for (k = 1; k < p; k = k * 2)
        ++q;
    }
    return q;
}
```

Which one of the following most closely approximates the return value of the function fun1?

A. n^3 B. $n(\log n)^2$ C. $n \log n$ D. $n \log(\log n)$

gatecse-2015-set1 algorithms normal identify-function

Answer key

1.32.28 Identify Function: GATE CSE 2015 Set 2 | Question: 11

Consider the following C function.

```
int fun(int n) {
   int x=1, k;
   if (n==1) return x;
   for (k=1; k<n; ++k)
      x = x + fun(k) * fun (n-k);
   return x;
}
```

The return value of $fun(5)$ is ______.

gatecse-2015-set2 algorithms identify-function recurrence-relation normal numerical-answers

Answer key

1.32.29 Identify Function: GATE CSE 2015 Set 3 | Question: 49

Suppose $c = \langle c[0], \dots, c[k-1] \rangle$ is an array of length k, where all the entries are from the set $\{0, 1\}$. For any positive integers a and n, consider the following pseudocode.

```
DOSOMETHING (c, a, n)

z ← 1
for i ← 0 to k-1
    do z ← z² mod n
    if c[i]=1
         then z ← (z × a) mod n
return z
```

If $k = 4, c = \langle 1, 0, 1, 1 \rangle, a = 2, \text{ and } n = 8$, then the output of DOSOMETHING(*c, a, n*) is _______.

gatecse-2015-set3 algorithms identify-function normal numerical-answers

Answer key

1.32.30 Identify Function: GATE CSE 2019 | Question: 26

Consider the following C function.

```
void convert (int n ) {
    if (n<0)
        printf{“%d”, n);
    else {
        convert(n/2);
        printf(“%d”, n%2);
    }
}
```

Which one of the following will happen when the function *convert* is called with any positive integer n as argument?

A. It will print the binary representation of n and terminate
B. It will print the binary representation of n in the reverse order and terminate
C. It will print the binary representation of n but will not terminate
D. It will not print anything and will not terminate

gatecse-2019 algorithms identify-function two-marks

Answer key

1.32.31 Identify Function: GATE CSE 2020 | Question: 48

Consider the following C functions.

```
int tob (int b, int* arr) {
    int i;
    for (i = 0; b>0; i++)  {
        if (b%2)  arr [i] = 1;
        else      arr[i] = 0;
        b = b/2;
    }
    return (i);
}
```

```
int pp(int a, int b)  {
    int  arr[20];
    int i, tot = 1, ex, len;
    ex = a;
    len = tob(b, arr);
    for (i=0; i<len ; i++) {
        if (arr[i] ==1)
            tot = tot * ex;
        ex= ex*ex;
    }
return (tot) ;
}
```

The value returned by $pp(3, 4)$ is _______.

gatecse-2020 numerical-answers identify-function two-marks

Answer key

1.32.32 Identify Function: GATE CSE 2021 Set 1 | Question: 48

Consider the following ANSI C function:

```
int SimpleFunction(int Y[], int n, int x)
{
   int total = Y[0], loopIndex;
   for (loopIndex=1; loopIndex<=n-1; loopIndex++)
      total=x*total +Y[loopIndex];
   return total;
}
```

Let Z be an array of 10 elements with $\text{Z}[i] = 1$, for all i such that $0 \leq i \leq 9$. The value returned by $\text{SimpleFunction}(\text{Z}, 10, 2)$ is __________

gatecse-2021-set1 algorithms numerical-answers identify-function two-marks

Answer key

1.32.33 Identify Function: GATE CSE 2021 Set 2 | Question: 23

Consider the following ANSI C function:

```
int SomeFunction (int x, int y)
{
```

```
    if ((x==1) || (y==1)) return 1;
    if (x==y) return x;
    if (x > y) return SomeFunction(x-y, y);
    if (y > x) return SomeFunction (x, y-x);

}
```

The value returned by $\text{SomeFunction}(15, 255)$ is ________

gatecse-2021-set2 numerical-answers algorithms identify-function output one-mark

Answer key

1.32.34 Identify Function: GATE IT 2005 | Question: 53

The following C function takes two ASCII strings and determines whether one is an anagram of the other. An anagram of a string s is a string obtained by permuting the letters in s.

```
int anagram (char *a, char *b) {
    int count [128], j;
    for (j = 0;  j < 128; j++) count[j] = 0;
    j = 0;
    while (a[j] && b[j]) {
        A;
        B;
    }
    for (j = 0; j < 128; j++) if (count [j]) return 0;
    return 1;
}
```

Choose the correct alternative for statements A and B.

A. A: count [a[j]]++ and B: count[b[j]]--
B. A: count [a[j]]++ and B: count[b[j]]++
C. A: count [a[j++]]++ and B: count[b[j]]--
D. A: count [a[j]]++ and B: count[b[j++]]--

gateit-2005 normal identify-function

Answer key

1.32.35 Identify Function: GATE IT 2005 | Question: 57

What is the output printed by the following program?

```
#include <stdio.h>

int f(int n, int k) {
    if (n == 0) return 0;
    else if (n % 2) return f(n/2, 2*k) + k;
    else return f(n/2, 2*k) - k;
}

int main () {
    printf("%d", f(20, 1));
    return 0;
}
```

A. 5 B. 8 C. 9 D. 20

gateit-2005 algorithms identify-function normal

Answer key

1.32.36 Identify Function: GATE IT 2006 | Question: 52

The following function computes the value of $\binom{m}{n}$ correctly for all legal values m and n ($m \geq 1, n \geq 0$ and $m > n$)

```
int func(int m, int n)
{
    if (E) return 1;
    else return(func(m -1, n) + func(m - 1, n - 1));
}
```

In the above function, which of the following is the correct expression for E?

A. $(n == 0)||(m == 1)$
B. $(n == 0)$ && $(m == 1)$
C. $(n == 0)||(m == n)$
D. $(n == 0)$ && $(m == n)$

gateit-2006 algorithms identify-function normal

Answer key

1.32.37 Identify Function: GATE IT 2008 | Question: 82

Consider the code fragment written in C below :

```
void f (int n)
{
 if (n <=1)  {
  printf ("%d", n);
 }
 else {
  f (n/2);
  printf ("%d", n%2);
 }
}
```

What does f(173) print?

A. 010110101
B. 010101101
C. 10110101
D. 10101101

gateit-2008 algorithms recursion identify-function normal

Answer key

1.32.38 Identify Function: GATE IT 2008 | Question: 83

Consider the code fragment written in C below :

```
void f (int n)
{
   if (n <= 1)  {
      printf ("%d", n);
   }
   else {
      f (n/2);
      printf ("%d", n%2);
   }
}
```

Which of the following implementations will produce the same output for $f(173)$ as the above code?

P1

```
void f (int n)
{
   if (n/2)  {
      f(n/2);
   }
   printf ("%d", n%2);
}
```

P2

```
void f (int n)
{
   if (n <=1)  {
      printf ("%d", n);
   }
   else {
      printf ("%d", n%2);
      f (n/2);
   }
}
```

A. Both $P1$ and $P2$
B. $P2$ only
C. $P1$ only
D. Neither $P1$ nor $P2$

gateit-2008 algorithms recursion identify-function normal

Answer key

1.33 In Place Algo (1)

1.33.1 In Place Algo: UGC NET CSE | June 2019 | Part 2 | Question: 62

There are many sorting algorithms based on comparison. The running time of heapsort algorithm is

$O(n\lg n)$. Like P, but unlike Q, heapsort sorts in place where (P, Q) is equal to

A. Merge sort, Quick sort
B. Quick sort, insertion sort
C. Insertion sort, Quick sort
D. Insertion sort, Merge sort

ugcnetcse-june2019-paper2 in-place-algo quicksort-mergesort-insertion-sort

Answer key☟

1.34 Insertion Sort (3)

1.34.1 Insertion Sort: GATE CSE 2003 | Question: 22

The usual $\Theta(n^2)$ implementation of Insertion Sort to sort an array uses linear search to identify the position where an element is to be inserted into the already sorted part of the array. If, instead, we use binary search to identify the position, the worst case running time will

A. remain $\Theta(n^2)$
B. become $\Theta(n(\log n)^2)$
C. become $\Theta(n \log n)$
D. become $\Theta(n)$

gatecse-2003 algorithms sorting time-complexity normal insertion-sort

Answer key☟

1.34.2 Insertion Sort: GATE CSE 2003 | Question: 62

In a permutation $a_1 \dots a_n$, of n distinct integers, an inversion is a pair (a_i, a_j) such that $i < j$ and $a_i > a_j$. What would be the worst case time complexity of the Insertion Sort algorithm, if the inputs are restricted to permutations of $1 \dots n$ with at most n inversions?

A. $\Theta(n^2)$
B. $\Theta(n \log n)$
C. $\Theta(n^{1.5})$
D. $\Theta(n)$

gatecse-2003 algorithms sorting normal insertion-sort

Answer key☟

1.34.3 Insertion Sort: GATE DA 2025 | Question: 19

Suppose that insertion sort is applied to the array $[1, 3, 5, 7, 9, 11, x, 15, 13]$ and it takes exactly two swaps to sort the array. Select all possible values of x.

A. 10
B. 12
C. 14
D. 16

gateda-2025 algorithms insertion-sort sorting multiple-selects easy one-mark

Answer key☟

1.35 Knapsack Problem (2)

1.35.1 Knapsack Problem: UGC NET CSE | June 2014 | Part 3 | Question: 62

Consider the fractional knapsack instance
$n = 4, (p_1, p_2, p_3, p_4) = (10, 10, 12, 18), (w_1, w_2, w_3, w_4) = (2, 4, 6, 9)$ and $M = 15$.
The maximum profit is given by (Assume p and w denotes profit and weight of objects respectively)

A. 40
B. 38
C. 32
D. 30

ugcnetjune2014iii algorithms greedy-algorithms knapsack-problem

Answer key☟

1.35.2 Knapsack Problem: UGC NET CSE | September 2013 | Part 3 | Question: 42

Given 0-1 knapsack problem and fractional knapsack problem and the following statements:
S_1: 0-1 knapsack is efficiently solved using Greedy algorithm.
S_2: Fractional knapsack is efficiently solved using Dynamic programming.
Which of the following is true?

A. S_1 is correct and S_2 is not correct
B. Both S_1 and S_2 are correct

C. Both S_1 and S_2 are not correct

D. S_1 is not correct and S_2 is correct

ugcnetcse-sep2013-paper3 algorithms knapsack-problem

Answer key☟

1.36 Linear Probing (1)

1.36.1 Linear Probing: GATE DA 2025 | Question: 8

Consider a hash table of size 10 with indices $\{0, 1, \ldots, 9\}$, with the hash function

$$h(x) = 3x (\bmod 10)$$

where linear probing is used to handle collisions. The hash table is initially empty and then the following sequence of keys is inserted into the hash table: $1, 4, 5, 6, 14, 15$. The indices where the keys 14 and 15 are stored are, respectively

A. 2 and 5

B. 2 and 6

C. 4 and 5

D. 4 and 6

gateda-2025 algorithms hashing linear-probing easy one-mark

Answer key☟

1.37 Linear Search (1)

1.37.1 Linear Search: UGC NET CSE | Junet 2015 | Part 2 | Question: 24

The average case occurs in Linear Search Algorithm when

A. The item to be searched is in some where middle of the Array
B. The item to be searched is not in the array
C. The item to be searched is in the last of t he array
D. The item to be searched is either in the last or not in the array

ugcnetcse-june2015-paper2 algorithms linear-search

Answer key☟

1.38 Longest Common Subsequence (1)

1.38.1 Longest Common Subsequence: UGC NET CSE | December 2015 | Part 3 | Question: 17

Given two sequences X and Y:

$X = \langle a, b, c, b, d, a, b \rangle$

$Y = \langle b, d, c, a, b, a \rangle$

The longest common subsequence of X and Y is:

A. $\langle b, c, a \rangle$

B. $\langle c, a, b \rangle$

C. $\langle b, c, a, a \rangle$

D. $\langle b, c, b, a \rangle$

ugcnetcse-dec2015-paper3 algorithms longest-common-subsequence

Answer key☟

1.39 Matrix Chain Ordering (7)

1.39.1 Matrix Chain Ordering: GATE CSE 2011 | Question: 38

Four Matrices M_1, M_2, M_3 and M_4 of dimensions $p \times q,\ q \times r,\ r \times s$ and $s \times t$ respectively can be multiplied in several ways with different number of total scalar multiplications. For example when multiplied as $((M_1 \times M_2) \times (M_3 \times M_4))$, the total number of scalar multiplications is $pqr + rst + prt$. When multiplied as $(((M_1 \times M_2) \times M_3) \times M_4)$, the total number of scalar multiplications is $pqr + prs + pst$.

If $p = 10, q = 100, r = 20, s = 5$ and $t = 80$, then the minimum number of scalar multiplications needed is

A. 248000 B. 44000 C. 19000 D. 25000

gatecse-2011 algorithms dynamic-programming normal matrix-chain-ordering

Answer key

1.39.2 Matrix Chain Ordering: GATE CSE 2016 Set 2 | Question: 38

Let A_1, A_2, A_3 and A_4 be four matrices of dimensions $10 \times 5, 5 \times 20, 20 \times 10$ and 10×5, respectively. The minimum number of scalar multiplications required to find the product $A_1 A_2 A_3 A_4$ using the basic matrix multiplication method is _________.

gatecse-2016-set2 dynamic-programming algorithms matrix-chain-ordering normal numerical-answers

Answer key

1.39.3 Matrix Chain Ordering: GATE CSE 2018 | Question: 31

Assume that multiplying a matrix G_1 of dimension $p \times q$ with another matrix G_2 of dimension $q \times r$ requires pqr scalar multiplications. Computing the product of n matrices $G_1 G_2 G_3 \dots G_n$ can be done by parenthesizing in different ways. Define $G_i G_{i+1}$ as an **explicitly computed pair** for a given paranthesization if they are directly multiplied. For example, in the matrix multiplication chain $G_1 G_2 G_3 G_4 G_5 G_6$ using parenthesization $(G_1(G_2 G_3))(G_4(G_5 G_6)), G_2 G_3$ and $G_5 G_6$ are only explicitly computed pairs.

Consider a matrix multiplication chain $F_1 F_2 F_3 F_4 F_5$, where matrices F_1, F_2, F_3, F_4 and F_5 are of dimensions $2 \times 25, 25 \times 3, 3 \times 16, 16 \times 1$ and 1×1000, respectively. In the parenthesization of $F_1 F_2 F_3 F_4 F_5$ that minimizes the total number of scalar multiplications, the explicitly computed pairs is/are

A. $F_1 F_2$ and $F_3 F_4$ only
B. $F_2 F_3$ only
C. $F_3 F_4$ only
D. $F_1 F_2$ and $F_4 F_5$ only

gatecse-2018 algorithms dynamic-programming two-marks matrix-chain-ordering

Answer key

1.39.4 Matrix Chain Ordering: UGC NET CSE | August 2016 | Part 3 | Question: 31

Consider the problem of a chain <A_1, A_2, A_3, A_4> of four matrices. Suppose that the dimensions of the matrices A_1, A_2, A_3 and A_4 are $30 \times 35, 35 \times 15, 15 \times 5$ and 5×10 respectively. The minimum number of scalar multiplications needed to compute the product $A_1 A_2 A_3 A_4$ is ____.

A. 14875 B. 21000 C. 9375 D. 11875

ugcnetcse-aug2016-paper3 algorithms dynamic-programming numerical-answers matrix-chain-ordering

Answer key

1.39.5 Matrix Chain Ordering: UGC NET CSE | December 2014 | Part 3 | Question: 35

Consider the problem of a chain $\langle A_1, A_2, A_3 \rangle$ of three matrices. Suppose that the dimensions of the matrices are 10×100, 100×5 and 5×50 respectively. There are two different ways of parenthesization : (i) $((A_1 A_2) A_3)$ and (ii) $(A_1 (A_2 A_3))$. Computing the product according to the first parenthesization is ______ times faster in comparison to the second parenthesization.

A. 5 B. 10 C. 20 D. 100

ugcnetcse-dec2014-paper3 algorithms matrix-chain-ordering

Answer key

1.39.6 Matrix Chain Ordering: UGC NET CSE | January 2017 | Part 3 | Question: 34

The minimum number of scalar multiplication required, for parenthesization of a matrix-chain product whose sequence of dimensions for four matrices is $< 5, 10, 3, 12, 5 >$ is

A. 630 B. 580 C. 480 D. 405

ugcnetcse-jan2017-paper3 algorithms matrix-chain-ordering

Answer key

1.39.7 Matrix Chain Ordering: UGC NET CSE | September 2013 | Part 3 | Question: 39

The number of possible paranthesizations of a sequence of n matrices is

A. O(n)
B. θ(n lg n)
C. $\Omega(2^n)$
D. None of the above

ugcnetcse-sep2013-paper3 algorithms dynamic-programming matrix-chain-ordering

Answer key

1.40 Merge Sort (6)

1.40.1 Merge Sort: GATE CSE 1999 | Question: 1.14, ISRO2015-42

If one uses straight two-way merge sort algorithm to sort the following elements in ascending order:

$20, 47, 15, 8, 9, 4, 40, 30, 12, 17$

then the order of these elements after second pass of the algorithm is:

A. $8, 9, 15, 20, 47, 4, 12, 17, 30, 40$
B. $8, 15, 20, 47, 4, 9, 30, 40, 12, 17$
C. $15, 20, 47, 4, 8, 9, 12, 30, 40, 17$
D. $4, 8, 9, 15, 20, 47, 12, 17, 30, 40$

gate1999 algorithms merge-sort normal isro2015 sorting

Answer key

1.40.2 Merge Sort: GATE CSE 2012 | Question: 39

A list of n strings, each of length n, is sorted into lexicographic order using the merge-sort algorithm. The worst case running time of this computation is

A. $O(n \log n)$
B. $O(n^2 \log n)$
C. $O(n^2 + \log n)$
D. $O(n^2)$

gatecse-2012 algorithms sorting normal merge-sort

Answer key

1.40.3 Merge Sort: GATE CSE 2015 Set 3 | Question: 27

Assume that a mergesort algorithm in the worst case takes 30 seconds for an input of size 64. Which of the following most closely approximates the maximum input size of a problem that can be solved in 6 minutes?

A. 256
B. 512
C. 1024
D. 2018

gatecse-2015-set3 algorithms sorting merge-sort

Answer key

1.40.4 Merge Sort: UGC NET CSE | December 2013 | Part 2 | Question: 25

Given two sorted list of size 'm' and 'n' respectively. The number of comparisons needed in the worst case by the merge sort algorithm will be

A. m $\times$ n
B. max(m, n)
C. min(m, n)
D. m+n-1

ugcnetcse-dec2013-paper2 algorithms merge-sort

Answer key

1.40.5 Merge Sort: UGC NET CSE | June 2014 | Part 2 | Question: 36

Mergesort makes two recursive calls. Which statement is true after these two recursive calls finish, but before the merge step ?

A. The array elements form a heap.
B. Elements in each half of the array are sorted amongst themselves.
C. Elements in the first half of the array are less than or equal to elements in second half of the array.

D. All of the above

ugcnetcse-june2014-paper2 algorithms sorting merge-sort

Answer key

1.40.6 Merge Sort: UGC NET CSE | November 2017 | Part 2 | Question: 24

A list of n strings, each of length n, is sorted into lexicographic order using merge - sort algorithm. The worst case running time of this computation is:

A. $O(n \log n)$ B. $O(n^2 \log n)$ C. $O(n^2 + \log n)$ D. $O(n^3)$

ugcnetcse-nov2017-paper2 sorting merge-sort time-complexity data-structures algorithm-design

1.41 Merging (2)

1.41.1 Merging: GATE CSE 1995 | Question: 1.16

For merging two sorted lists of sizes m and n into a sorted list of size $m+n$, we require comparisons of

A. $O(m)$ B. $O(n)$ C. $O(m+n)$ D. $O(\log m + \log n)$

gate1995 algorithms sorting normal merging

Answer key

1.41.2 Merging: GATE CSE 2014 Set 2 | Question: 38

Suppose P, Q, R, S, T are sorted sequences having lengths $20, 24, 30, 35, 50$ respectively. They are to be merged into a single sequence by merging together two sequences at a time. The number of comparisons that will be needed in the worst case by the optimal algorithm for doing this is ____.

gatecse-2014-set2 algorithms sorting normal numerical-answers merging

Answer key

1.42 Minimum Spanning Tree (40)

1.42.1 Minimum Spanning Tree: GATE CSE 1991 | Question: 03,vi

Kruskal's algorithm for finding a minimum spanning tree of a weighted graph G with n vertices and m edges has the time complexity of:

A. $O(n^2)$ B. $O(mn)$ C. $O(m+n)$ D. $O(m \log n)$
E. $O(m^2)$

gate1991 algorithms graph-algorithms minimum-spanning-tree time-complexity multiple-selects

Answer key

1.42.2 Minimum Spanning Tree: GATE CSE 1992 | Question: 01,ix

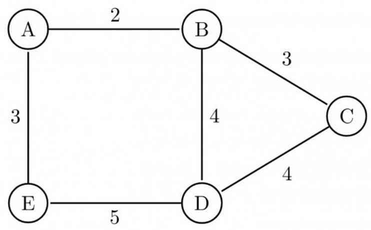
Complexity of Kruskal's algorithm for finding the minimum spanning tree of an undirected graph containing n vertices and m edges if the edges are sorted is _______

gate1992 minimum-spanning-tree algorithms time-complexity easy fill-in-the-blanks

Answer key

1.42.3 Minimum Spanning Tree: GATE CSE 1995 | Question: 22

How many minimum spanning trees does the following graph have? Draw them. (Weights are assigned to edges).



gate1995 algorithms graph-algorithms minimum-spanning-tree easy descriptive

Answer key

1.42.4 Minimum Spanning Tree: GATE CSE 1996 | Question: 16

A complete, undirected, weighted graph G is given on the vertex $\{0, 1, \ldots, n-1\}$ for any fixed 'n'. Draw the minimum spanning tree of G if

A. the weight of the edge (u, v) is $|u - v|$
B. the weight of the edge (u, v) is $u + v$

gate1996 algorithms graph-algorithms minimum-spanning-tree normal descriptive

Answer key

1.42.5 Minimum Spanning Tree: GATE CSE 1997 | Question: 9

Consider a graph whose vertices are points in the plane with integer co-ordinates (x, y) such that $1 \leq x \leq n$ and $1 \leq y \leq n$, where $n \geq 2$ is an integer. Two vertices (x_1, y_1) and (x_2, y_2) are adjacent iff $|x_1 - x_2 \mid \leq 1 \text{ and } \mid y_1 - y_2 \mid \leq 1$. The weight of an edge $\{(x_1, y_1), (x_2, y_2)\}$ is $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

A. What is the weight of a minimum weight-spanning tree in this graph? Write only the answer without any explanations.
B. What is the weight of a maximum weight-spanning tree in this graph? Write only the answer without any explanations.

gate1997 algorithms minimum-spanning-tree normal descriptive

Answer key

1.42.6 Minimum Spanning Tree: GATE CSE 2000 | Question: 2.18

Let G be an undirected connected graph with distinct edge weights. Let e_{max} be the edge with maximum weight and e_{min} the edge with minimum weight. Which of the following statements is false?

A. Every minimum spanning tree of G must contain e_{min}
B. If e_{max} is in a minimum spanning tree, then its removal must disconnect G
C. No minimum spanning tree contains e_{max}
D. G has a unique minimum spanning tree

gatecse-2000 algorithms minimum-spanning-tree normal

Answer key

1.42.7 Minimum Spanning Tree: GATE CSE 2001 | Question: 15

Consider a weighted undirected graph with vertex set $V = \{n1, n2, n3, n4, n5, n6\}$ and edge set $E = \{(n1, n2, 2), (n1, n3, 8), (n1, n6, 3), (n2, n4, 4), (n2, n5, 12), (n3, n4, 7), (n4, n5, 9), (n4, n6, 4)\}$.

The third value in each tuple represents the weight of the edge specified in the tuple.

A. List the edges of a minimum spanning tree of the graph.
B. How many distinct minimum spanning trees does this graph have?
C. Is the minimum among the edge weights of a minimum spanning tree unique over all possible minimum

spanning trees of a graph?

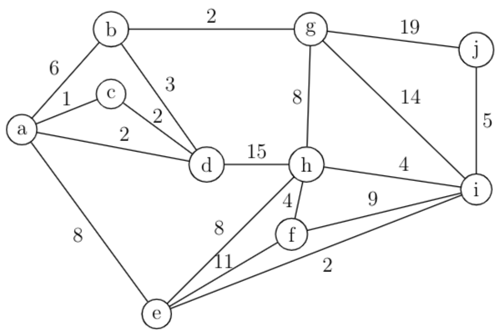
D. Is the maximum among the edge weights of a minimum spanning tree unique over all possible minimum spanning tree of a graph?

gatecse-2001 algorithms minimum-spanning-tree normal descriptive

Answer key

1.42.8 Minimum Spanning Tree: GATE CSE 2003 | Question: 68

What is the weight of a minimum spanning tree of the following graph?



A. 29 B. 31 C. 38 D. 41

gatecse-2003 algorithms minimum-spanning-tree normal

Answer key

1.42.9 Minimum Spanning Tree: GATE CSE 2005 | Question: 6

An undirected graph G has n nodes. its adjacency matrix is given by an $n \times n$ square matrix whose (i) diagonal elements are 0's and (ii) non-diagonal elements are 1's. Which one of the following is TRUE?

A. Graph G has no minimum spanning tree (MST)
B. Graph G has unique MST of cost $n-1$
C. Graph G has multiple distinct MSTs, each of cost $n-1$
D. Graph G has multiple spanning trees of different costs

gatecse-2005 algorithms minimum-spanning-tree normal

Answer key

1.42.10 Minimum Spanning Tree: GATE CSE 2006 | Question: 11

Consider a weighted complete graph G on the vertex set $\{v_1, v_2, \ldots\ldots v_n\}$ such that the weight of the edge (v_i, v_j) is $2|i-j|$. The weight of a minimum spanning tree of G is:

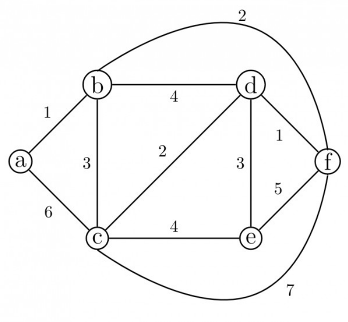
A. $n-1$ B. $2n-2$ C. $\binom{n}{2}$ D. n^2

gatecse-2006 algorithms minimum-spanning-tree normal

Answer key

1.42.11 Minimum Spanning Tree: GATE CSE 2006 | Question: 47

Consider the following graph:



Which one of the following cannot be the sequence of edges added, **in that order**, to a minimum spanning tree using Kruskal's algorithm?

A. $(a-b),(d-f),(b-f),(d-c),(d-e)$
B. $(a-b),(d-f),(d-c),(b-f),(d-e)$
C. $(d-f),(a-b),(d-c),(b-f),(d-e)$
D. $(d-f),(a-b),(b-f),(d-e),(d-c)$

gatecse-2006 algorithms graph-algorithms minimum-spanning-tree normal

Answer key

1.42.12 Minimum Spanning Tree: GATE CSE 2007 | Question: 49

Let w be the minimum weight among all edge weights in an undirected connected graph. Let e be a specific edge of weight w. Which of the following is FALSE?

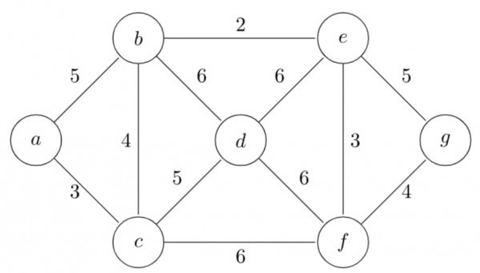
A. There is a minimum spanning tree containing e
B. If e is not in a minimum spanning tree T, then in the cycle formed by adding e to T, all edges have the same weight.
C. Every minimum spanning tree has an edge of weight w
D. e is present in every minimum spanning tree

gatecse-2007 algorithms minimum-spanning-tree normal

Answer key

1.42.13 Minimum Spanning Tree: GATE CSE 2009 | Question: 38

Consider the following graph:



Which one of the following is NOT the sequence of edges added to the minimum spanning tree using Kruskal's algorithm?

A. (b, e) (e, f) (a, c) (b, c) (f, g) (c, d)
B. (b, e) (e, f) (a, c) (f, g) (b, c) (c, d)
C. (b, e) (a, c) (e, f) (b, c) (f, g) (c, d)
D. (b, e) (e, f) (b, c) (a, c) (f, g) (c, d)

gatecse-2009 algorithms minimum-spanning-tree normal

Answer key

1.42.14 Minimum Spanning Tree: GATE CSE 2010 | Question: 50

Consider a complete undirected graph with vertex set $\{0,1,2,3,4\}$. Entry W_{ij} in the matrix W below is the weight of the edge $\{i,j\}$

$$W = \begin{pmatrix} 0 & 1 & 8 & 1 & 4 \\ 1 & 0 & 12 & 4 & 9 \\ 8 & 12 & 0 & 7 & 3 \\ 1 & 4 & 7 & 0 & 2 \\ 4 & 9 & 3 & 2 & 0 \end{pmatrix}$$

What is the minimum possible weight of a spanning tree T in this graph such that vertex 0 is a leaf node in the tree T?

A. 7 B. 8 C. 9 D. 10

gatecse-2010 algorithms minimum-spanning-tree normal

Answer key

1.42.15 Minimum Spanning Tree: GATE CSE 2010 | Question: 51

Consider a complete undirected graph with vertex set $\{0,1,2,3,4\}$. Entry W_{ij} in the matrix W below is the weight of the edge $\{i,j\}$

$$W = \begin{pmatrix} 0 & 1 & 8 & 1 & 4 \\ 1 & 0 & 12 & 4 & 9 \\ 8 & 12 & 0 & 7 & 3 \\ 1 & 4 & 7 & 0 & 2 \\ 4 & 9 & 3 & 2 & 0 \end{pmatrix}$$

What is the minimum possible weight of a path P from vertex 1 to vertex 2 in this graph such that P contains at most 3 edges?

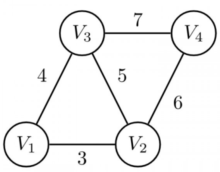
A. 7 B. 8 C. 9 D. 10

gatecse-2010 normal algorithms minimum-spanning-tree

Answer key

1.42.16 Minimum Spanning Tree: GATE CSE 2011 | Question: 54

An undirected graph $G(V,E)$ contains $n\ (n>2)$ nodes named $v_1,v_2,\ldots,v_n$. Two nodes v_i,v_j are connected if and only if $0<\mid i-j\mid\leq 2$. Each edge (v_i,v_j) is assigned a weight $i+j$. A sample graph with $n=4$ is shown below.



What will be the cost of the minimum spanning tree (MST) of such a graph with n nodes?

A. $\frac{1}{12}(11n^2-5n)$ B. n^2-n+1 C. $6n-11$ D. $2n+1$

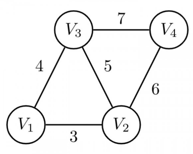
gatecse-2011 algorithms graph-algorithms minimum-spanning-tree normal

Answer key

1.42.17 Minimum Spanning Tree: GATE CSE 2011 | Question: 55

An undirected graph $G(V,E)$ contains $n\ (n>2)$ nodes named $v_1,v_2,\ldots,v_n$. Two nodes v_i,v_j are connected if and only if $0<\mid i-j\mid\leq 2$. Each edge (v_i,v_j) is assigned a weight $i+j$. A sample graph with

$n = 4$ is shown below.



The length of the path from v_5 to v_6 in the MST of previous question with $n = 10$ is

A. 11 B. 25 C. 31 D. 41

gatecse-2011 algorithms graph-algorithms minimum-spanning-tree normal

Answer key☟

1.42.18 Minimum Spanning Tree: GATE CSE 2012 | Question: 29

Let G be a weighted graph with edge weights greater than one and G' be the graph constructed by squaring the weights of edges in G. Let T and T' be the minimum spanning trees of G and G', respectively, with total weights t and t'. Which of the following statements is **TRUE**?

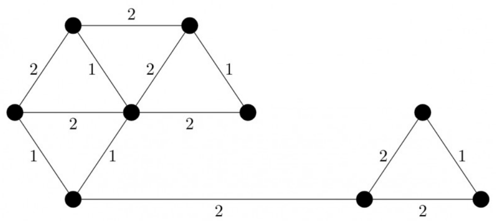
A. $T' = T$ with total weight $t' = t^2$
B. $T' = T$ with total weight $t' < t^2$
C. $T' \neq T$ but total weight $t' = t^2$
D. None of the above

gatecse-2012 algorithms minimum-spanning-tree normal marks-to-all

Answer key☟

1.42.19 Minimum Spanning Tree: GATE CSE 2014 Set 2 | Question: 52

The number of distinct minimum spanning trees for the weighted graph below is ______

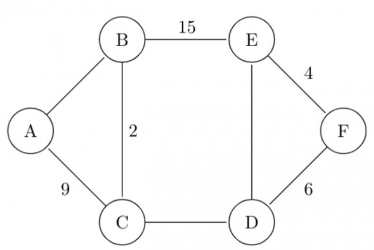


gatecse-2014-set2 algorithms minimum-spanning-tree numerical-answers normal

Answer key☟

1.42.20 Minimum Spanning Tree: GATE CSE 2015 Set 1 | Question: 43

The graph shown below has 8 edges with distinct integer edge weights. The minimum spanning tree (**MST**) is of weight 36 and contains the edges: $\{(A, C), (B, C), (B, E), (E, F), (D, F)\}$. The edge weights of only those edges which are in the **MST** are given in the figure shown below. The minimum possible sum of weights of all 8 edges of this graph is_______________.



gatecse-2015-set1 algorithms minimum-spanning-tree normal numerical-answers

Answer key☟

1.42.21 Minimum Spanning Tree: GATE CSE 2015 Set 3 | Question: 40

Let G be a connected undirected graph of 100 vertices and 300 edges. The weight of a minimum spanning tree of G is 500. When the weight of each edge of G is increased by five, the weight of a minimum spanning tree becomes ______.

gatecse-2015-set3 algorithms minimum-spanning-tree easy numerical-answers

Answer key

1.42.22 Minimum Spanning Tree: GATE CSE 2016 Set 1 | Question: 14

Let G be a weighted connected undirected graph with distinct positive edge weights. If every edge weight is increased by the same value, then which of the following statements is/are TRUE?

- P: Minimum spanning tree of G does not change.
- Q: Shortest path between any pair of vertices does not change.

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

gatecse-2016-set1 algorithms minimum-spanning-tree normal

Answer key

1.42.23 Minimum Spanning Tree: GATE CSE 2016 Set 1 | Question: 39

Let G be a complete undirected graph on 4 vertices, having 6 edges with weights being $1, 2, 3, 4, 5,$ and 6. The maximum possible weight that a minimum weight spanning tree of G can have is __________

gatecse-2016-set1 algorithms minimum-spanning-tree normal numerical-answers

Answer key

1.42.24 Minimum Spanning Tree: GATE CSE 2016 Set 1 | Question: 40

$G = (V, E)$ is an undirected simple graph in which each edge has a distinct weight, and e is a particular edge of G. Which of the following statements about the minimum spanning trees $(MSTs)$ of G is/are TRUE?

I. If e is the lightest edge of some cycle in G, then every MST of G includes e.
II. If e is the heaviest edge of some cycle in G, then every MST of G excludes e.

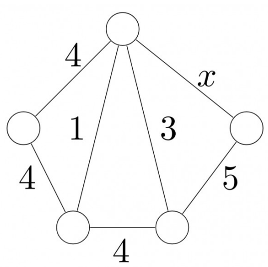
A. I only.
B. II only.
C. Both I and II.
D. Neither I nor II.

gatecse-2016-set1 algorithms minimum-spanning-tree normal

Answer key

1.42.25 Minimum Spanning Tree: GATE CSE 2018 | Question: 47

Consider the following undirected graph G:



Choose a value for x that will maximize the number of minimum weight spanning trees (MWSTs) of G. The number of MWSTs of G for this value of x is ____.

gatecse-2018 algorithms graph-algorithms minimum-spanning-tree numerical-answers two-marks

Answer key

1.42.26 Minimum Spanning Tree: GATE CSE 2020 | Question: 31

Let $G = (V, E)$ be a weighted undirected graph and let T be a Minimum Spanning Tree (MST) of G

maintained using adjacency lists. Suppose a new weighed edge $(u, v) \in V \times V$ is added to G. The worst case time complexity of determining if T is still an MST of the resultant graph is

A. $\Theta(|E| + |V|)$
B. $\Theta(|E||V|)$
C. $\Theta(E|\log|V|)$
D. $\Theta(|V|)$

gatecse-2020 algorithms minimum-spanning-tree graph-algorithms two-marks

Answer key☟

1.42.27 Minimum Spanning Tree: GATE CSE 2020 | Question: 49

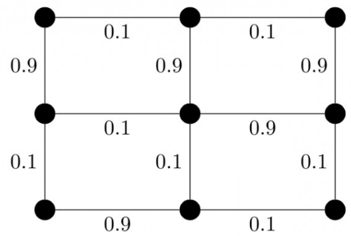
Consider a graph $G = (V, E)$, where $V = \{v_1, v_2, \ldots, v_{100}\}$, $E = \{(v_i, v_j) \mid 1 \leq i < j \leq 100\}$, and weight of the edge (v_i, v_j) is $|i - j|$. The weight of minimum spanning tree of G is ________

gatecse-2020 numerical-answers algorithms graph-algorithms two-marks minimum-spanning-tree

Answer key☟

1.42.28 Minimum Spanning Tree: GATE CSE 2021 Set 1 | Question: 17

Consider the following undirected graph with edge weights as shown:



The number of minimum-weight spanning trees of the graph is __________.

gatecse-2021-set1 algorithms graph-algorithms minimum-spanning-tree numerical-answers one-mark

Answer key☟

1.42.29 Minimum Spanning Tree: GATE CSE 2021 Set 2 | Question: 1

Let G be a connected undirected weighted graph. Consider the following two statements.

- S_1: There exists a minimum weight edge in G which is present in every minimum spanning tree of G.
- S_2: If every edge in G has distinct weight, then G has a unique minimum spanning tree.

Which one of the following options is correct?

A. Both S_1 and S_2 are true
B. S_1 is true and S_2 is false
C. S_1 is false and S_2 is true
D. Both S_1 and S_2 are false

gatecse-2021-set2 algorithms graph-algorithms minimum-spanning-tree one-mark

Answer key☟

1.42.30 Minimum Spanning Tree: GATE CSE 2022 | Question: 39

Consider a simple undirected weighted graph G, all of whose edge weights are distinct. Which of the following statements about the minimum spanning trees of G is/are TRUE?

A. The edge with the second smallest weight is always part of any minimum spanning tree of G.
B. One or both of the edges with the third smallest and the fourth smallest weights are part of any minimum spanning tree of G.
C. Suppose $S \subseteq V$ be such that $S \neq \phi$ and $S \neq V$. Consider the edge with the minimum weight such that one of its vertices is in S and the other in $V \setminus S$. Such an edge will always be part of any minimum spanning tree of G.
D. G can have multiple minimum spanning trees.

gatecse-2022 algorithms minimum-spanning-tree multiple-selects two-marks

Answer key☟

1.42.31 Minimum Spanning Tree: GATE CSE 2022 | Question: 48

Let $G(V,E)$ be a directed graph, where $V = \{1,2,3,4,5\}$ is the set of vertices and E is the set of directed edges, as defined by the following adjacency matrix A.

$$A[i][j] = \begin{cases} 1, & 1 \leq j \leq i \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

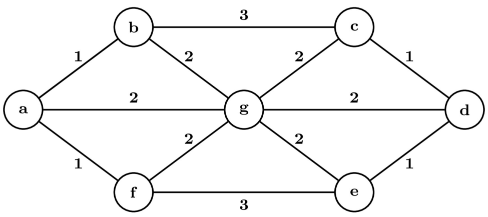
$A[i][j] = 1$ indicates a directed edge from node i to node j. A $\textit{directed spanning tree}$ of G, rooted at $r \in V$, is defined as a subgraph T of G such that the undirected version of T is a tree, and T contains a directed path from r to every other vertex in V. The number of such directed spanning trees rooted at vertex 5 is ________________.

gatecse-2022 numerical-answers algorithms minimum-spanning-tree two-marks

Answer key

1.42.32 Minimum Spanning Tree: GATE CSE 2024 | Set 2 | Question: 49

The number of distinct minimum-weight spanning trees of the following graph is

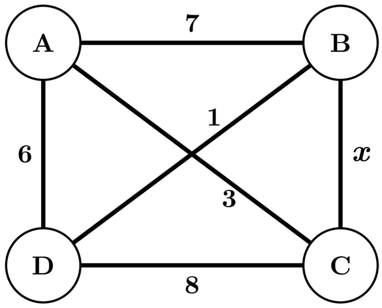


gatecse2024-set2 numerical-answers algorithms minimum-spanning-tree two-marks

Answer key

1.42.33 Minimum Spanning Tree: GATE CSE 2025 | Set 1 | Question: 54

The maximum value of x such that the edge between the nodes B and C is included in every minimum spanning tree of the given graph is _________. (answer in integer)



gatecse2025-set1 algorithms minimum-spanning-tree numerical-answers easy two-marks

Answer key

1.42.34 Minimum Spanning Tree: GATE IT 2005 | Question: 52

Let G be a weighted undirected graph and e be an edge with maximum weight in G. Suppose there is a minimum weight spanning tree in G containing the edge e. Which of the following statements is always TRUE?

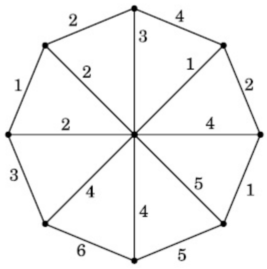
A. There exists a cutset in G having all edges of maximum weight.
B. There exists a cycle in G having all edges of maximum weight.
C. Edge e cannot be contained in a cycle.
D. All edges in G have the same weight.

gateit-2005 algorithms minimum-spanning-tree normal

Answer key☟

1.42.35 Minimum Spanning Tree: UGC NET CSE | December 2018 | Part 2 | Question: 12

Consider the graph shown below:



Use Kruskal's algorithm to find the minimum spanning tree of the graph. The weight of this minimum spanning tree is

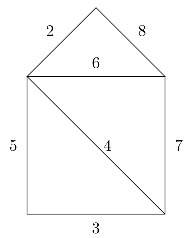
A. 17 B. 14 C. 16 D. 13

ugcnetcse-dec2018-paper2 algorithms minimum-spanning-tree

Answer key☟

1.42.36 Minimum Spanning Tree: UGC NET CSE | December 2019 | Part 2 | Question: 6

The weight of minimum spanning tree in graph G, calculated using Kruskal's algorithm is:



Graph G

A. 14 B. 15 C. 17 D. 18

ugcnetcse-dec2019-paper2 algorithms minimum-spanning-tree

Answer key☟

1.42.37 Minimum Spanning Tree: UGC NET CSE | November 2017 | Part 2 | Question: 23

Let G be an undirected connected graph with distinct edge weight. Let $E_{\max}$ be the edge with maximum weight and $E_{\min}$ the edge with minimum weight. Which of the following statements is false?

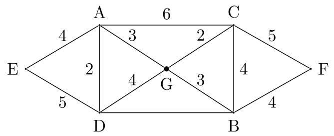
A. Every minimum spanning tree of G must contain $E_{\min}$
B. If $E_{\max}$ is in minimum spanning tree, then its removal must disconnect G
C. No minimum spanning tree contains $E_{\max}$
D. G has a unique minimum spanning tree

ugcnetcse-nov2017-paper2 graph-algorithms minimum-spanning-tree

Answer key☟

1.42.38 Minimum Spanning Tree: UGC NET CSE | November 2017 | Part 2 | Question: 5

Consider the graph given below:



Use Kruskal's algorithm to find a minimal spanning tree for the graph. The List of the edges of the tree in the order in which they are chosen is

A. AD, AE, AG, GC, GB, BF
B. GC, GB, BF, GA, AD, AE
C. GC, AD, GB, GA, BF, AE
D. AD, AG, GC, AE, GB, BF

ugcnetcse-nov2017-paper2 graph-algorithms minimum-spanning-tree

Answer key

1.42.39 Minimum Spanning Tree: UGC NET CSE | November 2017 | Part 3 | Question: 36

An undirected graph $G(V, E)$ contains $n(n > 2)$ nodes named $v_1, v_2, \ldots, v_n$. Two nodes v_i and v_j are connected if and only if $0 <| i - j | \leq 2$. Each edge (v_i, v_j) is assigned a weight $i + j$. The cost of the minimum spanning tree of such a graph with 10 nodes is

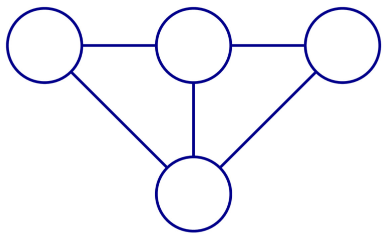
A. 88
B. 91
C. 49
D. 21

ugcnetcse-nov2017-paper3 graph-algorithms minimum-spanning-tree

Answer key

1.42.40 Minimum Spanning Tree: UGCNET CSE December 2022: 28

Consider the Graph below:



How many spanning trees can be found?

A. 10
B. 5
C. 9
D. 8

ugcnetcse-dec2022 algorithms minimum-spanning-tree graph-algorithms

Answer key

1.43 Modular Arithmetic (1)

1.43.1 Modular Arithmetic: UGC NET CSE | December 2019 | Part 2 | Question: 35

Let $a^{2c} \bmod n = (a^c)^2 \bmod n$ and $a^{2c+1} \bmod n = a \cdot (a^c)^2 \bmod n$. For $a = 7,\ b = 17$ and $n = 561$, What is the value of $a^b \pmod n$?

A. 160
B. 166
C. 157
D. 67

ugcnetcse-dec2019-paper2 data-structures modular-arithmetic number-theory

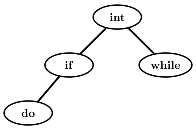
Answer key

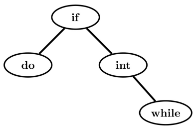
1.44 Optimal Search Tree (1)

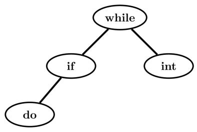
1.44.1 Optimal Search Tree: UGC NET CSE | December 2015 | Part 3 | Question: 21

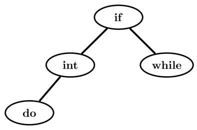
Let $n = 4$ and (a_1, a_2, a_3, a_4)=(do, if, int, while). Let $p(1:4) = \left(\frac{3}{8}, \frac{3}{8}, \frac{1}{8}, \frac{1}{8}\right)$ and

$q(1:4) = \left(\frac{2}{8}, \frac{3}{8}, \frac{1}{8}, \frac{1}{8}, \frac{1}{8}\right)$ where $p(i)$ and $q(i)$ denotes the probability with which we search a_i and the identifier x being searched satisfy $a_i < x < a_{i+1}$ respectively. The optimal search tree is given by:

A. 

B. 

C. 

D. 

ugcnetcse-dec2015-paper3 algorithms optimal-search-tree

Answer key

1.45 Optimal Solution (1)

1.45.1 Optimal Solution: UGC NET CSE | June 2019 | Part 2 | Question: 68

Consider the following steps:

S_1: Characterize the structure of an optimal solution

S_2: Compute the value of an optimal solution in bottom-up fashion

Which of the following step(s) is/are common to both dynamic programming and greedy algorithms?

A. Only S_1 B. Only S_2 C. Both S_1 and S_2 D. Neither S_1 nor S_2

ugcnetcse-june2019-paper2 optimal-solution dynamic-programming greedy-algorithms

Answer key

1.46 Out of Gatecse Syllabus (1)

1.46.1 Out of Gatecse Syllabus: GATE CSE 1987 | Question: 11c

The relative costs of assigning jobs J_1, J_2 and J_3 to machines M_1, M_2 and M_3 are given below:

JOBS	**Machines**		
	M_1	M_2	M_3
J_1	25	32	35
J_2	15	23	21
J_3	19	21	17

Using the assignment method find the assignment involving minimum cost. Is this an optimal assignment?

gate1987 algorithms descriptive out-of-gatecse-syllabus

Answer key

1.47 P NP NPC NPH (10)

1.47.1 P NP NPC NPH: GATE CSE 1992 | Question: 02,vi

Which of the following problems is not NP-hard?

a. Hamiltonian circuit problem
b. The $0/1$ Knapsack problem
c. Finding bi-connected components of a graph
d. The graph coloring problem

gate1992 p-np-npc-nph algorithms multiple-selects out-of-gatecse-syllabus

Answer key☟

1.47.2 P NP NPC NPH: GATE CSE 2003 | Question: 12

Ram and Shyam have been asked to show that a certain problem Π is NP-complete. Ram shows a polynomial time reduction from the 3-SAT problem to Π, and Shyam shows a polynomial time reduction from Π to 3-SAT. Which of the following can be inferred from these reductions?

A. Π is NP-hard but not NP-complete
B. Π is in NP, but is not NP-complete
C. Π is NP-complete
D. Π is neither NP-hard, nor in NP

gatecse-2003 algorithms p-np-npc-nph normal out-of-gatecse-syllabus

Answer key☟

1.47.3 P NP NPC NPH: GATE CSE 2004 | Question: 30, ISRO2017-10

The problem 3-SAT and 2-SAT are

A. both in P
B. both NP complete
C. NP-complete and in P respectively
D. undecidable and NP complete respectively

gatecse-2004 algorithms p-np-npc-nph easy isro2017 out-of-gatecse-syllabus

Answer key☟

1.47.4 P NP NPC NPH: GATE CSE 2006 | Question: 16, ISRO-DEC2017-27

Let S be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to S and S is polynomial-time reducible to R. Which one of the following statements is true?

A. R is NP-complete
B. R is NP-hard
C. Q is NP-complete
D. Q is NP-hard

gatecse-2006 algorithms p-np-npc-nph normal isrodec2017 out-of-gatecse-syllabus

Answer key☟

1.47.5 P NP NPC NPH: GATE CSE 2008 | Question: 44

The subset-sum problem is defined as follows: Given a set S of n positive integers and a positive integer W, determine whether there is a subset of S whose elements sum to W. An algorithm Q solves this problem in $O(nW)$ time. Which of the following statements is false?

A. Q solves the subset-sum problem in polynomial time when the input is encoded in unary
B. Q solves the subset-sum problem in polynomial time when the input is encoded in binary
C. The subset sum problem belongs to the class NP
D. The subset sum problem is NP-hard

gatecse-2008 algorithms p-np-npc-nph normal out-of-gatecse-syllabus

Answer key☟

1.47.6 P NP NPC NPH: GATE IT 2006 | Question: 10

A problem in NP is NP-complete if

A. it can be reduced to the 3-SAT problem in polynomial time
B. the 3-SAT problem can be reduced to it in polynomial time

C. it can be reduced to any other problem in NP in polynomial time
D. some problem in NP can be reduced to it in polynomial time

gateit-2006 algorithms p-np-npc-nph easy out-of-syllabus-now

Answer key

1.47.7 P NP NPC NPH: GATE IT 2008 | Question: 11

For problems X and Y, Y is NP-complete and X reduces to Y in polynomial time. Which of the following is TRUE?

A. If X can be solved in polynomial time, then so can Y
B. X is NP-complete
C. X is NP-hard
D. X is in NP, but not necessarily NP-complete

gateit-2008 algorithms p-np-npc-nph normal out-of-syllabus-now

Answer key

1.47.8 P NP NPC NPH: UGC NET CSE | December 2014 | Part 3 | Question: 33

We can show that the clique problem is NP-hard by proving that

A. CLIQUE $\leq$ P 3-CNF_SAT
B. CLIQUE $\leq$ P VERTEX_COVER
C. CLIQUE $\leq$ P SUBSET_SUM
D. None of the above

ugcnetcse-dec2014-paper3 algorithms p-np-npc-nph

Answer key

1.47.9 P NP NPC NPH: UGC NET CSE | June 2019 | Part 2 | Question: 67

Consider the complexity class $CO-NP$ as the set of languages L such that $\overline{L} \in NP$, and the following two statements:

$S_1: \; P \subseteq CO-NP$

$S_2: \; \text{If } NP \neq CO-NP, \text{ then } P \neq NP$

Which of the following is/are correct?

A. Only S_1
B. Only S_2
C. Both S_1 and S_2
D. Neither S_1 nor S_2

ugcnetcse-june2019-paper2 p-np-npc-nph

Answer key

1.47.10 P NP NPC NPH: UGC NET CSE | Junet 2015 | Part 3 | Question: 32

The travelling salesman problem can be solved in

A. Polynomial time using dynamic programming algorithm
B. Polynomial time using branch-and-bound algorithm
C. Exponential time using dynamic programming algorithm or branch-and-bound algorithm
D. Polynomial time using back tracking algorithm

algorithms p-np-npc-nph ugcnetcse-june2015-paper3

Answer key

1.48 Page Replacement (1)

1.48.1 Page Replacement: UGC NET CSE | November 2017 | Part 3 | Question: 50

Consider a virtual page reference string $7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1$. Suppose a demand paged virtual memory system running on a computer system such that the main memory has 3 page frames. Then ______ page replacement algorithm has minimum number of page faults.

A. FIFO
B. LIFO
C. LRU
D. Optimal

ugcnetcse-nov2017-paper3 operating-system page-replacement

Answer key

1.49 Parallel Algorithms (2)

1.49.1 Parallel Algorithms: UGC NET CSE | December 2007 | Part 2 | Question: 46

Given a parallel algorithm A with computation time t, if parallel algorithm A performs m computational operation, then p processors can execute algorithm A in time given by :

A. t/p B. mt/p C. $t+(m-t)/p$ D. $(m-t)/p$

ugcnetcse-dec2007-paper2 parallel-algorithms

1.49.2 Parallel Algorithms: UGC NET CSE | December 2019 | Part 2 | Question: 75

The following multithreaded algorithm computes transpose of a matrix in parallel:

p Trans (X, Y, N)

if $N=1$

then $Y[1,1] \leftarrow X[1,1]$

else partition X into four $(N/2)\times(N/2)$ submatrices $X_{11}, X_{12}, X_{21}, X_{22}$

partition Y into four $(N/2)\times(N/2)$ submatrices $Y_{11}, Y_{12}, Y_{21}, Y_{22}$

spawn p Trans $X_{11}, Y_{11}, N/2)$

spawn p Trans $X_{12}, Y_{12}, N/2)$

spawn p Trans $X_{21}, Y_{21}, N/2)$

spawn p Trans $X_{22}, Y_{22}, N/2)$

What is the asymptotic parallelism of the algorithm?

A. T_1/T_∞ or $\theta(N^2/\lg N)$
B. T_1/T_∞ or $\theta(N/\lg N)$
C. T_1/T_∞ or $\theta(\lg N/N^2)$
D. T_1/T_∞ or $\theta(\lg N/N)$

ugcnetcse-dec2019-paper2 asymptotic-notations algorithm-design parallel-algorithms matrix

Answer key

1.50 Polynomials (1)

1.50.1 Polynomials: UGC NET CSE | June 2023 | Part 2: 67

Match **List I** with **List II**

List I	**List II**
A. Parallel FFT	I. $\theta\left(n^2\right)$
B. Iterative FFT	II. $\theta(n)$
C. Evaluation of polynomial at n points by Horner method	III. $\theta(\lg n)$
D. Product of two polynomials that are represented in point value form	IV. $\theta(n \lg n)$

Choose the correct answer from the options given below:

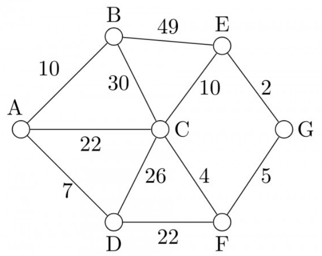
A. A-III B-I C-II D-III
B. A-II B-I C-III D-IV
C. A-III B-IV C-I D-II
D. A-II B-III C-IV D-I

ugcnetcse-june2023-paper2 time-complexity algorithm-design polynomials

1.51 Prims Algorithm (3)

1.51.1 Prims Algorithm: GATE IT 2004 | Question: 56

Consider the undirected graph below:



Using Prim's algorithm to construct a minimum spanning tree starting with node A, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?

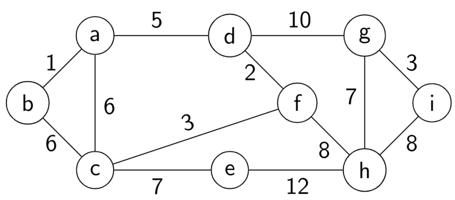
A. $(\mathrm{E, G}), (\mathrm{C, F}), (\mathrm{F, G}), (\mathrm{A, D}), (\mathrm{A, B}), (\mathrm{A, C})$
B. $(\mathrm{A, D}), (\mathrm{A, B}), (\mathrm{A, C}), (\mathrm{C, F}), (\mathrm{G, E}), (\mathrm{F, G})$
C. $(\mathrm{A, B}), (\mathrm{A, D}), (\mathrm{D, F}), (\mathrm{F, G}), (\mathrm{G, E}), (\mathrm{F, C})$
D. $(\mathrm{A, D}), (\mathrm{A, B}), (\mathrm{D, F}), (\mathrm{F, C}), (\mathrm{F, G}), (\mathrm{G, E})$

gateit-2004 algorithms graph-algorithms normal prims-algorithm

Answer key☟

1.51.2 Prims Algorithm: GATE IT 2008 | Question: 45

For the undirected, weighted graph given below, which of the following sequences of edges represents a correct execution of Prim's algorithm to construct a Minimum Spanning Tree?



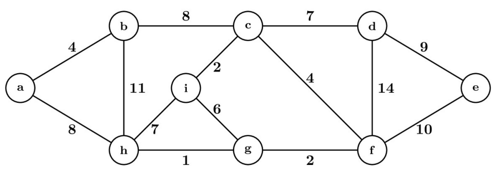
A. $(\mathrm{a, b}), (\mathrm{d, f}), (\mathrm{f, c}), (\mathrm{g, i}), (\mathrm{d, a}), (\mathrm{g, h}), (\mathrm{c, e}), (\mathrm{f, h})$
B. $(\mathrm{c, e}), (\mathrm{c, f}), (\mathrm{f, d}), (\mathrm{d, a}), (\mathrm{a, b}), (\mathrm{g, h}), (\mathrm{h, f}), (\mathrm{g, i})$
C. $(\mathrm{d, f}), (\mathrm{f, c}), (\mathrm{d, a}), (\mathrm{a, b}), (\mathrm{c, e}), (\mathrm{f, h}), (\mathrm{g, h}), (\mathrm{g, i})$
D. $(\mathrm{h, g}), (\mathrm{g, i}), (\mathrm{h, f}), (\mathrm{f, c}), (\mathrm{f, d}), (\mathrm{d, a}), (\mathrm{a, b}), (\mathrm{c, e})$

gateit-2008 algorithms graph-algorithms minimum-spanning-tree normal prims-algorithm

Answer key☟

1.51.3 Prims Algorithm: UGC NET CSE | October 2020 | Part 2 | Question: 78

Consider the undirected graph below:



Using Prim’s algorithm to construct a minimum spanning tree starting with node$a$, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?

A. $(a,b),(a,h),(g,h),(f,g),(c,f),(c,i),(c,d),(d,e)$
B. $(a,b),(b,h),(g,h),(g,i),(c,i),(c,f),(c,d),(d,e)$
C. $(a,b),(b,c),(c,i),(c,f),(f,g),(g,h),(c,d),(d,e)$
D. $(a,b),(g,h),(g,f),(c,f),(c,i),(f,e),(b,c),(d,e)$

prims-algorithm algorithms minimum-spanning-tree ugcnetcse-oct2020-paper2

Answer key

1.52 Priority Queue (1)

1.52.1 Priority Queue: UGC NET CSE | December 2019 | Part 2 | Question: 37

What is the worst case running time of Insert and Extract-min, in an implementation of a priority queue using an unsorted array? Assume that all the insertions can be accomodated.

A. $\theta(1),\theta(n)$
B. $\theta(n),\theta(1)$
C. $\theta(1),\theta(1)$
D. $\theta(n),\theta(n)$

ugcnetcse-dec2019-paper2 data-structures priority-queue time-complexity

Answer key

1.53 Quick Sort (15)

1.53.1 Quick Sort: GATE CSE 1987 | Question: 1-xviii

Let P be a quicksort program to sort numbers in ascending order. Let t_1 and t_2 be the time taken by the program for the inputs $[1\ 2\ 3\ 4]$ and $[5\ 4\ 3\ 2\ 1]$, respectively. Which of the following holds?

A. $t_1 = t_2$
B. $t_1 > t_2$
C. $t_1 < t_2$
D. $t_1 = t_2 + 5 \log 5$

gate1987 algorithms sorting quick-sort

Answer key

1.53.2 Quick Sort: GATE CSE 1989 | Question: 9

An input files has 10 records with keys as given below:

$$25 \quad 7 \quad 34 \quad 2 \quad 70 \quad 9 \quad 61 \quad 16 \quad 49 \quad 19$$

This is to be sorted in non-decreasing order.

i. Sort the input file using QUICKSORT by correctly positioning the first element of the file/subfile. Show the subfiles obtained at all intermediate steps. Use square brackets to demarcate subfiles.
ii. Sort the input file using 2-way- MERGESORT showing all major intermediate steps. Use square brackets to demarcate subfiles.

gate1989 descriptive algorithms sorting quick-sort

Answer key

1.53.3 Quick Sort: GATE CSE 1992 | Question: 03,iv

Assume that the last element of the set is used as partition element in Quicksort. If n distinct elements from the set $[1 \dots n]$ are to be sorted, give an input for which Quicksort takes maximum time.

gate1992 algorithms sorting easy quick-sort descriptive

Answer key

1.53.4 Quick Sort: GATE CSE 1996 | Question: 2.15

Quick-sort is run on two inputs shown below to sort in ascending order taking first element as pivot

i. $1, 2, 3, \dots n$

ii. $n, n-1, n-2, \dots, 2, 1$

Let C_1 and C_2 be the number of comparisons made for the inputs (i) and (ii) respectively. Then,

A. $C_1 < C_2$
B. $C_1 > C_2$
C. $C_1 = C_2$
D. we cannot say anything for arbitrary n

gate1996 algorithms sorting normal quick-sort

Answer key

1.53.5 Quick Sort: GATE CSE 2001 | Question: 1.14

Randomized quicksort is an extension of quicksort where the pivot is chosen randomly. What is the worst case complexity of sorting n numbers using Randomized quicksort?

A. $O(n)$
B. $O(n \log n)$
C. $O(n^2)$
D. $O(n!)$

gatecse-2001 algorithms sorting time-complexity easy quick-sort

Answer key

1.53.6 Quick Sort: GATE CSE 2006 | Question: 52

The median of n elements can be found in $O(n)$ time. Which one of the following is correct about the complexity of quick sort, in which median is selected as pivot?

A. $\Theta(n)$
B. $\Theta(n \log n)$
C. $\Theta(n^2)$
D. $\Theta(n^3)$

gatecse-2006 algorithms sorting easy quick-sort

Answer key

1.53.7 Quick Sort: GATE CSE 2008 | Question: 43

Consider the Quicksort algorithm. Suppose there is a procedure for finding a pivot element which splits the list into two sub-lists each of which contains at least one-fifth of the elements. Let $T(n)$ be the number of comparisons required to sort n elements. Then

A. $T(n) \leq 2T(n/5) + n$
B. $T(n) \leq T(n/5) + T(4n/5) + n$
C. $T(n) \leq 2T(4n/5) + n$
D. $T(n) \leq 2T(n/2) + n$

gatecse-2008 algorithms sorting easy quick-sort

Answer key

1.53.8 Quick Sort: GATE CSE 2009 | Question: 39

In quick-sort, for sorting n elements, the $(n/4)^{th}$ smallest element is selected as pivot using an $O(n)$ time algorithm. What is the worst case time complexity of the quick sort?

A. $\Theta(n)$
B. $\Theta(n \log n)$
C. $\Theta(n^2)$
D. $\Theta(n^2 \log n)$

gatecse-2009 algorithms sorting normal quick-sort

Answer key

1.53.9 Quick Sort: GATE CSE 2014 Set 1 | Question: 14

Let P be quicksort program to sort numbers in ascending order using the first element as the pivot. Let t_1 and t_2 be the number of comparisons made by P for the inputs $[1\ 2\ 3\ 4\ 5]$ and $[4\ 1\ 5\ 3\ 2]$ respectively. Which one of the following holds?

A. $t_1 = 5$
B. $t_1 < t_2$
C. $t_1 > t_2$
D. $t_1 = t_2$

gatecse-2014-set1 algorithms sorting easy quick-sort

Answer key

1.53.10 Quick Sort: GATE CSE 2014 Set 3 | Question: 14

You have an array of n elements. Suppose you implement quicksort by always choosing the central element of the array as the pivot. Then the tightest upper bound for the worst case performance is

A. $O(n^2)$ B. $O(n \log n)$ C. $\Theta(n \log n)$ D. $O(n^3)$

gatecse-2014-set3 algorithms sorting easy quick-sort

Answer key

1.53.11 Quick Sort: GATE CSE 2015 Set 1 | Question: 2

Which one of the following is the recurrence equation for the worst case time complexity of the quick sort algorithm for sorting $n\ (\geq 2)$ numbers? In the recurrence equations given in the options below, c is a constant.

A. $T(n) = 2T(n/2) + cn$
B. $T(n) = T(n-1) + T(1) + cn$
C. $T(n) = 2T(n-1) + cn$
D. $T(n) = T(n/2) + cn$

gatecse-2015-set1 algorithms recurrence-relation sorting easy quick-sort

Answer key

1.53.12 Quick Sort: GATE CSE 2015 Set 2 | Question: 45

Suppose you are provided with the following function declaration in the C programming language.

```
int partition(int a[], int n);
```

The function treats the first element of $a[\,]$ as a pivot and rearranges the array so that all elements less than or equal to the pivot is in the left part of the array, and all elements greater than the pivot is in the right part. In addition, it moves the pivot so that the pivot is the last element of the left part. The return value is the number of elements in the left part.

The following partially given function in the C programming language is used to find the k^{th} smallest element in an array $a[\,]$ of size n using the partition function. We assume $k \leq n$.

```
int kth_smallest (int a[], int n, int k)
{
   int left_end = partition (a, n);
   if (left_end+1==k) {
      return a[left_end];
   }
   if (left_end+1 > k) {
      return kth_smallest (___________);
   } else {
      return kth_smallest (___________);
   }
}
```

The missing arguments lists are respectively

A. $(a,$ left_end$, k)$ and $(a+$left_end$+1, n-$left_end$-1, k-$left_end$-1)$
B. $(a,$ left_end$, k)$ and $(a, n-$left_end$-1, k-$left_end$-1)$
C. $(a+$left_end$+1, n-$left_end$-1, k-$left_end$-1)$ and $(a,$ left_end$, k)$
D. $(a, n-$left_end$-1, k-$left_end$-1)$ and $(a,$left_end$, k)$

gatecse-2015-set2 algorithms normal sorting quick-sort

Answer key

1.53.13 Quick Sort: GATE CSE 2019 | Question: 20

An array of 25 distinct elements is to be sorted using quicksort. Assume that the pivot element is chosen uniformly at random. The probability that the pivot element gets placed in the worst possible location in the first round of partitioning (rounded off to 2 decimal places) is ________

gatecse-2019 numerical-answers algorithms quick-sort probability one-mark

Answer key

1.53.14 Quick Sort: GATE DS&AI 2024 | Question: 20

Consider sorting the following array of integers in ascending order using an inplace Quicksort algorithm that uses the last element as the pivot.

60	70	80	90	100

The minimum number of swaps performed during this Quicksort is ________.

gate-ds-ai-2024 numerical-answers algorithms quick-sort one-mark

Answer key☟

1.53.15 Quick Sort: UGC NET CSE | June 2014 | Part 3 | Question: 66

Suppose that the splits at every level of quicksort are in the proportion $(1-\alpha)$ to α, where $0 < \alpha \leq \frac{1}{2}$ is a constant. The minimum depth of a leaf in the recursion tree is approximately given by

A. $-\frac{lgn}{lg(1-\alpha)}$

B. $-\frac{lg(1-\alpha)}{lgn}$

C. $-\frac{lgn}{lg\alpha}$

D. $-\frac{lg\alpha}{lgn}$

ugcnetjune2014iii data-structures sorting algorithms quick-sort

Answer key☟

1.54 Recurrence Relation (41)

1.54.1 Recurrence Relation: GATE CSE 1987 | Question: 10a

Solve the recurrence equations:

- $T(n) = T(n-1) + n$
- $T(1) = 1$

gate1987 algorithms recurrence-relation descriptive

Answer key☟

1.54.2 Recurrence Relation: GATE CSE 1988 | Question: 13iv

Solve the recurrence equations:

- $T(n) = T(\frac{n}{2}) + 1$
- $T(1) = 1$

gate1988 descriptive algorithms recurrence-relation

Answer key☟

1.54.3 Recurrence Relation: GATE CSE 1989 | Question: 13b

Find a solution to the following recurrence equation:

- $T(n) = \sqrt{n} + T\left(\frac{n}{2}\right)$
- $T(1) = 1$

gate1989 descriptive algorithms recurrence-relation

Answer key☟

1.54.4 Recurrence Relation: GATE CSE 1990 | Question: 17a

Express $T(n)$ in terms of the harmonic number $H_n = \sum_{i=1}^{n} \frac{1}{i}, \quad n \geq 1$, where $T(n)$ satisfies the recurrence relation,

$T(n) = \frac{n+1}{n} T(n-1) + 1$, for $n \geq \sum$ and $T(1) = 1$

What is the asymptotic behaviour of $T(n)$ as a function of n ?

gate1990 descriptive algorithms recurrence-relation

Answer key

1.54.5 Recurrence Relation: GATE CSE 1992 | Question: 07a

Consider the function $F(n)$ for which the pseudocode is given below :

```
Function F(n)
begin
F1 ← 1
if(n=1) then F ← 3
 else
   For i = 1 to n do
       begin
          C ← 0
         For j = 1 to n – 1 do
         begin C ← C + 1 end
         F1 = F1 * C
      end
 F = F1
end
```

[n is a positive integer greater than zero]

A. Derive a recurrence relation for $F(n)$.

gate1992 algorithms recurrence-relation descriptive

Answer key

1.54.6 Recurrence Relation: GATE CSE 1992 | Question: 07b

Consider the function $F(n)$ for which the pseudocode is given below :

```
Function F(n)
begin
F1 ← 1
if(n=1) then F ← 3
 else
   For i = 1 to n do
       begin
          C ← 0
         For j = 1 to n – 1 do
         begin C ← C + 1 end
         F1 = F1 * C
      end
 F = F1
end
```

[n is a positive integer greater than zero]

B. Solve the recurrence relation for a closed form solution of $F(n)$.

gate1992 algorithms recurrence-relation descriptive

Answer key

1.54.7 Recurrence Relation: GATE CSE 1993 | Question: 15

Consider the recursive algorithm given below:

```
procedure bubblesort (n);
var i,j: index; temp : item;
begin
   for i:=1 to n-1 do
      if A[i] > A[i+1] then
      begin
         temp := A[i];
         A[i] := A[i+1];
         A[i+1] := temp;
      end;
   bubblesort (n-1)
end
```

Let a_n be the number of times the 'if…then…' statement gets executed when the algorithm is run with value n. Set up the recurrence relation by defining a_n in terms of a_{n-1}. Solve for a_n.

gate1993 algorithms recurrence-relation normal descriptive

Answer key

1.54.8 Recurrence Relation: GATE CSE 1994 | Question: 1.7, ISRO2017-14

The recurrence relation that arises in relation with the complexity of binary search is:

A. $T(n) = 2T\left(\frac{n}{2}\right) + k, \text{ k is a constant}$
B. $T(n) = T\left(\frac{n}{2}\right) + k, \text{ k is a constant}$
C. $T(n) = T\left(\frac{n}{2}\right) + \log n$
D. $T(n) = T\left(\frac{n}{2}\right) + n$

gate1994 algorithms recurrence-relation easy isro2017

Answer key

1.54.9 Recurrence Relation: GATE CSE 1996 | Question: 2.12

The recurrence relation

- $T(1) = 2$
- $T(n) = 3T(\frac{n}{4}) + n$

has the solution $T(n)$ equal to

A. $O(n)$
B. $O(\log n)$
C. $O\left(n^{\frac{3}{4}}\right)$
D. None of the above

gate1996 algorithms recurrence-relation normal

Answer key

1.54.10 Recurrence Relation: GATE CSE 1997 | Question: 15

Consider the following function.

```
Function F(n, m:integer):integer;
begin
  if (n<=0) or (m<=0) then F:=1
  else
   F:F(n-1, m) + F(n-1, m-1);
end;
```

Use the recurrence relation $\begin{pmatrix} n \\ k \end{pmatrix} = \begin{pmatrix} n-1 \\ k \end{pmatrix} + \begin{pmatrix} n-1 \\ k-1 \end{pmatrix}$ to answer the following questions. Assume that n, m are positive integers. Write only the answers without any explanation.

a. What is the value of $F(n, 2)$?
b. What is the value of $F(n, m)$?
c. How many recursive calls are made to the function F, including the original call, when evaluating $F(n, m)$.

gate1997 algorithms recurrence-relation descriptive

Answer key

1.54.11 Recurrence Relation: GATE CSE 1997 | Question: 4.6

Let $T(n)$ be the function defined by $T(1) = 1,\ T(n) = 2T(\lfloor \frac{n}{2} \rfloor) + \sqrt{n}$ for $n \geq 2$.
Which of the following statements is true?

A. $T(n) = O\sqrt{n}$
B. $T(n) = O(n)$
C. $T(n) = O(\log n)$
D. None of the above

gate1997 algorithms recurrence-relation normal

Answer key

1.54.12 Recurrence Relation: GATE CSE 1998 | Question: 6a

Solve the following recurrence relation

$x_n = 2x_{n-1} - 1, n > 1$

$x_1 = 2$

gate1998 algorithms recurrence-relation descriptive

Answer key

1.54.13 Recurrence Relation: GATE CSE 2002 | Question: 1.3

The solution to the recurrence equation $T(2^k) = 3T(2^{k-1}) + 1, T(1) = 1$ is

A. 2^k
B. $\frac{(3^{k+1}-1)}{2}$
C. $3^{\log_2 k}$
D. $2^{\log_3 k}$

gatecse-2002 algorithms recurrence-relation normal

Answer key

1.54.14 Recurrence Relation: GATE CSE 2002 | Question: 2.11

The running time of the following algorithm

Procedure $A(n)$

If $n \leqslant 2$ return (1) else return $(A(\lceil \sqrt{n} \rceil))$;

is best described by

A. $O(n)$
B. $O(\log n)$
C. $O(\log \log n)$
D. $O(1)$

gatecse-2002 algorithms recurrence-relation normal

Answer key

1.54.15 Recurrence Relation: GATE CSE 2003 | Question: 35

Consider the following recurrence relation

$T(1) = 1$

$T(n+1) = T(n) + \lfloor \sqrt{n+1} \rfloor$ for all $n \geq 1$

The value of $T(m^2)$ for $m \geq 1$ is

A. $\frac{m}{6}(21m - 39) + 4$
B. $\frac{m}{6}(4m^2 - 3m + 5)$
C. $\frac{m}{2}(3m^{2.5} - 11m + 20) - 5$
D. $\frac{m}{6}(5m^3 - 34m^2 + 137m - 104) + \frac{5}{6}$

gatecse-2003 algorithms time-complexity recurrence-relation difficult

Answer key

1.54.16 Recurrence Relation: GATE CSE 2004 | Question: 83, ISRO2015-40

The time complexity of the following C function is (assume $n > 0$)

```
int recursive (int n) {
    if(n == 1)
        return (1);
```

```
    else
        return (recursive (n-1) + recursive (n-1));
}
```

A. $O(n)$ B. $O(n \log n)$ C. $O(n^2)$ D. $O(2^n)$

gatecse-2004 algorithms recurrence-relation time-complexity normal isro2015

Answer key

1.54.17 Recurrence Relation: GATE CSE 2004 | Question: 84

The recurrence equation
$T(1) = 1$
$T(n) = 2T(n-1) + n, n \geq 2$

evaluates to

A. $2^{n+1} - n - 2$ B. $2^n - n$ C. $2^{n+1} - 2n - 2$ D. $2^n + n$

gatecse-2004 algorithms recurrence-relation normal

Answer key

1.54.18 Recurrence Relation: GATE CSE 2006 | Question: 51, ISRO2016-34

Consider the following recurrence:

$$T(n) = 2T\left(\sqrt{n}\right) + 1, T(1) = 1$$

Which one of the following is true?

A. $T(n) = \Theta(\log \log n)$
B. $T(n) = \Theta(\log n)$
C. $T(n) = \Theta(\sqrt{n})$
D. $T(n) = \Theta(n)$

algorithms recurrence-relation isro2016 gatecse-2006

Answer key

1.54.19 Recurrence Relation: GATE CSE 2008 | Question: 78

Let x_n denote the number of binary strings of length n that contain no consecutive 0s.
Which of the following recurrences does x_n satisfy?

A. $x_n = 2x_{n-1}$
B. $x_n = x_{\lfloor n/2 \rfloor} + 1$
C. $x_n = x_{\lfloor n/2 \rfloor} + n$
D. $x_n = x_{n-1} + x_{n-2}$

gatecse-2008 algorithms recurrence-relation normal

Answer key

1.54.20 Recurrence Relation: GATE CSE 2008 | Question: 79

Let x_n denote the number of binary strings of length n that contain no consecutive 0s.
The value of x_5 is

A. 5 B. 7 C. 8 D. 16

gatecse-2008 algorithms recurrence-relation normal

Answer key

1.54.21 Recurrence Relation: GATE CSE 2009 | Question: 35

The running time of an algorithm is represented by the following recurrence relation:

$$T(n) = \begin{cases} n & n \leq 3 \\ T(\frac{n}{3}) + cn & \text{otherwise} \end{cases}$$

Which one of the following represents the time complexity of the algorithm?

A. $\Theta(n)$
B. $\Theta(n \log n)$

C. $\Theta(n^2)$

D. $\Theta(n^2 \log n)$

gatecse-2009 algorithms recurrence-relation time-complexity normal

Answer key

1.54.22 Recurrence Relation: GATE CSE 2012 | Question: 16

The recurrence relation capturing the optimal execution time of the $Towers\ of\ Hanoi$ problem with n discs is

A. $T(n) = 2T(n-2) + 2$

B. $T(n) = 2T(n-1) + n$

C. $T(n) = 2T(n/2) + 1$

D. $T(n) = 2T(n-1) + 1$

gatecse-2012 algorithms easy recurrence-relation

Answer key

1.54.23 Recurrence Relation: GATE CSE 2014 Set 2 | Question: 13

Which one of the following correctly determines the solution of the recurrence relation with $T(1) = 1$?

$$T(n) = 2T\left(\frac{n}{2}\right) + \log n$$

A. $\Theta(n)$

B. $\Theta(n \log n)$

C. $\Theta(n^2)$

D. $\Theta(\log n)$

gatecse-2014-set2 algorithms recurrence-relation normal

Answer key

1.54.24 Recurrence Relation: GATE CSE 2015 Set 1 | Question: 49

Let a_n represent the number of bit strings of length n containing two consecutive 1s. What is the recurrence relation for a_n?

A. $a_{n-2} + a_{n-1} + 2^{n-2}$

B. $a_{n-2} + 2a_{n-1} + 2^{n-2}$

C. $2a_{n-2} + a_{n-1} + 2^{n-2}$

D. $2a_{n-2} + 2a_{n-1} + 2^{n-2}$

gatecse-2015-set1 algorithms recurrence-relation normal

Answer key

1.54.25 Recurrence Relation: GATE CSE 2015 Set 3 | Question: 39

Consider the following recursive C function.

```
void get(int n)
{
   if (n<1) return;
   get (n-1);
   get (n-3);
   printf("%d", n);
}
```

If $get(6)$ function is being called in $main()$ then how many times will the $get()$ function be invoked before returning to the $main()$?

A. 15

B. 25

C. 35

D. 45

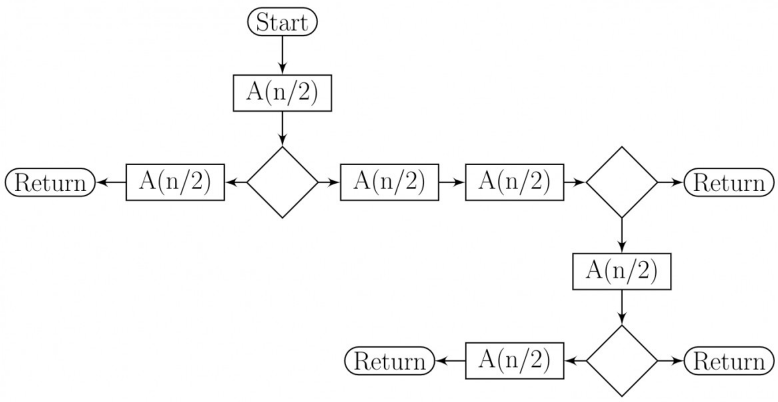
gatecse-2015-set3 algorithms recurrence-relation normal

Answer key

1.54.26 Recurrence Relation: GATE CSE 2016 Set 2 | Question: 39

The given diagram shows the flowchart for a recursive function $A(n)$. Assume that all statements, except for the recursive calls, have $O(1)$ time complexity. If the worst case time complexity of this function is $O(n^{\alpha})$, then the least possible value (accurate up to two decimal positions) of α is ________.

Flow chart for Recursive Function $A(n)$.



gatecse-2016-set2 algorithms time-complexity recurrence-relation normal numerical-answers

Answer key☟

1.54.27 Recurrence Relation: GATE CSE 2017 Set 2 | Question: 30

Consider the recurrence function

$$T(n) = \begin{cases} 2T(\sqrt{n}) + 1, & n > 2 \\ 2, & 0 < n \leq 2 \end{cases}$$

Then $T(n)$ in terms of Θ notation is

A. $\Theta(\log \log n)$
B. $\Theta(\log n)$
C. $\Theta(\sqrt{n})$
D. $\Theta(n)$

gatecse-2017-set2 algorithms recurrence-relation

Answer key☟

1.54.28 Recurrence Relation: GATE CSE 2020 | Question: 2

For parameters a and b, both of which are $\omega(1)$, $T(n) = T(n^{1/a}) + 1$, and $T(b) = 1$. Then $T(n)$ is

A. $\Theta(\log_a \log_b n)$
B. $\Theta(\log_{ab} n)$
C. $\Theta(\log_b \log_a \ n)$
D. $\Theta(\log_2 \log_2 n)$

gatecse-2020 algorithms recurrence-relation one-mark

Answer key☟

1.54.29 Recurrence Relation: GATE CSE 2021 Set 1 | Question: 30

Consider the following recurrence relation.

$$T(n) = \begin{cases} T(n/2) + T(2n/5) + 7n & \text{if } n > 0 \\ 1 & \text{if } n = 0 \end{cases}$$

Which one of the following options is correct?

A. $T(n) = \Theta(n^{5/2})$
B. $T(n) = \Theta(n \log n)$
C. $T(n) = \Theta(n)$
D. $T(n) = \Theta((\log n)^{5/2})$

gatecse-2021-set1 algorithms recurrence-relation time-complexity two-marks

Answer key☟

1.54.30 Recurrence Relation: GATE CSE 2021 Set 2 | Question: 39

For constants $a \geq 1$ and $b > 1$, consider the following recurrence defined on the non-negative integers:

$$T(n) = a \cdot T\left(\frac{n}{b}\right) + f(n)$$

Which one of the following options is correct about the recurrence $T(n)$?

A. If $f(n)$ is $n\log_2(n)$, then $T(n)$ is $\Theta(n\log_2(n))$
B. If $f(n)$ is $\frac{n}{\log_2(n)}$, then $T(n)$ is $\Theta(\log_2(n))$
C. If $f(n)$ is $O(n^{\log_b(a)-\epsilon})$ for some $\epsilon > 0$, then $T(n)$ is $\Theta(n^{\log_b(a)})$
D. If $f(n)$ is $\Theta(n^{\log_b(a)})$, then $T(n)$ is $\Theta(n^{\log_b(a)})$

gatecse-2021-set2 algorithms recurrence-relation two-marks

Answer key☟

1.54.31 Recurrence Relation: GATE CSE 2024 | Set 1 | Question: 32

Consider the following recurrence relation:

$$T(n) = \begin{cases} \sqrt{n}T(\sqrt{n}) + n \text{ for } n \geq 1, \\ \quad 1 \quad \text{for } n = 1 \end{cases}$$

Which one of the following options is CORRECT?

A. $T(n) = \Theta(n\log\log n)$
B. $T(n) = \Theta(n\log n)$
C. $T(n) = \Theta\left(n^2\log n\right)$
D. $T(n) = \Theta\left(n^2\log\log n\right)$

gatecse2024-set1 algorithms recurrence-relation two-marks

Answer key☟

1.54.32 Recurrence Relation: GATE CSE 2025 | Set 1 | Question: 10

Consider the following recurrence relation:

$$T(n) = 2T(n-1) + n2^n \text{ for } n > 0, \quad T(0) = 1$$

Which ONE of the following options is CORRECT?

A. $T(n) = \Theta\left(n^2 2^n\right)$
B. $T(n) = \Theta\left(n2^n\right)$
C. $T(n) = \Theta\left((\log n)^2 2^n\right)$
D. $T(n) = \Theta\left(4^n\right)$

gatecse2025-set1 algorithms time-complexity recurrence-relation one-mark

Answer key☟

1.54.33 Recurrence Relation: GATE IT 2004 | Question: 57

Consider a list of recursive algorithms and a list of recurrence relations as shown below. Each recurrence relation corresponds to exactly one algorithm and is used to derive the time complexity of the algorithm.

	Recursive Algorithm		**Recurrence Relation**
P	Binary search	l.	$T(n) = T(n-k) + T(k) + cn$
Q.	Merge sort	ll.	$T(n) = 2T(n-1) + 1$
R.	Quick sort	lll.	$T(n) = 2T(n/2) + cn$
S.	Tower of Hanoi	lV.	$T(n) = T(n/2) + 1$

Which of the following is the correct match between the algorithms and their recurrence relations?

A. P-II, Q-III, R-IV, S-I
B. P-IV, Q-III, R-I, S-II
C. P-III, Q-II, R-IV, S-I
D. P-IV, Q-II, R-I, S-III

gateit-2004 algorithms recurrence-relation normal match-the-following

Answer key☟

1.54.34 Recurrence Relation: GATE IT 2005 | Question: 51

Let $T(n)$ be a function defined by the recurrence
$T(n) = 2T(n/2) + \sqrt{n}$ for $n \geq 2$ and
$T(1) = 1$
Which of the following statements is **TRUE**?

A. $T(n) = \Theta(\log n)$
B. $T(n) = \Theta(\sqrt{n})$
C. $T(n) = \Theta(n)$
D. $T(n) = \Theta(n \log n)$

gateit-2005 algorithms recurrence-relation easy

Answer key☟

1.54.35 Recurrence Relation: GATE IT 2008 | Question: 44

When $n = 2^{2k}$ for some $k \geqslant 0$, the recurrence relation

$T(n) = \sqrt(2)T(n/2) + \sqrt{n}, T(1) = 1$

evaluates to :

A. $\sqrt(n)(\log n + 1)$
B. $\sqrt(n) \log n$
C. $\sqrt(n) \log \sqrt(n)$
D. $n \log \sqrt{n}$

gateit-2008 algorithms recurrence-relation normal

Answer key☟

1.54.36 Recurrence Relation: UGC NET CSE | December 2012 | Part 3 | Question: 14

Let $T(n)$ be a function defined by $T(n) = 1$ and $T(n) = 2T(n/2) + \sqrt{n}$, which of the following is true?

A. $T(n) = O(\sqrt{n})$
B. $T(n) = O(\log_2 n)$
C. $T(n) = O(n)$
D. $T(n) = O(n^2)$

ugcnetcse-dec2012-paper3 algorithms recurrence-relation time-complexity

Answer key☟

1.54.37 Recurrence Relation: UGC NET CSE | December 2015 | Part 3 | Question: 19

The solution of the reccurence relation

$$T(n) \leq \begin{cases} \theta(1) & \text{if } n \leq 80 \\ T\left(\frac{n}{s}\right) + T\left(\frac{7n}{10} + 6\right) + O(n) & \text{if } n > 80 \end{cases}$$ is

A. $O(\lg n)$
B. $O(n)$
C. $O(n \lg n)$
D. None of the above

ugcnetcse-dec2015-paper3 algorithms recurrence-relation

Answer key☟

1.54.38 Recurrence Relation: UGC NET CSE | July 2018 | Part 2 | Question: 21

The solution of the recurrence relation $T(m) = T(3m/4) + 1$ is

A. $\Theta(\lg\ m)$
B. $\Theta(m)$
C. $\Theta(m \lg m)$
D. $\Theta(\lg \lg m)$

ugcnetcse-july2018-paper2 algorithms time-complexity recurrence-relation

Answer key☟

1.54.39 Recurrence Relation: UGC NET CSE | June 2013 | Part 3 | Question: 12

The solution of recurrence relation, $T(n) = 2T(floor(\sqrt{n})) + \log n$ is

A. $O(n \log \log \log n)$
B. $O(n \log \log n)$
C. $O(\log \log n)$
D. $O(\log n \log \log n)$

ugcnetcse-june2013-paper3 algorithms recurrence-relation

Answer key

1.54.40 Recurrence Relation: UGC NET CSE | June 2014 | Part 3 | Question: 63

The solution of the recurrence relation of $T(n) = 3T\left(floor\left(\frac{n}{4}\right)\right) + n$ is

A. $O(n^2)$ B. $O(n/gn)$ C. $O(n)$ D. $O(lgn)$

ugcnetjune2014iii algorithms recurrence-relation

Answer key

1.54.41 Recurrence Relation: UGC NET CSE | September 2013 | Part 3 | Question: 37

The time complexity of reccurence relation T(n) = T(n/3) + T(2n/3) +O(n) is

A. O(lg n) B. O(n) C. O(n lg n) D. O(n^2)

ugcnetcse-sep2013-paper3 algorithms time-complexity recurrence-relation

Answer key

1.55 Recursion (6)

1.55.1 Recursion: GATE CSE 1995 | Question: 2.9

A language with string manipulation facilities uses the following operations

```
head(s): first character of a string
tail(s): all but exclude the first character of a string
```

```
concat(s1, s2): s1s2
```

For the string "$acbc$" what will be the output of

```
concat(head(s), head(tail(tail(s))))
```

A. ac B. bc C. ab D. cc

gate1995 algorithms normal recursion

Answer key

1.55.2 Recursion: GATE CSE 2007 | Question: 44

In the following C function, let $n \geq m$.

```
int gcd(n,m)  {
    if (n%m == 0) return m;
    n = n%m;
    return gcd(m,n);
}
```

How many recursive calls are made by this function?

A. $\Theta(\log_2 n)$ B. $\Omega(n)$
C. $\Theta(\log_2 \log_2 n)$ D. $\Theta(\sqrt{n})$

gatecse-2007 algorithms recursion time-complexity normal

Answer key

1.55.3 Recursion: GATE CSE 2018 | Question: 45

Consider the following program written in pseudo-code. Assume that x and y are integers.

```
Count (x, y) {
    if (y !=1 ) {
        if (x !=1) {
            print("*");
            Count (x/2, y);
        }
        else {
            y=y-1;
```

```
        Count (1024, y);
      }
    }
}
```

The number of times that the $print$ statement is executed by the call $Count(1024, 1024)$ is _____

gatecse-2018 numerical-answers algorithms recursion two-marks

Answer key

1.55.4 Recursion: GATE CSE 2021 Set 2 | Question: 49

Consider the following ANSI C program

```c
#include <stdio.h>
int foo(int x, int y, int q)
   {
      if ((x<=0) && (y<=0))
      return q;
      if (x<=0)
      return foo(x, y-q, q);
      if (y<=0)
      return foo(x-q, y, q);
      return foo(x, y-q, q) + foo(x-q, y, q);
   }
int main( )
{
   int r = foo(15, 15, 10);
   printf("%d", r);
   return 0;
}
```

The output of the program upon execution is _________

gatecse-2021-set2 algorithms recursion output numerical-answers two-marks

Answer key

1.55.5 Recursion: UGC NET CSE | December 2009 | Part 2 | Question: 11

Recursive functions are executed in a

A. First in first out-order
B. Last in first out-order
C. Parallel fashion
D. Load balancing

ugcnetcse-dec2009-paper2 algorithms recursion

Answer key

1.55.6 Recursion: UGC NET CSE | December 2011 | Part 2 | Question: 3

Which of the following is a bad example of recursion ?

A. Factorial
B. Fibonacci numbers
C. Tower of Hanai
D. Tree traversal

ugcnetcse-dec2011-paper2 algorithms recursion

Answer key

1.56 Red Black Tree (1)

1.56.1 Red Black Tree: UGC NET CSE | January 2017 | Part 3 | Question: 33

Red-black trees are one of many search tree schemes that are "balanced" in order to guarantee that basic dynamic-set operations take _____ time in the worst case.

A. $O(1)$
B. $O(\lg n)$
C. $O(n)$
D. $O(n \lg n)$

ugcnetcse-jan2017-paper3 algorithms red-black-tree

Answer key

1.57 Routing (1)

1.57.1 Routing: UGC NET CSE | November 2017 | Part 2 | Question: 27

__________ do not take their decisions on measurements or estimates of the current traffic and topology.

A. Static algorithms
B. Adaptive algorithms
C. Non-Adaptive algorithms
D. Recursive algorithms.

ugcnetcse-nov2017-paper2 computer-networks routing algorithms

Answer key

1.58 Searching (7)

1.58.1 Searching: GATE CSE 1996 | Question: 18

Consider the following program that attempts to locate an element x in an array $a[]$ using binary search. Assume $N > 1$. The program is erroneous. Under what conditions does the program fail?

```
var i,j,k: integer; x: integer;
   a: array; [1..N] of integer;
begin i:= 1; j:= n;
repeat
   k:(i+j) div 2;
   if a[k] < x then i:= k
   else j:= k
until (a[k] = x) or (i >= j);

if (a[k] = x) then
   writeln ('x is in the array')
else
   writeln ('x is not in the array')
end;
```

gate1996 algorithms searching normal descriptive

Answer key

1.58.2 Searching: GATE CSE 1996 | Question: 2.13, ISRO2016-28

The average number of key comparisons required for a successful search for sequential search on n items is

A. $\frac{n}{2}$
B. $\frac{n-1}{2}$
C. $\frac{n+1}{2}$
D. None of the above

gate1996 algorithms easy isro2016 searching

Answer key

1.58.3 Searching: GATE CSE 2002 | Question: 2.10

Consider the following algorithm for searching for a given number x in an unsorted array $A[1..n]$ having n distinct values:

1. Choose an i at random from $1..n$
2. If $A[i] = x$, then Stop else Goto 1;

Assuming that x is present in A, what is the expected number of comparisons made by the algorithm before it terminates?

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

gatecse-2002 searching normal

Answer key

1.58.4 Searching: GATE CSE 2008 | Question: 84

Consider the following C program that attempts to locate an element x in an array $Y[\,]$ using binary search. The program is erroneous.

```
f (int Y[10] , int x) {
  int i, j, k;
```

```
    i= 0; j = 9;
    do {
        k = (i+ j) / 2;
        if( Y[k] < x) i = k;else j = k;
        } while (Y[k] != x) && (i < j)) ;
    if(Y[k] == x) printf(" x is in the array ") ;
    else printf(" x is not in the array ") ;
}
```

On which of the following contents of Y and x does the program fail?

A. Y is $[1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9\ 10]$ and $x < 10$
B. Y is $[1\ 3\ 5\ 7\ 9\ 11\ 13\ 15\ 17\ 19]$ and $x < 1$
C. Y is $[2\ 2\ 2\ 2\ 2\ 2\ 2\ 2\ 2\ 2]$ and $x > 2$
D. Y is $[2\ 4\ 6\ 8\ 10\ 12\ 14\ 16\ 18\ 20]$ and $2 < x < 20$ and x is even

gatecse-2008 algorithms searching normal

Answer key

1.58.5 Searching: GATE CSE 2008 | Question: 85

Consider the following C program that attempts to locate an element x in an array $Y[\ ]$ using binary search. The program is erroneous.

```
f (int Y[10] , int x) {
  int i, j, k;
  i= 0; j = 9;
  do {
      k = (i + j) / 2;
      if( Y[k] < x) i = k;else j = k;
      } while (Y[k] != x) && (i < j)) ;
  if(Y[k] == x) printf(" x is in the array ") ;
  else printf(" x is not in the array ") ;
}
```

The correction needed in the program to make it work properly is

A. Change line 6 to: if $(Y[k] < x) i = k + 1$; else $j = k - 1$;
B. Change line 6 to: if $(Y[k] < x) i = k - 1$; else $j = k + 1$;
C. Change line 6 to: if $(Y[k] < x) i = k$; else $j = k$;
D. Change line 7 to: } while $((Y[k] == x) \&\& (i < j))$;

gatecse-2008 algorithms searching normal

Answer key

1.58.6 Searching: GATE CSE 2017 Set 1 | Question: 48

Let A be an array of 31 numbers consisting of a sequence of 0's followed by a sequence of 1's. The problem is to find the smallest index i such that $A[i]$ is 1 by probing the minimum number of locations in A. The *worst case* number of probes performed by an *optimal* algorithm is ____________.

gatecse-2017-set1 algorithms normal numerical-answers searching

Answer key

1.58.7 Searching: GATE CSE 2025 | Set 2 | Question: 19

Which of the following statements regarding Breadth First Search (BFS) and Depth First Search (DFS) on an undirected simple graph G is/are TRUE?

A. A DFS tree of G is a Shortest Path tree of G.
B. Every non-tree edge of G with respect to a DFS tree is a forward/back edge.
C. If (u, v) is a non-tree edge of G with respect to a BFS tree, then the distances from the source vertex s to u and v in the BFS tree are within ± 1 of each other.
D. Both BFS and DFS can be used to find the connected components of G.

gatecse2025-set2 algorithms searching breadth-first-search depth-first-search multiple-selects one-mark

Answer key

1.59 Sequence Series (1)

1.59.1 Sequence Series: UGC NET CSE | November 2017 | Part 3 | Question: 34

Consider the following two sequences:

$X =< B, C, D, C, A, B, C >$ and $Y =< C, A, D, B, C, B >$

The length of longest common subsequence of X and Y is

A. 5
B. 3
C. 4
D. 2

ugcnetcse-nov2017-paper3 dynamic-programming sequence-series data-structures

Answer key

1.60 Shortest Path (13)

1.60.1 Shortest Path: GATE CSE 2002 | Question: 12

Fill in the blanks in the following template of an algorithm to compute all pairs shortest path lengths in a directed graph G with $n * n$ adjacency matrix A. $A[i, j]$ equals 1 if there is an edge in G from i to j, and 0 otherwise. Your aim in filling in the blanks is to ensure that the algorithm is correct.

```
INITIALIZATION: For i = 1 ... n
  {For j = 1 ... n
    { if a[i,j] = 0 then P[i,j] =_______ else P[i,j] =_______;}
  }

ALGORITHM: For i = 1 ... n
  {For j = 1 ... n
    {For k = 1 ... n
      {P[__,__] = min{_______,_______}; }
    }
  }
```

a. Copy the complete line containing the blanks in the Initialization step and fill in the blanks.
b. Copy the complete line containing the blanks in the Algorithm step and fill in the blanks.
c. Fill in the blank: The running time of the Algorithm is O(___).

gatecse-2002 algorithms graph-algorithms time-complexity normal descriptive shortest-path

Answer key

1.60.2 Shortest Path: GATE CSE 2003 | Question: 67

Let $G = (V, E)$ be an undirected graph with a subgraph $G_1 = (V_1, E_1)$. Weights are assigned to edges of G as follows.

$$w(e) = \begin{cases} 0, & \text{if } e \in E_1 \\ 1, & \text{otherwise} \end{cases}$$

A single-source shortest path algorithm is executed on the weighted graph (V, E, w) with an arbitrary vertex v_1 of V_1 as the source. Which of the following can always be inferred from the path costs computed?

A. The number of edges in the shortest paths from v_1 to all vertices of G
B. G_1 is connected
C. V_1 forms a clique in G
D. G_1 is a tree

gatecse-2003 algorithms graph-algorithms normal shortest-path

Answer key

1.60.3 Shortest Path: GATE CSE 2007 | Question: 41

In an unweighted, undirected connected graph, the shortest path from a node S to every other node is computed most efficiently, in terms of *time complexity*, by

A. Dijkstra's algorithm starting from S.
B. Warshall's algorithm.
C. Performing a DFS starting from S.
D. Performing a BFS starting from S.

gatecse-2007 algorithms graph-algorithms easy shortest-path

Answer key

1.60.4 Shortest Path: GATE CSE 2020 | Question: 40

Let $G=(V,E)$ be a directed, weighted graph with weight function $w: E \rightarrow \mathbb{R}$. For some function $f: V \rightarrow \mathbb{R}$, for each edge $(u,v) \in E$, define $w'(u,v)$ as $w(u,v)+f(u)-f(v)$.

Which one of the options completes the following sentence so that it is TRUE?

"The shortest paths in G under w are shortest paths under w' too,_____________".

A. for every $f: V \rightarrow \mathbb{R}$
B. if and only if $\forall u \in V,\ f(u)$ is positive
C. if and only if $\forall u \in V,\ f(u)$ is negative
D. if and only if $f(u)$ is the distance from s to u in the graph obtained by adding a new vertex s to G and edges of zero weight from s to every vertex of G

gatecse-2020 algorithms graph-algorithms two-marks shortest-path

Answer key

1.60.5 Shortest Path: GATE CSE 2025 | Set 1 | Question: 33

Let $G(V,E)$ be an undirected and unweighted graph with 100 vertices. Let $d(u,v)$ denote the number of edges in a shortest path between vertices u and v in V. Let the maximum value of $d(u,v), u,v \in V$ such that $u \neq v$, be 30. Let T be any breadth-first-search tree of G. Which ONE of the given options is CORRECT for every such graph G ?

A. The height of T is exactly 15.
B. The height of T is exactly 30.
C. The height of T is at least 15.
D. The height of T is at least 30.

gatecse2025-set1 algorithms breadth-first-search shortest-path two-marks

Answer key

1.60.6 Shortest Path: GATE CSE 2025 | Set 1 | Question: 8

Let G be any undirected graph with positive edge weights, and T be a minimum spanning tree of G. For any two vertices, u and v, let $d_1(u,v)$ and $d_2(u,v)$ be the shortest distances between u and v in G and T, respectively. Which ONE of the options is CORRECT for all possible G, T, u and v ?

A. $d_1(u,v)=d_2(u,v)$
B. $d_1(u,v) \leq d_2(u,v)$
C. $d_1(u,v) \geq d_2(u,v)$
D. $d_1(u,v) \neq d_2(u,v)$

gatecse2025-set1 algorithms minimum-spanning-tree shortest-path one-mark

Answer key

1.60.7 Shortest Path: GATE CSE 2025 | Set 2 | Question: 27

Let G be an edge-weighted undirected graph with positive edge weights. Suppose a positive constant α is added to the weight of every edge.

Which ONE of the following statements is TRUE about the minimum spanning trees (MSTs) and shortest paths (SPs) in G before and after the edge weight update?

A. Every MST remains an MST, and every SP remains an SP.
B. MSTs need not remain MSTs, and every SP remains an SP.
C. Every MST remains an MST, and SPs need not remain SPs.

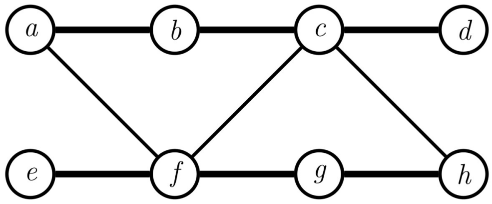
D. MSTs need not remain MSTs, and SPs need not remain SPs.

gatecse2025-set2 algorithms minimum-spanning-tree shortest-path two-marks

Answer key

1.60.8 Shortest Path: GATE DA 2025 | Question: 48

Let G be a simple, unweighted, and undirected graph. A subset of the vertices and edges of G are shown below.



It is given that $a - b - c - d$ is a shortest path between a and d; $e - f - g - h$ is a shortest path between e and h; $a - f - c - h$ is a shortest path between a and h. Which of the following is/are NOT the edges of G ?

A. (b, d) B. (b, g) C. (b, h) D. (e, g)

gateda-2025 algorithms shortest-path multiple-selects two-marks

Answer key

1.60.9 Shortest Path: GATE IT 2007 | Question: 3, UGCNET-June2012-III: 34

Consider a weighted, undirected graph with positive edge weights and let uv be an edge in the graph. It is known that the shortest path from the source vertex s to u has weight 53 and the shortest path from s to v has weight 65. Which one of the following statements is always TRUE?

A. Weight $(u, v) \leq 12$
B. Weight $(u, v) = 12$
C. Weight $(u, v) \geq 12$
D. Weight $(u, v) > 12$

gateit-2007 algorithms graph-algorithms normal ugcnetcse-june2012-paper3 shortest-path

Answer key

1.60.10 Shortest Path: UGC NET CSE | December 2014 | Part 3 | Question: 34

Dijkstra algorithm, which solves the single-source shortest--paths problem, is a _______, and the Floyd-Warshall algorithm, which finds shortest paths between all pairs of vertices, is a ________.

A. Greedy algorithm, Divide-conquer algorithm
B. Divide-conquer algorithm, Greedy algorithm
C. Greedy algorithm, Dynamic programming algorithm
D. Dynamic programming algorithm, Greedy algorithm

ugcnetcse-dec2014-paper3 algorithms shortest-path

Answer key

1.60.11 Shortest Path: UGC NET CSE | December 2019 | Part 2 | Question: 40

Consider a weighted directed graph. The current shortest distance from source S to node x is represented by $d[x]$. Let $d[v] = 29$, $d[u] = 15$, $w[u, v] = 12$. What is the updated value of $d[v]$ based on current information?

A. 29 B. 27 C. 25 D. 17

ugcnetcse-dec2019-paper2 graph-algorithms shortest-path

Answer key

1.60.12 Shortest Path: UGC NET CSE | June 2007 | Part 2 | Question: 21

The time required to find the shortest path in a graph with n vertices and e edges is:

A. $O(e)$ B. $O(n)$ C. $O(e^2)$ D. $O(n^2)$

ugcnetcse-june2007-paper2 graph-algorithms shortest-path asymptotic-notations algorithm-design

Answer key☟

1.60.13 Shortest Path: UGC NET CSE | Junet 2015 | Part 3 | Question: 31

An all-pairs shortest-paths problem is efficiently solved using:

A. Dijkstra's algorithm
B. Bellman-Ford algorithm
C. Kruskal algorithm
D. Floyd-Warshall algorithm

ugcnetcse-june2015-paper3 algorithms easy shortest-path

Answer key☟

1.61 Sorting (35)

1.61.1 Sorting: GATE CSE 1988 | Question: 1iii

Quicksort is ________ efficient than heapsort in the worst case.

gate1988 algorithms sorting fill-in-the-blanks easy

Answer key☟

1.61.2 Sorting: GATE CSE 1990 | Question: 3-v

The complexity of comparison based sorting algorithms is:

A. $\Theta(n \log n)$
B. $\Theta(n)$
C. $\Theta\left(n^2\right)$
D. $\Theta(n\sqrt{n})$

gate1990 normal algorithms sorting easy time-complexity multiple-selects

Answer key☟

1.61.3 Sorting: GATE CSE 1991 | Question: 01,vii

The minimum number of comparisons required to sort 5 elements is ______

gate1991 normal algorithms sorting numerical-answers

Answer key☟

1.61.4 Sorting: GATE CSE 1991 | Question: 13

Give an optimal algorithm in pseudo-code for sorting a sequence of n numbers which has only k distinct numbers (k is not known a Priori). Give a brief analysis for the time-complexity of your algorithm.

gate1991 sorting time-complexity algorithms difficult descriptive

Answer key☟

1.61.5 Sorting: GATE CSE 1992 | Question: 02,ix

Following algorithm(s) can be used to sort n in the range $[1 \dots n^3]$ in $O(n)$ time

a. Heap sort b. Quick sort c. Merge sort d. Radix sort

gate1992 easy algorithms sorting multiple-selects

Answer key☟

1.61.6 Sorting: GATE CSE 1995 | Question: 12

Consider the following sequence of numbers:

$$92, 37, 52, 12, 11, 25$$

Use Bubble sort to arrange the sequence in ascending order. Give the sequence at the end of each of the first five passes.

gate1995 algorithms sorting easy descriptive bubble-sort

Answer key

1.61.7 Sorting: GATE CSE 1996 | Question: 14

A two dimensional array $A[1..n][1..n]$ of integers is partially sorted if $\forall i, j \in [1..n-1], A[i][j] < A[i][j+1] \text{ and } A[i][j] < A[i+1][j]$

a. The smallest item in the array is at $A[i][j]$ where $i =$ __ and $j =$ __.
b. The smallest item is deleted. Complete the following $O(n)$ procedure to insert item x (which is guaranteed to be smaller than any item in the last row or column) still keeping A partially sorted.

```
procedure insert (x: integer);
var i,j: integer;
begin
   i:=1; j:=1, A[i][j]:=x;
   while (x > __ or x > __) do
      if A[i+1][j] < A[i][j] ___ then begin
         A[i][j]:=A[i+1][j]; i:=i+1;
      end
      else begin
         _____
      end
   A[i][j]:= ____
end
```

gate1996 algorithms sorting normal descriptive

Answer key

1.61.8 Sorting: GATE CSE 1998 | Question: 1.22

Give the correct matching for the following pairs:

(A)	$O(\log n)$	(P)	Selection
(B)	$O(n)$	(Q)	Insertion sort
(C)	$O(n \log n)$	(R)	Binary search
(D)	$O(n^2)$	(S)	Merge sort

A. A-R B-P C-Q D-S
B. A-R B-P C-S D-Q
C. A-P B-R C-S D-Q
D. A-P B-S C-R D-Q

gate1998 algorithms sorting easy match-the-following

Answer key

1.61.9 Sorting: GATE CSE 1999 | Question: 1.12

A sorting technique is called stable if

A. it takes $O(n \log n)$ time
B. it maintains the relative order of occurrence of non-distinct elements
C. it uses divide and conquer paradigm
D. it takes $O(n)$ space

gate1999 algorithms sorting easy

Answer key

1.61.10 Sorting: GATE CSE 1999 | Question: 8

Let A be an $n \times n$ matrix such that the elements in each row and each column are arranged in ascending order. Draw a decision tree, which finds 1^{st}, 2^{nd} and 3^{rd} smallest elements in minimum number of comparisons.

gate1999 algorithms sorting normal descriptive

Answer key

1.61.11 Sorting: GATE CSE 2000 | Question: 17

An array contains four occurrences of 0, five occurrences of 1, and three occurrences of 2 in any order. The array is to be sorted using swap operations (elements that are swapped need to be adjacent).

a. What is the minimum number of swaps needed to sort such an array in the worst case?
b. Give an ordering of elements in the above array so that the minimum number of swaps needed to sort the array is maximum.

gatecse-2000 algorithms sorting normal descriptive

Answer key

1.61.12 Sorting: GATE CSE 2003 | Question: 61

In a permutation $a_1 \dots a_n$, of n distinct integers, an inversion is a pair (a_i, a_j) such that $i < j$ and $a_i > a_j$.
If all permutations are equally likely, what is the expected number of inversions in a randomly chosen permutation of $1 \dots n$?

A. $\dfrac{n(n-1)}{2}$
B. $\dfrac{n(n-1)}{4}$
C. $\dfrac{n(n+1)}{4}$
D. $2n[\log_2 n]$

gatecse-2003 algorithms sorting inversion normal

Answer key

1.61.13 Sorting: GATE CSE 2005 | Question: 39

Suppose there are $\lceil \log n \rceil$ sorted lists of $\lfloor n/\log n \rfloor$ elements each. The time complexity of producing a sorted list of all these elements is: (Hint:Use a heap data structure)

A. $O(n \log \log n)$
B. $\Theta(n \log n)$
C. $\Omega(n \log n)$
D. $\Omega\left(n^{3/2}\right)$

gatecse-2005 algorithms sorting normal

Answer key

1.61.14 Sorting: GATE CSE 2006 | Question: 14, ISRO2011-14

Which one of the following in place sorting algorithms needs the minimum number of swaps?

A. Quick sort
B. Insertion sort
C. Selection sort
D. Heap sort

gatecse-2006 algorithms sorting easy isro2011

Answer key

1.61.15 Sorting: GATE CSE 2007 | Question: 14

Which of the following sorting algorithms has the lowest worse-case complexity?

A. Merge sort
B. Bubble sort
C. Quick sort
D. Selection sort

gatecse-2007 algorithms sorting time-complexity easy

Answer key

1.61.16 Sorting: GATE CSE 2009 | Question: 11

What is the number of swaps required to sort n elements using selection sort, in the worst case?

A. $\Theta(n)$
B. $\Theta(n \log n)$

C. $\Theta(n^2)$

D. $\Theta(n^2 \log n)$

gatecse-2009 algorithms sorting easy selection-sort

Answer key

1.61.17 Sorting: GATE CSE 2013 | Question: 30

The number of elements that can be sorted in $\Theta(\log n)$ time using heap sort is

A. $\Theta(1)$

B. $\Theta(\sqrt{\log} n)$

C. $\Theta(\frac{\log n}{\log \log n})$

D. $\Theta(\log n)$

gatecse-2013 algorithms sorting normal heap-sort

Answer key

1.61.18 Sorting: GATE CSE 2013 | Question: 6

Which one of the following is the tightest upper bound that represents the number of swaps required to sort n numbers using selection sort?

A. $O(\log n)$

B. $O(n)$

C. $O(n \log n)$

D. $O(n^2)$

gatecse-2013 algorithms sorting easy selection-sort

Answer key

1.61.19 Sorting: GATE CSE 2014 Set 1 | Question: 39

The minimum number of comparisons required to find the minimum and the maximum of 100 numbers is ________

gatecse-2014-set1 algorithms numerical-answers normal maximum-minimum sorting

Answer key

1.61.20 Sorting: GATE CSE 2016 Set 1 | Question: 13

The worst case running times of *Insertion sort* , *Merge sort* and *Quick sort*, respectively are:

A. $\Theta(n \log n)$, $\Theta(n \log n)$ and $\Theta(n^2)$

B. $\Theta(n^2)$, $\Theta(n^2)$ and $\Theta(n \log n)$

C. $\Theta(n^2)$, $\Theta(n \log n)$ and $\Theta(n \log n)$

D. $\Theta(n^2)$, $\Theta(n \log n)$ and $\Theta(n^2)$

gatecse-2016-set1 algorithms sorting easy

Answer key

1.61.21 Sorting: GATE CSE 2016 Set 2 | Question: 13

Assume that the algorithms considered here sort the input sequences in ascending order. If the input is already in the ascending order, which of the following are **TRUE**?

I. Quicksort runs in $\Theta(n^2)$ time
II. Bubblesort runs in $\Theta(n^2)$ time
III. Mergesort runs in $\Theta(n)$ time
IV. Insertion sort runs in $\Theta(n)$ time

A. I and II only

B. I and III only

C. II and IV only

D. I and IV only

gatecse-2016-set2 algorithms sorting time-complexity normal ambiguous

Answer key

1.61.22 Sorting: GATE CSE 2021 Set 1 | Question: 9

Consider the following array.

23	32	45	69	72	73	89	97

Which algorithm out of the following options uses the least number of comparisons (among the array elements) to sort the above array in ascending order?

A. Selection sort
B. Mergesort
C. Insertion sort
D. Quicksort using the last element as pivot

gatecse-2021-set1 algorithms sorting one-mark

Answer key☟

1.61.23 Sorting: GATE CSE 2024 | Set 1 | Question: 31

An array $[82, 101, 90, 11, 111, 75, 33, 131, 44, 93]$ is heapified. Which one of the following options represents the first three elements in the heapified array?

A. $82, 90, 101$
B. $82, 11, 93$
C. $131, 11, 93$
D. $131, 111, 90$

gatecse2024-set1 algorithms heap-sort sorting two-marks

Answer key☟

1.61.24 Sorting: GATE CSE 2024 | Set 2 | Question: 25

Let A be an array containing integer values. The distance of A is defined as the minimum number of elements in A that must be replaced with another integer so that the resulting array is sorted in non-decreasing order. The distance of the array $[2, 5, 3, 1, 4, 2, 6]$ is ___________.

gatecse2024-set2 numerical-answers algorithms sorting one-mark

Answer key☟

1.61.25 Sorting: GATE CSE 2025 | Set 2 | Question: 10

Consider an unorders list of N distinct integers.

What is the minimum number of element comaparisons required to find an integer in the list that is NOT the largest in the list?

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

gatecse2025-set2 algorithms sorting one-mark

Answer key☟

1.61.26 Sorting: GATE DS&AI 2024 | Question: 35

Consider the following sorting algorithms:

i. Bubble sort
ii. Insertion sort
iii. Selection sort

Which ONE among the following choices of sorting algorithms sorts the numbers in the array $[4, 3, 2, 1, 5]$ in increasing order after exactly two passes over the array?

A. (i) only
B. (iii) only
C. (i) and (iii) only
D. (ii) and (iii) only

gate-ds-ai-2024 algorithms sorting two-marks

Answer key☟

1.61.27 Sorting: GATE IT 2005 | Question: 59

Let a and b be two sorted arrays containing n integers each, in non-decreasing order. Let c be a sorted array containing $2n$ integers obtained by merging the two arrays a and b. Assuming the arrays are indexed starting from 0, consider the following four statements

I. $a[i] \geq b[i] \Rightarrow c[2i] \geq a[i]$
II. $a[i] \geq b[i] \Rightarrow c[2i] \geq b[i]$
III. $a[i] \geq b[i] \Rightarrow c[2i] \leq a[i]$
IV. $a[i] \geq b[i] \Rightarrow c[2i] \leq b[i]$

Which of the following is TRUE?

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

gateit-2005 algorithms sorting normal

Answer key

1.61.28 Sorting: GATE IT 2008 | Question: 43

If we use Radix Sort to sort n integers in the range $\left(n^{k/2}, n^k\right]$, for some $k > 0$ which is independent of n, the time taken would be?

A. $\Theta(n)$
B. $\Theta(kn)$
C. $\Theta(n \log n)$
D. $\Theta(n^2)$

gateit-2008 algorithms sorting normal

Answer key

1.61.29 Sorting: UGC NET CSE | December 2011 | Part 2 | Question: 2

The total number of comparisons in a bubble sort is

A. $0(\log n)$
B. $0(n \log n)$
C. $0(n)$
D. None of the above

ugcnetcse-dec2011-paper2 algorithms sorting

Answer key

1.61.30 Sorting: UGC NET CSE | December 2013 | Part 3 | Question: 38

Assuming there are n keys and each key is in the range [0, m-1]. The run time of bucket sort is

A. O(n)
B. O(n lgn)
C. O(n lgm)
D. O(n+m)

ugcnetcse-dec2013-paper3 algorithms sorting

Answer key

1.61.31 Sorting: UGC NET CSE | December 2014 | Part 2 | Question: 22

You have to sort a list L, consisting of a sorted list followed by a few 'random' elements. Which of the following sorting method would be most suitable for such a task ?

A. Bubble sort
B. Selection sort
C. Quick sort
D. Insertion sort

ugcnetcse-dec2014-paper2 algorithms data-structures sorting

Answer key

1.61.32 Sorting: UGC NET CSE | December 2015 | Part 3 | Question: 18

If there are n integers to sort, each integer had d digits and each digit is in the set $\{1, 2, \ldots, k\}$, radix sort can sort the numbers in

A. $O(d\,n\,k)$
B. $O(dn^k)$
C. $O(d+n)k)$
D. $O(d(n+k))$

ugcnetcse-dec2015-paper3 algorithms sorting

Answer key

1.61.33 Sorting: UGC NET CSE | December 2018 | Part 2 | Question: 30

The second smallest of n elements can be found with _____ comparisons in the worst case.

A. $n-1$
B. $\lg n$
C. $n+\lceil \lg n \rceil -2$
D. $\frac{3n}{2}$

ugcnetcse-dec2018-paper2 algorithms sorting

1.61.34 Sorting: UGC NET CSE | June 2019 | Part 2 | Question: 64

Which of the following is best running time to sort n integers in the range 0 to n^2-1?

A. $O(\lg n)$
B. $O(n)$
C. $O(n \lg n)$
D. $O(n^2)$

ugcnetcse-june2019-paper2 sorting

Answer key

1.61.35 Sorting: UGC NET CSE | Junet 2015 | Part 2 | Question: 48

Which of the following algorithms sort n integers, having the range 0 to (n^2-1), in ascending order in $O(n)$ time?

A. Selection sort
B. Bubble sort
C. Radix sort
D. Insertion sort

ugcnetcse-june2015-paper2 algorithms sorting

Answer key

1.62 Space Complexity (3)

1.62.1 Space Complexity: GATE CSE 2005 | Question: 81a

```
double foo(int n)
{
    int i;
    double sum;
    if(n == 0)
    {
        return 1.0;
    }
    else
    {
        sum = 0.0;
        for(i = 0; i < n; i++)
        {
            sum += foo(i);
        }
        return sum;
    }
}
```

The space complexity of the above code is?

A. $O(1)$
B. $O(n)$
C. $O(n!)$
D. n^n

gatecse-2005 algorithms recursion normal space-complexity

Answer key

1.62.2 Space Complexity: UGC NET CSE | December 2015 | Part 2 | Question: 39

An ideal sort is an in-place-sort whose additional space requirement is

A. O ($\log_2$ n)
B. O (n$\log_2$ n)
C. O (1)
D. O (n)

ugcnetcse-dec2015-paper2 algorithms sorting space-complexity

Answer key

1.62.3 Space Complexity: UGC NET CSE | October 2020 | Part 2 | Question: 73

Match List I with List II

	List I		List II
(A)	Greedy Best-First Search	(I)	Space complexity is O(d) where d=depth of the deepest optimal solution
(B)	A^*	(II)	Incomplete even if the search space is finite
(C)	Recursive Best-First Search	(III)	Optimal if optimal solution is reachable; otherwise, returns the best reachable optimal solution
(D)	SMA*	(IV)	Computation and space complexity is too high

Choose the correct answer from the options given below:

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

ugcnetcse-oct2020-paper2 space-complexity algorithms

Answer key☟

1.63 Strongly Connected Components (3)

1.63.1 Strongly Connected Components: GATE CSE 2008 | Question: 7

The most efficient algorithm for finding the number of connected components in an undirected graph on n vertices and m edges has time complexity

A. $\Theta(n)$
B. $\Theta(m)$
C. $\Theta(m+n)$
D. $\Theta(mn)$

gatecse-2008 algorithms graph-algorithms time-complexity normal strongly-connected-components

Answer key☟

1.63.2 Strongly Connected Components: GATE CSE 2018 | Question: 43

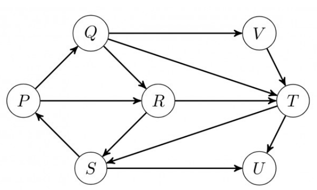
Let G be a graph with $100!$ vertices, with each vertex labelled by a distinct permutation of the numbers $1, 2, \ldots, 100$. There is an edge between vertices u and v if and only if the label of u can be obtained by swapping two adjacent numbers in the label of v. Let y denote the degree of a vertex in G, and z denote the number of connected components in G. Then, $y + 10z =$ ______.

gatecse-2018 algorithms graph-algorithms numerical-answers two-marks strongly-connected-components

Answer key☟

1.63.3 Strongly Connected Components: GATE IT 2006 | Question: 46

Which of the following is the correct decomposition of the directed graph given below into its strongly connected components?



A. $\{P, Q, R, S\}, \{T\}, \{U\}, \{V\}$
B. $\{P, Q, R, S, T, V\}, \{U\}$
C. $\{P, Q, S, T, V\}, \{R\}, \{U\}$
D. $\{P, Q, R, S, T, U, V\}$

gateit-2006 algorithms graph-algorithms normal strongly-connected-components

Answer key

1.64 Time Complexity (39)

1.64.1 Time Complexity: GATE CSE 1988 | Question: 6i

Given below is the sketch of a program that represents the path in a two-person game tree by the sequence of active procedure calls at any time. The program assumes that the payoffs are real number in a limited range; that the constant INF is larger than any positive payoff and its negation is smaller than any negative payoff and that there is a function "payoff" and that computes the payoff for any board that is a leaf. The type "boardtype" has been suitably declared to represent board positions. It is player-1's move if mode = MAX and player-2's move if mode=MIN. The type modetype = (MAX, MIN). The functions "min" and "max" find the minimum and maximum of two real numbers.

```
function search(B: boardtype; mode: modetype): real;
  var
    C:boardtype; {a child of board B}
    value:real;
  begin
    if B is a leaf then
      return (payoff(B))
    else
      begin
      if mode = MAX then value :=-INF
      else
        value:INF;
      for each child C of board B do
      if mode = MAX then
        value:=max (value, search (C, MIN))
      else
        value:=min(value, search(C, MAX))
      return(value)
      end
  end; (search)
```

Comment on the working principle of the above program. Suggest a possible mechanism for reducing the amount of search.

gate1988 normal descriptive algorithms time-complexity

Answer key

1.64.2 Time Complexity: GATE CSE 1989 | Question: 2-iii

Match the pairs in the following:

(A)	$O(\log n)$	(p)	Heapsort
(B)	$O(n)$	(q)	Depth-first search
(C)	$O(n \log n)$	(r)	Binary search
(D)	$O(n^2)$	(s)	Selection of the k^{th} smallest element in a set of n elements

gate1989 match-the-following algorithms time-complexity

Answer key

1.64.3 Time Complexity: GATE CSE 1993 | Question: 8.7

$\sum\limits_{1 \leq k \leq n} O(n)$, where $O(n)$ stands for order n is:

A. $O(n)$
B. $O(n^2)$
C. $O(n^3)$
D. $O(3n^2)$
E. $O(1.5n^2)$

gate1993 algorithms time-complexity easy

Answer key

1.64.4 Time Complexity: GATE CSE 1999 | Question: 1.13

Suppose we want to arrange the n numbers stored in any array such that all negative values occur before all positive ones. Minimum number of exchanges required in the worst case is

A. $n-1$
B. n
C. $n+1$
D. None of the above

gate1999 algorithms time-complexity normal

Answer key

1.64.5 Time Complexity: GATE CSE 1999 | Question: 1.16

If n is a power of 2, then the minimum number of multiplications needed to compute a^n is

A. $\log_2 n$
B. $\sqrt{n}$
C. $n-1$
D. n

gate1999 algorithms time-complexity normal

Answer key

1.64.6 Time Complexity: GATE CSE 1999 | Question: 11a

Consider the following algorithms. Assume, procedure A and procedure B take $O(1)$ and $O(1/n)$ unit of time respectively. Derive the time complexity of the algorithm in O-notation.

```
algorithm what (n)
begin
   if n = 1 then call A
   else
      begin
         what (n-1);
         call B(n)
      end
end.
```

gate1999 algorithms time-complexity normal descriptive

Answer key

1.64.7 Time Complexity: GATE CSE 2000 | Question: 1.15

Let S be a sorted array of n integers. Let $T(n)$ denote the time taken for the most efficient algorithm to determined if there are two elements with sum less than 1000 in S. Which of the following statement is true?

A. $T(n)$ is $O(1)$
B. $n \leq T(n) \leq n \log_2 n$
C. $n \log_2 n \leq T(n) < \frac{n}{2}$
D. $T(n) = \binom{n}{2}$

gatecse-2000 easy algorithms time-complexity

Answer key

1.64.8 Time Complexity: GATE CSE 2003 | Question: 66

The cube root of a natural number n is defined as the largest natural number m such that $(m^3 \leq n)$. The complexity of computing the cube root of n (n is represented by binary notation) is

A. $O(n)$ but not $O(n^{0.5})$
B. $O(n^{0.5})$ but not $O((\log n)^k)$ for any constant $k > 0$
C. $O((\log n)^k)$ for some constant $k > 0$, but not $O((\log \log n)^m)$ for any constant $m > 0$
D. $O((\log \log n)^k)$ for some constant $k > 0.5$, but not $O((\log \log n)^{0.5})$

gatecse-2003 algorithms time-complexity normal

Answer key

1.64.9 Time Complexity: GATE CSE 2004 | Question: 39

Two matrices M_1 and M_2 are to be stored in arrays A and B respectively. Each array can be stored either in row-major or column-major order in contiguous memory locations. The time complexity of an algorithm to compute $M_1 \times M_2$ will be

A. best if A is in row-major, and B is in column-major order
B. best if both are in row-major order
C. best if both are in column-major order
D. independent of the storage scheme

gatecse-2004 algorithms time-complexity easy

Answer key☟

1.64.10 Time Complexity: GATE CSE 2004 | Question: 82

Let $A[1, \dots, n]$ be an array storing a bit (1 or 0) at each location, and $f(m)$ is a function whose time complexity is $\Theta(m)$. Consider the following program fragment written in a C like language:

```
counter = 0;
for (i=1; i<=n; i++)
{
    if (a[i] == 1) counter++;
    else {f (counter); counter = 0;}
}
```

The complexity of this program fragment is

A. $\Omega(n^2)$
B. $\Omega(n \log n)$ and $O(n^2)$
C. $\Theta(n)$
D. $o(n)$

gatecse-2004 algorithms time-complexity normal

Answer key☟

1.64.11 Time Complexity: GATE CSE 2006 | Question: 15

Consider the following C-program fragment in which i, j and n are integer variables.

```
for( i = n, j = 0; i > 0; i /= 2, j +=i );
```

Let $val(j)$ denote the value stored in the variable j after termination of the for loop. Which one of the following is true?

A. $val(j) = \Theta(\log n)$
B. $val(j) = \Theta(\sqrt{n})$
C. $val(j) = \Theta(n)$
D. $val(j) = \Theta(n \log n)$

gatecse-2006 algorithms normal time-complexity

Answer key☟

1.64.12 Time Complexity: GATE CSE 2007 | Question: 15, ISRO2016-26

Consider the following segment of C-code:

```
int j, n;
j = 1;
while (j <= n)
   j = j * 2;
```

The number of comparisons made in the execution of the loop for any $n > 0$ is:

A. $\lceil \log_2 n \rceil + 1$
B. n
C. $\lceil \log_2 n \rceil$
D. $\lfloor \log_2 n \rfloor + 1$

gatecse-2007 algorithms time-complexity normal isro2016

Answer key☟

1.64.13 Time Complexity: GATE CSE 2007 | Question: 45

What is the time complexity of the following recursive function?

```
int  DoSomething (int n) {
   if (n <= 2)
      return 1;
   else
      return (DoSomething (floor (sqrt(n))) + n);
}
```

A. $\Theta(n^2)$

B. $\Theta(n \log_2 n)$

C. $\Theta(\log_2 n)$

D. $\Theta(\log_2 \log_2 n)$

gatecse-2007 algorithms time-complexity normal

Answer key

1.64.14 Time Complexity: GATE CSE 2007 | Question: 50

An array of n numbers is given, where n is an even number. The maximum as well as the minimum of these n numbers needs to be determined. Which of the following is **TRUE** about the number of comparisons needed?

A. At least $2n - c$ comparisons, for some constant c are needed.
B. At most $1.5n - 2$ comparisons are needed.
C. At least $n \log_2 n$ comparisons are needed
D. None of the above

gatecse-2007 algorithms time-complexity easy

Answer key

1.64.15 Time Complexity: GATE CSE 2007 | Question: 51

Consider the following C program segment:

```
int IsPrime (n)
  {
     int i, n;
     for (i=2; i<=sqrt(n);i++)
        if(n%i == 0)
           {printf("Not Prime \n"); return 0;}
     return 1;
  }
```

Let $T(n)$ denote number of times the for loop is executed by the program on input n. Which of the following is TRUE?

A. $T(n) = O(\sqrt{n})$ and $T(n) = \Omega(\sqrt{n})$

B. $T(n) = O(\sqrt{n})$ and $T(n) = \Omega(1)$

C. $T(n) = O(n)$ and $T(n) = \Omega(\sqrt{n})$

D. None of the above

gatecse-2007 algorithms time-complexity normal

Answer key

1.64.16 Time Complexity: GATE CSE 2008 | Question: 40

The minimum number of comparisons required to determine if an integer appears more than $\frac{n}{2}$ times in a sorted array of n integers is

A. $\Theta(n)$

B. $\Theta(\log n)$

C. $\Theta(\log^* n)$

D. $\Theta(1)$

gatecse-2008 normal algorithms time-complexity

Answer key

1.64.17 Time Complexity: GATE CSE 2008 | Question: 47

We have a binary heap on n elements and wish to insert n more elements (not necessarily one after another) into this heap. The total time required for this is

A. $\Theta(\log n)$ B. $\Theta(n)$ C. $\Theta(n \log n)$ D. $\Theta(n^2)$

gatecse-2008 algorithms time-complexity normal

Answer key

1.64.18 Time Complexity: GATE CSE 2008 | Question: 74

Consider the following C functions:

```
int f1 (int n)
{
    if(n == 0 || n == 1)
        return n;
    else
        return (2 * f1(n-1) + 3 * f1(n-2));
}
int f2(int n)
{
    int i;
    int X[N], Y[N], Z[N];
    X[0] = Y[0] = Z[0] = 0;
    X[1] = 1; Y[1] = 2; Z[1] = 3;
    for(i = 2; i <= n; i++){
        X[i] = Y[i-1] + Z[i-2];
        Y[i] = 2 * X[i];
        Z[i] = 3 * X[i];
    }
    return X[n];
}
```

The running time of $f1(n)$ and $f2(n)$ are

A. $\Theta(n)$ and $\Theta(n)$
B. $\Theta(2^n)$ and $\Theta(n)$
C. $\Theta(n)$ and $\Theta(2^n)$
D. $\Theta(2^n)$ and $\Theta(2^n)$

gatecse-2008 algorithms time-complexity normal

Answer key

1.64.19 Time Complexity: GATE CSE 2008 | Question: 75

Consider the following C functions:

```
int f1 (int n)
{
    if(n == 0 || n == 1)
        return n;
    else
        return (2 * f1(n-1) + 3 * f1(n-2));
}
int f2(int n)
{
    int i;
    int X[N], Y[N], Z[N];
    X[0] = Y[0] = Z[0] = 0;
    X[1] = 1; Y[1] = 2; Z[1] = 3;
    for(i = 2; i <= n; i++){
        X[i] = Y[i-1] + Z[i-2];
        Y[i] = 2 * X[i];
        Z[i] = 3 * X[i];
    }
    return X[n];
}
```

$f1(8)$ and $f2(8)$ return the values

A. 1661 and 1640 B. 59 and 59 C. 1640 and 1640 D. 1640 and 1661

gatecse-2008 normal algorithms time-complexity

Answer key

1.64.20 Time Complexity: GATE CSE 2010 | Question: 12

Two alternative packages A and B are available for processing a database having 10^k records. Package A requires $0.0001n^2$ time units and package B requires $10n\log_{10} n$ time units to process n records. What is the smallest value of k for which package B will be preferred over A?

A. 12 B. 10 C. 6 D. 5

gatecse-2010 algorithms time-complexity easy

Answer key

1.64.21 Time Complexity: GATE CSE 2014 Set 1 | Question: 42

Consider the following pseudo code. What is the total number of multiplications to be performed?

```
D = 2
for i = 1 to n do
   for j = i to n do
      for k = j + 1 to n do
         D = D * 3
```

A. Half of the product of the 3 consecutive integers.
B. One-third of the product of the 3 consecutive integers.
C. One-sixth of the product of the 3 consecutive integers.
D. None of the above.

gatecse-2014-set1 algorithms time-complexity normal

Answer key

1.64.22 Time Complexity: GATE CSE 2015 Set 1 | Question: 40

An algorithm performs $(\log N)^{\frac{1}{2}}$ find operations , N insert operations, $(\log N)^{\frac{1}{2}}$ delete operations, and $(\log N)^{\frac{1}{2}}$ decrease-key operations on a set of data items with keys drawn from a linearly ordered set . For a delete operation, a pointer is provided to the record that must be deleted . For the decrease-key operation, a pointer is provided to the record that has its key decreased. Which one of the following data structures is the most suited for the algorithm to use, if the goal is to achieve the best total asymptotic complexity considering all the operations?

A. Unsorted array
B. Min - heap
C. Sorted array
D. Sorted doubly linked list

gatecse-2015-set1 algorithms data-structures normal time-complexity

Answer key

1.64.23 Time Complexity: GATE CSE 2015 Set 2 | Question: 22

An unordered list contains n distinct elements. The number of comparisons to find an element in this list that is neither maximum nor minimum is

A. $\Theta(n \log n)$ B. $\Theta(n)$ C. $\Theta(\log n)$ D. $\Theta(1)$

gatecse-2015-set2 algorithms time-complexity easy

Answer key

1.64.24 Time Complexity: GATE CSE 2017 Set 2 | Question: 03

Match the algorithms with their time complexities:

Algorithms	Time Complexity
P. Tower of Hanoi with n disks	i. $\Theta(n^2)$
Q. Binary Search given n sorted numbers	ii. $\Theta(n \log n)$
R. Heap sort given n numbers at the worst case	iii. $\Theta(2^n)$
S. Addition of two $n \times n$ matrices	iv. $\Theta(\log n)$

A. $P \to (iii) \quad Q \to (iv) \quad r \to (i) \quad S \to (ii)$
B. $P \to (iv) \quad Q \to (iii) \quad r \to (i) \quad S \to (ii)$
C. $P \to (iii) \quad Q \to (iv) \quad r \to (ii) \quad S \to (i)$
D. $P \to (iv) \quad Q \to (iii) \quad r \to (ii) \quad S \to (i)$

gatecse-2017-set2 algorithms time-complexity match-the-following easy

Answer key

1.64.25 Time Complexity: GATE CSE 2017 Set 2 | Question: 38

Consider the following C function

```
int fun(int n) {
   int i, j;
   for(i=1; i<=n; i++) {
      for (j=1; j<n; j+=i) {
         printf("%d %d", i, j);
      }
   }
}
```

Time complexity of fun in terms of Θ notation is

A. $\Theta(n\sqrt{n})$
B. $\Theta(n^2)$
C. $\Theta(n \log n)$
D. $\Theta(n^2 \log n)$

gatecse-2017-set2 algorithms time-complexity

Answer key

1.64.26 Time Complexity: GATE CSE 2019 | Question: 37

There are n unsorted arrays: $A_1, A_2, \dots, A_n$. Assume that n is odd.Each of $A_1, A_2, \dots, A_n$ contains n distinct elements. There are no common elements between any two arrays. The worst-case time complexity of computing the median of the medians of $A_1, A_2, \dots, A_n$ is

A. $O(n)$
B. $O(n \log n)$
C. $O(n^2)$
D. $\Omega(n^2 \log n)$

gatecse-2019 algorithms time-complexity two-marks

Answer key

1.64.27 Time Complexity: GATE CSE 2024 | Set 1 | Question: 7

Given an integer array of size N, we want to check if the array is sorted (in either ascending or descending order). An algorithm solves this problem by making a single pass through the array and comparing each element of the array only with its adjacent elements. The worst-case time complexity of this algorithm is

A. both $\mathrm{O}(N)$ and $\Omega(N)$
B. $\mathrm{O}(N)$ but not $\Omega(N)$
C. $\Omega(N)$ but not $\mathrm{O}(N)$
D. neither $\mathrm{O}(N)$ nor $\Omega(N)$

gatecse2024-set1 algorithms time-complexity one-mark

Answer key

1.64.28 Time Complexity: GATE IT 2007 | Question: 17

Exponentiation is a heavily used operation in public key cryptography. Which of the following options is the tightest upper bound on the number of multiplications required to compute $b^n \bmod m, 0 \leq b, n \leq m$?

A. $O(\log n)$
B. $O(\sqrt{n})$

C. $O\left(\frac{n}{\log n}\right)$

D. $O(n)$

gateit-2007 algorithms time-complexity normal

Answer key

1.64.29 Time Complexity: GATE IT 2007 | Question: 81

Let $P_1, P_2, \ldots, P_n$ 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 among all $n(n-1)/2$ lines.

The time complexity of the best algorithm for finding P_a and P_b is

A. $\Theta\left(n\right)$

B. $\Theta\left(n \log n\right)$

C. $\Theta\left(n \log^2 n\right)$

D. $\Theta\left(n^2\right)$

gateit-2007 algorithms time-complexity normal

Answer key

1.64.30 Time Complexity: UGC NET CSE | December 2006 | Part 2 | Question: 21

Which algorithm has the same average, worst case and best case time?

A. Binary search

B. Maximum of n number

C. Quick sort

D. Fibonacci search

algorithms time-complexity ugcnetcse-dec2006-paper2

Answer key

1.64.31 Time Complexity: UGC NET CSE | December 2010 | Part 2 | Question: 23

The time complexity to build a heap of n elements is

A. $0(1)$

B. $0(\text{lgn})$

C. $0(\text{n})$

D. $0(\text{nlgn})$

ugcnetcse-dec2010-paper2 algorithms time-complexity

Answer key

1.64.32 Time Complexity: UGC NET CSE | December 2012 | Part 3 | Question: 11

The time complexities of some standard graph algorithms are given. Match each algorithm with its time complexity ? (n and m are no. of nodes and edges respectively)

a.	Bellman Ford algorithm	i.	$O(m \log n)$
b.	Kruskals algorithm	ii.	$O(n^3)$
c.	Floyd Warshall algorithm	iii.	$O(mn)$
d.	Topological sorting	iv.	$O(n+m)$

Codes :

A. a-iii, b-i, c-ii, d-iv

B. a-ii, b-iv, c-iii, d-i

C. a-iii, b-iv, c-i, d-ii

D. a-ii, b-i, c-iii, d-iv

ugcnetcse-dec2012-paper3 algorithms time-complexity

Answer key

1.64.33 Time Complexity: UGC NET CSE | December 2014 | Part 3 | Question: 32

Match the following :

	List – I		List – II
a.	Bucket sort	i.	$O(n^3 \lg n)$
b.	Matrix chain multiplication	ii.	$O(n^3)$
c.	Huffman codes	iii.	$O(n \lg n)$
d.	All pairs shortest paths	iv.	$O(n)$

Codes :

A. a-iv, b-ii, c-i, d-iii
B. a-ii, b-iv, c-i, d-iii
C. a-iv, b-ii, c-iii, d-i
D. a-iii, b-ii, c-iv, d-i

ugcnetcse-dec2014-paper3 algorithms time-complexity

Answer key

1.64.34 Time Complexity: UGC NET CSE | Junet 2015 | Part 3 | Question: 33

Which of the following is asymptotically smaller?

A. lg(lg*n)
B. lg*(lgn)
C. lg(n!)
D. lg*(n!)

algorithms ugcnetcse-june2015-paper3 time-complexity

Answer key

1.64.35 Time Complexity: UGC NET CSE | October 2020 | Part 2 | Question: 25

If algorithm A and another algorithm B take $\log_2(n)$ and $\sqrt{n}$ microseconds, respectively, to solve a problem, then the largest size n of a problem these algorithms can solve, respectively, in one second are ______ and ______.

A. 2^{10^n} and 10^6
B. 2^{10^n} and 10^{12}
C. 2^{10^n} and 6.10^6
D. 2^{10^n} and 6.10^{12}

ugcnetcse-oct2020-paper2 algorithms time-complexity

Answer key

1.64.36 Time Complexity: UGC NET CSE | October 2020 | Part 2 | Question: 52

The running time of an algorithm is $O(g(n))$ if and only if

a. its worst-case running time is $O(g(n))$ and its best-case running time is $\Omega(g(n)) \cdot (O = \ big\, O)$
b. its worst-case running time is $\Omega(g(n))$ and its best-case running time is $O(g(n)) \cdot (O = \ big\, O)$
c. $O(g(n)) = \Omega(g(n)) (O = big\, O)$
d. $O(g(n)) \cap \omega(g(n))$ is non-empty set, $(o = \ small\, o)$

ugcnetcse-oct2020-paper2 algorithms time-complexity

Answer key

1.64.37 Time Complexity: UGC NET CSE | October 2022 | Part 1 | Question: 87

Consider the following algorithms and their running times :

Algorithms	Complexities
(A) Breadth First Search	(I) $\theta(v+E)$
(B) Rabin-Karp Algorithm	(II) $O(v+E)$
(C) Depth-First Search	(I I I) $\theta((n-m-1)m)$
(D) Heap sort (worst case)	(IV) $O\left(n^2\right)$
(E) Quick sort (worst case)	(V) $O(n \lg n)$

Which one of the following is correct?

A. (A)-(III), (B)-(II), (C)-(I), (D)-(IV), (E)-(V)
B. (A)-(II), (B)-(III), (C)-(I), (D)-(IV), (E)-(V)
C. (A)-(II), (B)-(III), (C)-(I), (D)-(V), (E)-(IV)

D. (A)-(III), (B)-(I), (C)-(II), (D)-(IV), (E)-(V)

ugcnetcse-oct2022-paper1 algorithms time-complexity match-the-following

Answer key

1.64.38 Time Complexity: UGC NET CSE | September 2013 | Part 2 | Question: 9

The amortized time complexity to perform ____ operation(s) in Splay trees is O(lg n)

A. Search
B. Search and Insert
C. Search and Delete
D. Search, Insert and Delete

ugcnetsep2013ii algorithms time-complexity

Answer key

1.64.39 Time Complexity: UGC NET CSE | September 2013 | Part 3 | Question: 40

The time complexity of an efficient algorithm to find the longest monotonically increasing subsequence of n numbers is

A. $\mathrm{O}(\mathrm{n})$
B. $\mathrm{O}(\mathrm{n} \lg \mathrm{n})$
C. $\mathrm{O}(\mathrm{n}^2)$
D. None of the above

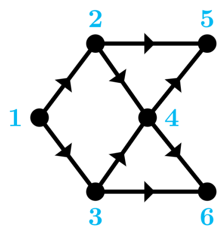
algorithms time-complexity ugcnetcse-sep2013-paper3

Answer key

1.65 Topological Sort (5)

1.65.1 Topological Sort: GATE CSE 2007 | Question: 5

Consider the DAG with $V = \{1, 2, 3, 4, 5, 6\}$ shown below.



Which of the following is not a topological ordering?

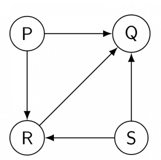
A. 1 2 3 4 5 6
B. 1 3 2 4 5 6
C. 1 3 2 4 6 5
D. 3 2 4 1 6 5

gatecse-2007 algorithms graph-algorithms topological-sort easy

Answer key

1.65.2 Topological Sort: GATE CSE 2014 Set 1 | Question: 13

Consider the directed graph below given.



Which one of the following is **TRUE**?

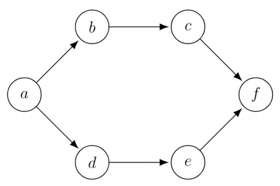
A. The graph does not have any topological ordering.
B. Both PQRS and SRQP are topological orderings.
C. Both PSRQ and SPRQ are topological orderings.
D. PSRQ is the only topological ordering.

gatecse-2014-set1 graph-algorithms easy topological-sort

Answer key☟

1.65.3 Topological Sort: GATE CSE 2016 Set 1 | Question: 11

Consider the following directed graph:



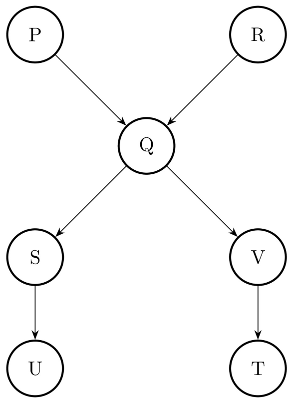
The number of different topological orderings of the vertices of the graph is _____________.

gatecse-2016-set1 algorithms graph-algorithms normal numerical-answers topological-sort

Answer key☟

1.65.4 Topological Sort: GATE DS&AI 2024 | Question: 41

Consider the directed acyclic graph (DAG) below:



Which of the following is/are valid vertex orderings that can be obtained from a topological sort of the DAG?

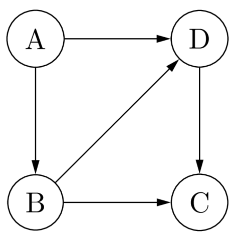
A. P Q R S T U V
B. P R Q V S U T
C. P Q R S V U T
D. P R Q S V T U

gate-ds-ai-2024 algorithms topological-sort directed-acyclic-graph multiple-selects two-marks

Answer key☟

1.65.5 Topological Sort: UGC NET CSE | December 2005 | Part 2 | Question: 23

Consider the graph, which of the following is a valid topological sorting?



A. ABCD
B. BACD
C. BADC
D. ABDC

ugcnetcse-dec2005-paper2 algorithms topological-sort

Answer key☟

1.66 Tree (3)

1.66.1 Tree: UGC NET CSE | December 2015 | Part 2 | Question: 37

The number of disk pages access in B-tree search, where h is height, n is the number of keys and t is the minimum degree, is

A. $\theta(\log_n h * t)$
B. $\theta(\log_t n * h)$
C. $\theta(\log_h n)$
D. $\theta(\log_t n)$

ugcnetcse-dec2015-paper2 algorithms tree

Answer key

1.66.2 Tree: UGC NET CSE | January 2017 | Part 3 | Question: 32

Any decision tree that sorts n elements has height ____

A. $\Omega(\lg n)$
B. $\Omega(n)$
C. $\Omega(n \lg n)$
D. $\Omega(n^2)$

ugcnetcse-jan2017-paper3 algorithms tree

Answer key

1.66.3 Tree: UGC NET CSE | June 2011 | Part 2 | Question: 21

The number of different trees with 8 nodes is

A. 256
B. 255
C. 248
D. None of these

ugcnetcse-june2011-paper2 algorithms tree

Answer key

1.67 Tree Search Algorithm (2)

1.67.1 Tree Search Algorithm: UGC NET CSE | Junet 2015 | Part 3 | Question: 58

Which of the following statements is true for Branch-and-Bound search?

A. Underestimates of remaining distance may cause deviation from optimal path
B. Overestimates can't cause right path to be overlooked
C. Dynamic programming principle can be used to discard redundant partial paths
D. All of the above

ugcnetcse-june2015-paper3 algorithms branch-and-bound tree-search-algorithm graph-search

Answer key

1.67.2 Tree Search Algorithm: UGC NET CSE | September 2013 | Part 3 | Question: 2

$\alpha - \beta$ cutoffs are applied to

A. Depth first search
B. Best first search
C. Minimax search
D. Breadth first search

ugcnetcse-sep2013-paper3 algorithms graph-search tree-search-algorithm

Answer key

1.68 Tree Traversal (1)

1.68.1 Tree Traversal: UGC NET CSE | Junet 2015 | Part 2 | Question: 4

Consider the following statements:

i. Depth-first search is used to traverse a rooted tree
ii. Pre-order, Post-order and Inorder are used to list the vertices of an ordered rooted tree.
iii. Huffman's algorithm is used to find an optimal binary tree with given weights
iv. Topological sorting provides a labelling such that the parents have larger labels than their children

Which one of the above statements is true?

A. i and ii
B. iii and iv
C. i, ii, and iii
D. i, ii, iii, and iv

ugcnetcse-june2015-paper2 tree tree-traversal

Answer key

1.69 Vertex Cover (1)

1.69.1 Vertex Cover: UGC NET CSE | October 2022 | Part 1 | Question: 56

Consider the following statements of approximation algorithm :

Statement I: Vertex-cover is a polynomial time 2-approximation algorithm.

Statement II: TSP-tour is a polynomial time 3-approximation algorithm for travelling salesman problem with the triangle inequality.

Which of the following is correct?

A. Statement I true and Statement II false
B. Statement I and Statement II true
C. Statement I false and Statement II true
D. Statement I and Statement II false

ugcnetcse-oct2022-paper1 algorithms vertex-cover

Answer Keys

1.0.1	C	1.0.2	D	1.0.3	D	1.0.4	D	1.0.5	A
1.0.6	A	1.0.7	A	1.1.1	C	1.2.1	N/A	1.2.2	N/A
1.2.3	B	1.2.4	C	1.2.5	12	1.2.6	29	1.2.7	A;C
1.2.8	B	1.2.9	D	1.2.10	C	1.2.11	D	1.2.12	B
1.2.13	B	1.2.14	B	1.2.15	C	1.2.16	D	1.2.17	B
1.3.1	N/A	1.3.2	B	1.3.3	C	1.3.4	A	1.3.5	B
1.3.6	A	1.3.7	C	1.3.8	C	1.3.9	C	1.3.10	A
1.4.1	B	1.5.1	C	1.5.2	D	1.6.1	B	1.6.2	C
1.6.3	C	1.7.1	A;B	1.7.2	B	1.7.3	X	1.7.4	D
1.7.5	B	1.7.6	A	1.7.7	C	1.7.8	C	1.7.9	D
1.7.10	A	1.7.11	C	1.7.12	C	1.7.13	D	1.7.14	B
1.7.15	D	1.7.16	A	1.7.17	A;C	1.7.18	A;D	1.7.19	A
1.7.20	D	1.7.21	A	1.7.22	B	1.7.23	B	1.7.24	X
1.7.25	C	1.7.26	B	1.7.27	B	1.7.28	B	1.7.29	D
1.8.1	D	1.8.2	C	1.9.1	B	1.9.2	C	1.9.3	X
1.10.1	A	1.10.2	B	1.11.1	B	1.11.2	C	1.11.3	A
1.12.1	B	1.13.1	D	1.13.2	C	1.13.3	A	1.13.4	C
1.13.5	A	1.13.6	C	1.13.7	D	1.14.1	D	1.15.1	N/A
1.16.1	D	1.16.2	D	1.16.3	C	1.17.1	B	1.18.1	C
1.19.1	C	1.19.2	A	1.19.3	B	1.19.4	D	1.19.5	C
1.20.1	N/A	1.20.2	B	1.20.3	D	1.20.4	A	1.20.5	D
1.20.6	D	1.20.7	C	1.20.8	C	1.21.1	75:75	1.22.1	10:10
1.22.2	C	1.23.1	B	1.23.2	C	1.23.3	C	1.23.4	B

1.23.5	B
1.23.10	C
1.25.1	B
1.27.4	A
1.27.9	929 : 929
1.27.14	B
1.28.4	C
1.28.9	B
1.28.14	A
1.28.19	A
1.28.24	B
1.29.5	16
1.30.5	B
1.31.2	A
1.31.7	C
1.32.3	C
1.32.8	N/A
1.32.13	D
1.32.18	D
1.32.23	B
1.32.28	51
1.32.33	15 : 15
1.32.38	C
1.35.1	B
1.39.1	C
1.39.6	D
1.40.4	D
1.42.1	B;D;E
1.42.6	C
1.42.11	D
1.42.16	B
1.42.21	995
1.42.26	D
1.42.31	24
1.42.36	B
1.43.1	A
1.47.2	C
1.47.7	D
1.49.1	C

1.23.6	A
1.23.11	4
1.26.1	B
1.27.5	A
1.27.10	A
1.27.15	B
1.28.5	D
1.28.10	19
1.28.15	5040
1.28.20	D
1.29.1	A
1.30.1	B
1.30.6	C
1.31.3	D
1.31.8	B
1.32.4	A
1.32.9	C
1.32.14	C
1.32.19	B
1.32.24	A
1.32.29	0
1.32.34	D
1.33.1	D
1.35.2	C
1.39.2	1500
1.39.7	C
1.40.5	B
1.42.2	N/A
1.42.7	N/A
1.42.12	D
1.42.17	C
1.42.22	A
1.42.27	99
1.42.32	9
1.42.37	C
1.44.1	C
1.47.3	C
1.47.8	D
1.49.2	A

1.23.7	34
1.23.12	B
1.27.1	N/A
1.27.6	B
1.27.11	C
1.28.1	N/A
1.28.6	D
1.28.11	D
1.28.16	C
1.28.21	D
1.29.2	B
1.30.2	N/A
1.30.7	D
1.31.4	225
1.31.9	C
1.32.5	N/A
1.32.10	D
1.32.15	C
1.32.20	C
1.32.25	9
1.32.30	D
1.32.35	C
1.34.1	A
1.36.1	D
1.39.3	C
1.40.1	B
1.40.6	B
1.42.3	2
1.42.8	B
1.42.13	D
1.42.18	X
1.42.23	7
1.42.28	3 : 3
1.42.33	5:5
1.42.38	C
1.45.1	A
1.47.4	B
1.47.9	C
1.50.1	C

1.23.8	150
1.23.13	B
1.27.2	B
1.27.7	A
1.27.12	D
1.28.2	C
1.28.7	C
1.28.12	31
1.28.17	60
1.28.22	D
1.29.3	D
1.30.3	13
1.30.8	B
1.31.5	B
1.32.1	N/A
1.32.6	C
1.32.11	A
1.32.16	D
1.32.21	B
1.32.26	A
1.32.31	81
1.32.36	C
1.34.2	D
1.37.1	A
1.39.4	C
1.40.2	B
1.41.1	C
1.42.4	N/A
1.42.9	C
1.42.14	D
1.42.19	6
1.42.24	B
1.42.29	C
1.42.34	A
1.42.39	B
1.46.1	N/A
1.47.5	B
1.47.10	C
1.51.1	D

1.23.9	C
1.24.1	A
1.27.3	D
1.27.8	A;B
1.27.13	A
1.28.3	C
1.28.8	C
1.28.13	D
1.28.18	6:6
1.28.23	B
1.29.4	A
1.30.4	C
1.31.1	2.33
1.31.6	A
1.32.2	N/A
1.32.7	C
1.32.12	B
1.32.17	D
1.32.22	D
1.32.27	D
1.32.32	1023 : 1023
1.32.37	D
1.34.3	A;C
1.38.1	B
1.39.5	B
1.40.3	B
1.41.2	358
1.42.5	N/A
1.42.10	B
1.42.15	B
1.42.20	69
1.42.25	4
1.42.30	A;B;C
1.42.35	C
1.42.40	D
1.47.1	C
1.47.6	B
1.48.1	D
1.51.2	C

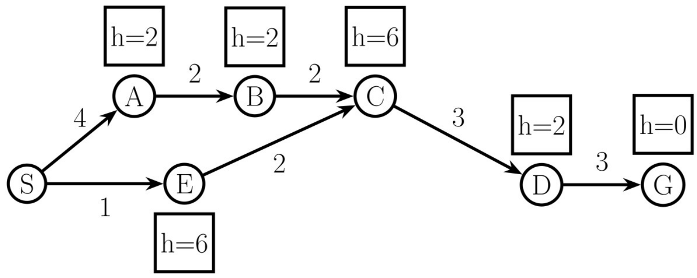
1.51.3	A;C	1.52.1	A	1.53.1	C	1.53.2	N/A	1.53.3	N/A
1.53.4	C	1.53.5	C	1.53.6	B	1.53.7	B	1.53.8	B
1.53.9	C	1.53.10	A	1.53.11	B	1.53.12	A	1.53.13	0.08
1.53.14	0	1.53.15	C	1.54.1	N/A	1.54.2	N/A	1.54.3	N/A
1.54.4	N/A	1.54.5	N/A	1.54.6	N/A	1.54.7	N/A	1.54.8	B
1.54.9	A	1.54.10	N/A	1.54.11	B	1.54.12	N/A	1.54.13	B
1.54.14	C	1.54.15	B	1.54.16	D	1.54.17	A	1.54.18	B
1.54.19	D	1.54.20	X	1.54.21	A	1.54.22	D	1.54.23	A
1.54.24	A	1.54.25	B	1.54.26	2.32 : 2.33	1.54.27	B	1.54.28	A
1.54.29	C	1.54.30	C	1.54.31	A	1.54.32	A	1.54.33	B
1.54.34	C	1.54.35	A	1.54.36	C	1.54.37	C	1.54.38	A
1.54.39	D	1.54.40	C	1.54.41	C	1.55.1	C	1.55.2	A
1.55.3	10230	1.55.4	60 : 60	1.55.5	B	1.55.6	B	1.56.1	B
1.57.1	C	1.58.1	N/A	1.58.2	C	1.58.3	A	1.58.4	C
1.58.5	A	1.58.6	5	1.58.7	B;C;D	1.59.1	C	1.60.1	N/A
1.60.2	B	1.60.3	D	1.60.4	A	1.60.5	C	1.60.6	B
1.60.7	C	1.60.8	A;C;D	1.60.9	C	1.60.10	C	1.60.11	B
1.60.12	D	1.60.13	D	1.61.1	N/A	1.61.2	A	1.61.3	7
1.61.4	N/A	1.61.5	D	1.61.6	N/A	1.61.7	N/A	1.61.8	B
1.61.9	B	1.61.10	N/A	1.61.11	N/A	1.61.12	B	1.61.13	A
1.61.14	C	1.61.15	A	1.61.16	A	1.61.17	C	1.61.18	B
1.61.19	147.1 : 148.1	1.61.20	D	1.61.21	D	1.61.22	C	1.61.23	D
1.61.24	3	1.61.25	A	1.61.26	B	1.61.27	C	1.61.28	C
1.61.29	D	1.61.30	D	1.61.31	D	1.61.32	D	1.61.33	C
1.61.34	B	1.61.35	C	1.62.1	B	1.62.2	C	1.62.3	A
1.63.1	C	1.63.2	109	1.63.3	B	1.64.1	N/A	1.64.2	N/A
1.64.3	B;C;D;E	1.64.4	D	1.64.5	A	1.64.6	N/A	1.64.7	A
1.64.8	C	1.64.9	D	1.64.10	C	1.64.11	C	1.64.12	D
1.64.13	D	1.64.14	B	1.64.15	B	1.64.16	B	1.64.17	B
1.64.18	B	1.64.19	C	1.64.20	C	1.64.21	C	1.64.22	A
1.64.23	D	1.64.24	C	1.64.25	C	1.64.26	C	1.64.27	A
1.64.28	A	1.64.29	B	1.64.30	B	1.64.31	C	1.64.32	A
1.64.33	C	1.64.34	A	1.64.35	B	1.64.36	X	1.64.37	N/A
1.64.38	D	1.64.39	B	1.65.1	D	1.65.2	C	1.65.3	6
1.65.4	B;D	1.65.5	D	1.66.1	D	1.66.2	C	1.66.3	TBA
1.67.1	C	1.67.2	C	1.68.1	D	1.69.1	A		

2 Artificial Intelligence (84)

2.1 A Star Algorithm (1)

2.1.1 A Star Algorithm: GATE DA 2025 | Question: 34

The state graph shows the action cost along the edges and the heuristic function h associated with each state.



Suppose A^* algorithm is applied on this state graph using priority queue to store the frontier. In what sequence are the nodes expanded?

A. $\mathrm{S}, \mathrm{A}, \mathrm{E}, \mathrm{C}, \mathrm{B}, \mathrm{D}, \mathrm{G}$
B. $\mathrm{S}, \mathrm{E}, \mathrm{A}, \mathrm{C}, \mathrm{B}, \mathrm{D}, \mathrm{G}$
C. $\mathrm{S}, \mathrm{A}, \mathrm{E}, \mathrm{B}, \mathrm{C}, \mathrm{D}, \mathrm{G}$
D. $\mathrm{S}, \mathrm{A}, \mathrm{B}, \mathrm{E}, \mathrm{C}, \mathrm{D}, \mathrm{G}$

gateda-2025 artificial-intelligence a-star-algorithm two-marks

2.2 Admissible Heuristic (1)

2.2.1 Admissible Heuristic: GATE DS&AI 2024 | Question: 13

Let h_1 and h_2 be two admissible heuristics used in A^* search.

Which **ONE** of the following expressions is always an admissible heuristic?

A. $h_1 + h_2$
B. $h_1 \times h_2$
C. $h_1/h_2, (h_2 \neq 0)$
D. $|h_1 - h_2|$

gate-ds-ai-2024 artificial-intelligence admissible-heuristic one-mark

Answer key☟

2.3 Adversarial Search (1)

2.3.1 Adversarial Search: GATE DS&AI 2024 | Question: 15

Consider the following statement:

In adversarial search, $\alpha - \beta$ pruning can be applied to game trees of any depth where α is the **(m)** value choice we have formed so far at any choice point along the path for the MAX player and β is the **(n)** value choice we have formed so far at any choice point along the path for the MIN player.

Which ONE of the following choices of $(\mathbf{m})$ and $(\mathbf{n})$ and makes the above statement valid?

A. $(\mathbf{m}) =$ highest,$(\mathbf{n}) =$ highest
B. $(\mathbf{m}) =$ lowest,$(\mathbf{n}) =$ highest
C. $(\mathbf{m}) =$ highest,$(\mathbf{n}) =$ lowest
D. $(\mathbf{m}) =$ lowest, $(\mathbf{n}) =$ lowest

gate-ds-ai-2024 artificial-intelligence adversarial-search one-mark

Answer key

2.4 Agents (2)

2.4.1 Agents: UGC NET CSE | December 2018 | Part 2 | Question: 91

An agent can improve its performance by

A. Perceiving
B. Responding
C. Learning
D. Observing

ugcnetcse-dec2018-paper2 artificial-intelligence agents

Answer key

2.4.2 Agents: UGC NET CSE | July 2018 | Part 2 | Question: 72

In artificial Intelligence (AI), a simple reflex agent selects actions on the basis of ___

A. current percept, completely ignoring rest of the percept history
B. rest of the percept history, completely ignoring the current percept
C. both current percept and complete percept history
D. both current percept and just previous percept

ugcnetcse-july2018-paper2 artificial-intelligence agents

Answer key

2.5 Algorithm Design (2)

2.5.1 Algorithm Design: UGC NET CSE | December 2018 | Part 2 | Question: 96

Consider the following statements related to $AND - OR$ Search algorithm.

S1 : A solution is a subtree that has a goal node at every leaf.

S2 : OR nodes are analogous to the branching in a deterministic environment.

S3 : AND nodes are analogous to the branching in a non-deterministic environment.

Which of the following is true referencing the above statements ?

Choose the correct answer from the code given below :

$Code$:

A. $S1\text{–}False, S2\text{–}True, S3\text{–}True$
B. $S1\text{–}True, S2\text{–}True, S3\text{–}False$
C. $S1\text{–}True, S2\text{–}True, S3\text{–}True$
D. $S1\text{–}False, S2\text{–}True, S3\text{–}False$

ugcnetcse-dec2018-paper2 artificial-intelligence algorithm-design

Answer key

2.5.2 Algorithm Design: UGC NET CSE | October 2022 | Part 1 | Question: 94

In a game playing search tree, upto which depth $\alpha - \beta$ pruning can be applied?

(A) Root (0) level
(B) 6 level
(C) 8 level
(D) Depends on utility value in a breadth first order

Choose the correct answer from the options given below :

A. (B) and (C) only
B. (A) and (B) only
C. (A) (B) and (C) only
D. (A) and (D) only

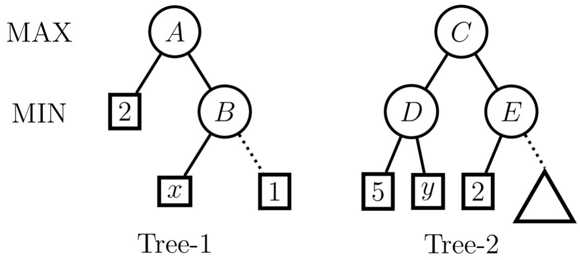
ugcnetcse-oct2022-paper1 artificial-intelligence algorithm-design

Answer key

2.6 Alpha Beta Pruning (2)

2.6.1 Alpha Beta Pruning: GATE DA 2025 | Question: 33

Consider game trees Tree-1 and Tree-2 as shown. The first level is a MAX agent and the second level is a MIN agent. The value in the square node is the output of the utility function.



For what ranges of x and y, the right child of node B and the right child of node E will be pruned by alpha-beta pruning algorithm?

A. $x \in [1, \infty)$ and $y \in (-\infty, 2]$
B. $x \in (-\infty, 2]$ and $y \in (-\infty, 5]$
C. $x \in (-\infty, 2]$ and $y \in [2, \infty)$
D. $x \in [1, \infty)$ and $y \in (-\infty, 5]$

gateda-2025 artificial-intelligence alpha-beta-pruning game-tree two-marks

Answer key☟

2.6.2 Alpha Beta Pruning: UGC NET CSE | December 2013 | Part 3 | Question: 27

In alpha-beta pruning, _____ is used to cut off the search at maximizing level only and ____ is used to cut off the search at maximizing level only.

A. alpha, beta
B. beta, alpha
C. alpha, alpha
D. beta, beta

ugcnetcse-dec2013-paper3 artificial-intelligence alpha-beta-pruning

Answer key☟

2.7 Artificial Intelligence (29)

2.7.1 Artificial Intelligence: GATE DA 2025 | Question: 5

Let p and q be any two propositions. Consider the following propositional statements.

$$S_1 : p \rightarrow q, \quad S_2 : \neg p \wedge q, \quad S_3 : \neg p \vee q, \quad S_4 : \neg p \vee \neg q,$$

where $\wedge$ denotes conjunction (AND operation), $\vee$ denotes disjunction (OR operation), and $\neg$ denotes negation (NOT operation). Which one of the following options is correct?
(Note: $\equiv$ denotes logical equivalence)

A. $S_1 \equiv S_3$
B. $S_2 \equiv S_3$
C. $S_2 \equiv S_4$
D. $S_1 \equiv S_4$

gateda-2025 artificial-intelligence propositional-logic easy one-mark

Answer key☟

2.7.2 Artificial Intelligence: GATE DS&AI 2024 | Question: 24

The sample average of 50 data points is 40. The updated sample average after including a new data point taking the value of 142 is ________.

gate-ds-ai-2024 artificial-intelligence numerical-answers one-mark

Answer key☟

2.7.3 Artificial Intelligence: GATE DS&AI 2024 | Question: 44

Let game(ball, rugby) be true if the ball is used in rugby and false otherwise.

Let shape(ball, round) be true if the ball is round and false otherwise.

Consider the following logical sentences:

s1: $\forall$ ball $\neg$ game(ball, rugby) $\Rightarrow$ shape(ball, round)
s2: $\forall$ ball $\neg$ shape(ball, round) $\Rightarrow$ game(ball, rugby)
s3: $\forall$ ball game(ball, rugby) $\Rightarrow$ $\neg$ shape(ball, round)
s4: $\forall$ ball shape(ball, round) $\Rightarrow$ $\neg$ game(ball, rugby)

Which of the following choices is/are logical representations of the assertion,

"All balls are round except balls used in rugby"?

A. $s1 \wedge s3$
B. $s1 \wedge s2$
C. $s2 \wedge s3$
D. $s3 \wedge s4$

gate-ds-ai-2024 artificial-intelligence first-order-logic multiple-selects two-marks

Answer key☟

2.7.4 Artificial Intelligence: UGC NET CSE | December 2013 | Part 3 | Question: 26

The mean-end analysis process centers around the detection of differences between the current state and goal state. Once such a difference is isolated, an operator that can reduce the difference must be found. But perhaps that operator cannot be applied to the current state. So a sub-problem of getting to a state in which it can be applied is set up. The kind of backward chaining in which operators are selected and then sub goals are set up to establish the precondition of operators is called

A. backward planning
B. goal stack planning
C. operator subgoaling
D. operator overloading

ugcnetcse-dec2013-paper3 artificial-intelligence

Answer key☟

2.7.5 Artificial Intelligence: UGC NET CSE | December 2014 | Part 3 | Question: 72

Match the following learning modes $w.r.t.$ characteristics of available information for learning :

a. Supervised	i. Instructive information on desired responses, explicitly specified by a teacher.
b. Recording	ii. A priori design information for memory storing
c. Reinforcement	iii. Partial information about desired responses, or only “right” or “wrong” evaluative information
d. Unsupervised	iv. No information about desired responses

Codes :

	a	b	c	d
A.	i	ii	iii	iv
B.	i	iii	ii	iv
C.	ii	iv	iii	i
D.	ii	iii	iv	i

ugcnetcse-dec2014-paper3 artificial-intelligence machine-learning

Answer key☟

2.7.6 Artificial Intelligence: UGC NET CSE | December 2015 | Part 3 | Question: 46

Language model used in LISP is

A. Functional programming
B. Logic programming
C. Object oriented programming
D. All of the above

ugcnetcse-dec2015-paper3 artificial-intelligence

Answer key

2.7.7 Artificial Intelligence: UGC NET CSE | December 2015 | Part 3 | Question: 64

Consider the two class classification task that consists of the following points:

Class $C_1 : [-1,-1], [-1,1], [1,-1]$

Class $C_2 : [1,1]$

The decision boundary between the two classes C_1 and C_2 using single perception is given by:

A. $x_1 - x_2 - 0.5 = 0$
B. $-x_1 - x_2 - 0.5 = 0$
C. $0.5(x_1 + x_2) - 1.5 = 0$
D. $x_1 + x_2 - 0.5 = 0$

ugcnetcse-dec2015-paper3 artificial-intelligence

Answer key

2.7.8 Artificial Intelligence: UGC NET CSE | December 2018 | Part 2 | Question: 92

Which of the following is true for *semi-dynamic* environment?

A. The environment may change while the agent is deliberating
B. The environment itself does not change with the passage of time but the agent's performance score does
C. Even if the environment changes with the passage of time while deliberating, the performance score does not change.
D. Environment and performance score, both change simultaneously

ugcnetcse-dec2018-paper2 artificial-intelligence

Answer key

2.7.9 Artificial Intelligence: UGC NET CSE | January 2017 | Part 3 | Question: 55

Consider following two rules R1 and R2 in logical reasoning in Artificial Intelligence (AI):

R1 : From $\alpha \supset \beta \, \frac{\text{and } \alpha}{\text{Inter } \beta}$ is known as Modulus Tollens (MT)

R2 : From $\alpha \supset \beta \frac{\text{and } \neg\beta}{\text{Inter } \neg\alpha}$ is known as Modus Ponens(MP)

A. Only R1 is correct.
B. Only R2 is correct.
C. Both R1 and R2 are correct.
D. Neither R1 nor R2 is correct.

ugcnetcse-jan2017-paper3 non-gatecse artificial-intelligence

Answer key

2.7.10 Artificial Intelligence: UGC NET CSE | July 2016 | Part 3 | Question: 75

A software program that infers and manipulates existing knowledge in order to generate new knowledge is known as:

A. Data dictionary
B. Reference mechanism
C. Inference engine
D. Control strategy

ugcnetcse-july2016-paper3 artificial-intelligence

Answer key

2.7.11 Artificial Intelligence: UGC NET CSE | July 2018 | Part 2 | Question: 71

In artificial Intelligence (AI), an environment is uncertain if it is ___

A. Not fully observable and not deterministic
B. Not fully observable or not deterministic
C. Fully observable but not deterministic
D. Not fully observable but deterministic

ugcnetcse-july2018-paper2 artificial-intelligence

Answer key

2.7.12 Artificial Intelligence: UGC NET CSE | July 2018 | Part 2 | Question: 74

Consider following sentences regarding A^*, an informed search strategy in Artificial Intelligence (AI).

a. A^* expands all nodes with $f(n) < C^*$
b. A^* expands no nodes with $f(n) \geq C^*$
c. Pruning is integral to A^*

Here, C^* is the cost of the optimal solution path. Which of the following is correct with respect to the above statements?

A. Both statements a and statement b are true
B. Both statements a and statement c are true
C. Both statements b and statement c are true
D. All the statements a, b and c are true

ugcnetcse-july2018-paper2 artificial-intelligence

Answer key

2.7.13 Artificial Intelligence: UGC NET CSE | June 2012 | Part 3 | Question: 2

In Delta Rule for error minimization

A. weights are adjusted w.r.to change in the output
B. weights are adjusted w.r.to difference between desired output and actual output
C. weights are adjusted w.r.to difference between output and output
D. none of the above

ugcnetcse-june2012-paper3 artificial-intelligence machine-learning

Answer key

2.7.14 Artificial Intelligence: UGC NET CSE | June 2012 | Part 3 | Question: 21

A^* algorithm uses $f' = g + h'$ to estimate the cost of getting from the initial state to the goal state, where g is a measure of cost getting from initial state to the current node and the function h' is an estimate of the cost of getting from the current node to the goal state. To find a path involving the fewest number of steps, we should test,

A. $g = 1$ B. $g = 0$ C. $h' = 0$ D. $h' = 1$

ugcnetcse-june2012-paper3 artificial-intelligence

Answer key

2.7.15 Artificial Intelligence: UGC NET CSE | June 2014 | Part 3 | Question: 28

Match the following :

	List – I		List – II
a.	Expert systems	i.	Pragmatics
b.	Planning	ii.	Resolution
c.	Prolog	iii.	means-end analysis
d.	Natural language processing	iv.	Explanation facility

Codes :

A. a-iii, b-iv, c-i, d-ii
B. a-iii, b-iv, c-ii, d-i
C. a-i, b-ii, c-iii, d-iv
D. a-iv, b-iii, c-ii, d-i

ugcnetjune2014iii artificial-intelligence

Answer key

2.7.16 Artificial Intelligence: UGC NET CSE | June 2014 | Part 3 | Question: 30

Slots and facets are used in

A. Semantic Networks B. Frames C. Rules D. All of these

ugcnetjune2014iii artificial-intelligence

Answer key

2.7.17 Artificial Intelligence: UGC NET CSE | June 2023 | Part 2: 12

Which is not a basic approach to the problem of conflict resolution in a production system?

A. Assigning a preference based on the rule that matched
B. Assigning a preference based the object that matched
C. Assigning a preference based on the action that the matched rule would perform
D. Assigning a preference based on the action that the matched object would perform

ugcnetcse-june2023-paper2 artificial-intelligence

2.7.18 Artificial Intelligence: UGC NET CSE | June 2023 | Part 2: 36

Which of the following is not a property of a good system for representation of knowledge in a particular domain?

A. Presentation adequacy
B. infrential adequacy
C. Infential efficiency
D. acquisitional efficiency

ugcnetcse-june2023-paper2 artificial-intelligence

2.7.19 Artificial Intelligence: UGC NET CSE | June 2023 | Part 2: 38

Which is not the component of the natural language understanding process?

A. Morphological analysis
B. Semantic analysis
C. Pragmatic analysis
D. Meaning analysis

ugcnetcse-june2023-paper2 artificial-intelligence parsing

2.7.20 Artificial Intelligence: UGC NET CSE | June 2023 | Part 2: 81

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Dendral is an expert system

Reason R: The rationality of an agent is not related to its reaction to the environment.

In the light of the above statements, choose the correct answer from the options given below.

A. Both A and R are true and R is the correct explanation of A
B. Both A and R are true but R is NOT the correct explanation of A
C. A is true but R is false
D. A is false but R is true

ugcnetcse-june2023-paper2 artificial-intelligence logical-reasoning

2.7.21 Artificial Intelligence: UGC NET CSE | Junet 2015 | Part 3 | Question: 23

Which of the following is false for the programming language PROLOG?

A. A PROLOG variable can only be assigned to a value once
B. PROLOG is a strongly typed language
C. The scope of a variable in PROLOG is a single clause or rule
D. The scope of a variable in PROLOG is a single query

ugcnetcse-june2015-paper3 artificial-intelligence

Answer key

2.7.22 Artificial Intelligence: UGC NET CSE | Junet 2015 | Part 3 | Question: 56

Match the following knowledge representation techniques with their applications :

	List – I		List – II
(a)	Frames	(i)	Pictorial representation of objects, their attributes and relationships
(b)	Conceptual dependencies	(ii)	To describe real world stereotype events
(c)	Associative networks	(iii)	Record like structures for grouping closely related knowledge
(d)	Scripts	(iv)	Structures and primitives to represent sentences

Codes :

A. (a)-(ii), (b)-(iv), (c)-(i), (d)-(ii)
B. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
C. (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
D. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

ugcnetcse-june2015-paper3 artificial-intelligence

Answer key

2.7.23 Artificial Intelligence: UGC NET CSE | Junet 2015 | Part 3 | Question: 59

Match the following with respect to heuristic search techniques :

	List – I		List – II
(a)	Steepest-acccent Hill Climbing	(i)	Keeps track of all partial paths which can be candiadate for further explaination
(b)	Branch-and-bound	(ii)	Discover problem state(s) that satisfy a set of constraints
(c)	Constraint satisfaction	(iii)	Detects difference between current state and goal state
(d)	Means-end-analysis	(iv)	Considers all moves from current state and selects best move

Codes :

A. (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
B. (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
C. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
D. (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

ugcnetcse-june2015-paper3 artificial-intelligence

Answer key

2.7.24 Artificial Intelligence: UGC NET CSE | November 2017 | Part 3 | Question: 55

In Artificial Intelligence (AI), which agent deals with happy and unhappy state?

A. Simple reflex agent
B. Model based agent
C. Learning agent
D. Utility based agent

ugcnetcse-nov2017-paper3 artificial-intelligence

2.7.25 Artificial Intelligence: UGC NET CSE | November 2017 | Part 3 | Question: 56

If b is the branching factor and m is the maximum depth of the search tree, what is the space complexity of greedy search?

A. $O(b+m)$
B. $O(bm)$
C. $O(b^m)$
D. $O(m^b)$

ugcnetcse-nov2017-paper3 artificial-intelligence time-complexity asymptotic-notations

Answer key☟

2.7.26 Artificial Intelligence: UGC NET CSE | November 2017 | Part 3 | Question: 60

Standard planning algorithms assume environment to be ______

A. Both deterministic and fully observable
B. Neither deterministic nor fully observable
C. Deterministic but not fully observable
D. Not deterministic but fully observable

ugcnetcse-nov2017-paper3 artificial-intelligence

Answer key☟

2.7.27 Artificial Intelligence: UGC NET CSE | October 2020 | Part 2 | Question: 36

Which of the following is NOT true in problem solving in artificial intelligence?

A. Implements heuristic search technique
B. Solution steps are not explicit
C. Knowledge is imprecise
D. It works on or implements repetition mechanism

ugcnetcse-oct2020-paper2 non-gatecse artificial-intelligence

Answer key☟

2.7.28 Artificial Intelligence: UGC NET CSE | October 2022 | Part 1 | Question: 7

Match List I with List II :

List I	List II
(A) Ontological Engineering	(I) Organizing subclass relations
(B) Taxonomy Hierarchy	(II) Organizing knowledge into category and sub category
(C) Inheritance	(III) Attaches a number with each possibility
(D) Probability mode	(IV) Representing concepts. events, time. physical concepts of different domains

Choose the correct answer from the options given below :

A. (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
B. (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
C. (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
D. (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

ugcnetcse-oct2022-paper1 artificial-intelligence probability logical-reasoning

Answer key☟

2.7.29 Artificial Intelligence: UGCNET CSE December 2022: 63

Which AI System mimics the evolutionary process to generate increasingly better solutions to a process to a problem?

A. Self organizing neural network.
B. Back propagation neural network.
C. Genetic algorithm.
D. Forward propagation neural network.

Choose the correct answer from the options given below:

A. A Only
B. B Only
C. C Only
D. D Only

ugcnetcse-dec2022 artificial-intelligence

2.8 Artificial Neural Network (1)

2.8.1 Artificial Neural Network: UGC NET CSE | December 2013 | Part 3 | Question: 30

An artificial neuron receives n inputs $x_1, x_2, \ldots, x_n$ with weights $w_1, w_2, \ldots, w_n$ attached to the input links. The weighted sum ____ is computed to be passed on to a non-linear filter ϕ called activation function to release the output.

A. $\Sigma\, w_i$
B. $\Sigma\, x_i$
C. $\Sigma\, w_i + \Sigma\, x_i$
D. $\Sigma\, w_i \cdot \Sigma\, x_i$

ugcnetcse-dec2013-paper3 machine-learning artificial-neural-network

Answer key

2.9 Backpropagation (1)

2.9.1 Backpropagation: UGC NET CSE | December 2012 | Part 2 | Question: 46

Back propagation is a learning technique that adjusts weights in the neutral network by propagating weight changes.

A. Forward from source to sink
B. Backward from sink to source
C. Forward from source to hidden nodes
D. Backward from sink to hidden nodes

ugcnetcse-dec2012-paper2 machine-learning data-mining backpropagation

Answer key

2.10 Blocks World Problem (1)

2.10.1 Blocks World Problem: UGC NET CSE | September 2013 | Part 3 | Question: 5

The Blocks World Problem in Artificial Intelligence is normally discussed to explain a

A. Search technique
B. Planning system
C. Constraint satisfaction system
D. Knowledge base system

ugcnetcse-sep2013-paper3 artificial-intelligence blocks-world-problem

Answer key

2.11 Chaining (1)

2.11.1 Chaining: UGC NET CSE | December 2015 | Part 3 | Question: 8

Forward chaining systems are ____ where as backward chaining systems are ____

A. Data driven, Data driven
B. Goal driven, Data driven
C. Data driven, Goal driven
D. Goal driven, Goal driven

ugcnetcse-dec2015-paper3 artificial-intelligence chaining

Answer key

2.12 Dempster Shafer Theory (1)

2.12.1 Dempster Shafer Theory: UGC NET CSE | December 2019 | Part 2 | Question: 58

According to Dempster-Shafer theory for uncertainity management,

A. $Bel(A) + Bel(\neg A) \leq 1$
B. $Bel(A) + Bel(\neg A) \geq 1$
C. $Bel(A) + Bel(\neg A) = 1$
D. $Bel(A) + Bel(\neg A) = 0$

Where $Bel(A)$ denotes Belief of event A.

ugcnetcse-dec2019-paper2 artificial-intelligence dempster-shafer-theory

Answer key

2.13 Expert System (2)

2.13.1 Expert System: UGC NET CSE | December 2012 | Part 3 | Question: 67

An expert system shell is an expert system without

A. domain knowledge
B. explanation facility
C. reasoning with knowledge
D. all of the above

ugcnetcse-dec2012-paper3 artificial-intelligence expert-system

Answer key

2.13.2 Expert System: UGC NET CSE | December 2015 | Part 3 | Question: 45

Reasoning strategies used in expert systems include

A. Forward chaining, backward chaining and problem reduction
B. Forward chaining, backward chaining and boundary mutation
C. Forward chaining, backward chaining and back propagation
D. Forward chaining, problem reduction and boundary mutation

ugcnetcse-dec2015-paper3 artificial-intelligence expert-system

Answer key

2.14 First Order Logic (1)

2.14.1 First Order Logic: UGC NET CSE | October 2022 | Part 1 | Question: 88

Given below are two statements :

Statement I: "Grandparent is a parent of one's parent".

Statement II: First Order Predicate Logic (FOPL) representation of above statement is
$\forall g$, c grandparent $(g, c) \Leftrightarrow \exists p$ parent $(g, p) \wedge$ parent (p, c)
In the light of the above statements, choose the most appropriate answer from the options given below :

A. Both Statement I and Statement II are correct
B. Both Statement I and Statement II are incorrect
C. Statement I is correct but Statement II is incorrect
D. Statement I is incorrect but Statement II is correct

ugcnetcse-oct2022-paper1 first-order-logic logical-reasoning

2.15 Fuzzy Logic (2)

2.15.1 Fuzzy Logic: UGC NET CSE | December 2019 | Part 2 | Question: 61

Consider the following models:

M_1: Mamdani model

M_2: Takagi – Sugeno – Kang model

M_3: Kosko's additive model (SAM)

Which of the following option contains examples of additive rule model?

A. Only M_1 and M_2
B. Only M_2 and M_3
C. Only M_1 and M_3
D. M_1, M_2 and M_3

ugcnetcse-dec2019-paper2 artificial-intelligence fuzzy-logic

Answer key

2.15.2 Fuzzy Logic: UGC NET CSE | June 2019 | Part 2 | Question: 94

A fuzzy conjunction operator denoted as $t(x, y)$ and a fuzzy disjunction operator denoted as $s(x, y)$ form a dual pair if they satisfy the condition:

A. $t(x,y) = 1 - s(x,y)$
B. $t(x,y) = s(1-x, 1-y)$
C. $t(x,y) = 1 - s(1-x, 1-y)$
D. $t(x,y) = s(1+x, 1+y)$

ugcnetcse-june2019-paper2 artificial-intelligence fuzzy-logic

Answer key

2.16 Fuzzy Set (2)

2.16.1 Fuzzy Set: UGC NET CSE | June 2023 | Part 2: 24

Given below are two statements:

Statement I: Fuzzifier is a part of a fuzzy system

Statement II: Inference engine is a part of fuzzy system

In the light of the above statements, choose the most appropriate answer from the options given below.

A. Both Statement I and Statement II are correct
B. Both Statement I and Statement II are incorrect
C. Statement I is correct but Statement II is incorrect
D. Statement I is incorrect but Statement II is correct

ugcnetcse-june2023-paper2 fuzzy-set artificial-intelligence

2.16.2 Fuzzy Set: UGC NET CSE | November 2017 | Part 3 | Question: 70

Consider a Takagi-Sugeno – Kang (TSK) Model consisting of rules of the form:

If x_1 is A_{i1} and ... and x_r is A_{ir}

THEN $y = f_i(x_1, x_2, \ldots, x_t) = b_{i0} + b_{i1}x_1 + \cdots + b_{ir}x_r$

assume, α_i is the matching degree of rule i, then the total output of the model is given by:

A. $y = \sum_{i=1}^{L} \alpha_i f_i(x_1, x_2, \ldots, x_r)$

B. $y = \dfrac{\sum_{i=1}^{L} \alpha_i f_i(x_1, x_2, \ldots, x_r)}{\sum_{i=1}^{L} \alpha_i}$

C. $y = \dfrac{\sum_{i=1}^{L} f_i(x_1, x_2, \ldots, x_r)}{\sum_{i=1}^{L} \alpha_i}$

D. $y = \max_i [\alpha_i f_i(x_1, x_2, \ldots, x_r)]$

ugcnetcse-nov2017-paper3 artificial-intelligence fuzzy-set

Answer key

2.17 Fuzzy System (1)

2.17.1 Fuzzy System: UGC NET CSE | June 2023 | Part 2: 76

Match **List I** with **List II**

List I	List II
A. Expert system	I. Decision tree
B. Fuzzy system	II. Scramble
C. Operator in genetic algorithm	III. Inference engine
D. Supervised technique	IV. Mycin

Choose the correct answer from the options given below: Choose the correct answer from the options given below:

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

ugcnetcse-june2023-paper2 artificial-intelligence decision-trees expert-system fuzzy-system genetic-algorithms

2.18 General Awareness (1)

2.18.1 General Awareness: UGC NET CSE | June 2019 | Part 1 | Question: 2

Who developed the theory of 'Multiple Intelligence'?

A. Alfred Binet
B. L. Thurstone
C. Charles Spearman
D. Howard Gardner

ugcnetcse-june2019-paper1 general-awareness artificial-intelligence

Answer key☟

2.19 Genetic Algorithms (4)

2.19.1 Genetic Algorithms: UGC NET CSE | December 2019 | Part 2 | Question: 65

Let the population of chromosomes in genetic algorithm is represented in terms of binary number. The strength of fitness of a chromosome in decimal form, x, is given by

$Sf(x) = \frac{f(x)}{\Sigma f(x)}$ where $f(x) = x^2$

The population is given by P where:

$P = \{(01101, (11000), (01000), (10011)\}$

The strength of fitness of chromosome (11000) is ________

A. 24
B. 576
C. 14.4
D. 49.2

ugcnetcse-dec2019-paper2 genetic-algorithms probability artificial-intelligence

Answer key☟

2.19.2 Genetic Algorithms: UGC NET CSE | June 2019 | Part 2 | Question: 97

Consider the following:

i. Evolution
ii. Selection
iii. Reproduction
iv. Mutation

Which of the following are found in genetic algorithms?

A. b, c and d only
B. b and d only
C. a, b, c and d
D. a, b and d only

ugcnetcse-june2019-paper2 artificial-intelligence genetic-algorithms

Answer key☟

2.19.3 Genetic Algorithms: UGC NET CSE | June 2023 | Part 2: 23

Which of the following is not a mutation operator in a genetic algorithm?

A. Random resetting
B. Scramble
C. Inversion
D. Difference

Choose the correct answer from the options given below:

A. A and B only
B. B and D only
C. C and D only
D. D only

ugcnetcse-june2023-paper2 artificial-intelligence genetic-algorithms

2.19.4 Genetic Algorithms: UGC NET CSE | June 2023 | Part 2: 29

Which of the following is not a solution representation in a genetic algorithm?

A. Binary valued
B. Real valued
C. Permutation
D. Combinations

ugcnetcse-june2023-paper2 artificial-intelligence genetic-algorithms

2.20 Heuristic Search (2)

2.20.1 Heuristic Search: UGC NET CSE | December 2013 | Part 3 | Question: 25

If h* represents an estimate from the cost of getting from the current node N to the goal node and h represents actual cost of getting from the current node to the goal node, then A* algorithm gives an optimal solution if

A. h* is equal to h
B. h* overestimates h
C. h* underestimates h
D. none of these

ugcnetcse-dec2013-paper3 artificial-intelligence heuristic-search

Answer key☟

2.20.2 Heuristic Search: UGC NET CSE | July 2018 | Part 2 | Question: 73

In heuristic search algorithms in Artificial Intelligence (AI), if a collection of admissible heuristics $h_1 \ldots h_m$ is available for a problem and none of them dominates any of the others, which should we choose?

A. $h(n) = max\{h_1(n), \ldots, h_m(n)\}$
B. $h(n) = min\{h_1(n), \ldots, h_m(n)\}$
C. $h(n) = avg\{h_1(n), \ldots, h_m(n)\}$
D. $h(n) = sum\{h_1(n), \ldots, h_m(n)\}$

ugcnetcse-july2018-paper2 artificial-intelligence heuristic-search

Answer key☟

2.21 Heuristics (2)

2.21.1 Heuristics: UGC NET CSE | December 2018 | Part 2 | Question: 95

Consider the following statements :

S1: A heuristic is admissible if it never overestimates the cost to reach the goal.

S2: A heuristic is monotonous if it follows triangle inequality property.

Which of the following is true referencing the above statements ?

Choose the correct answer from the code given below :

$Code$:

A. Neither of the statements S1 and S2 are true
B. Statement S1 is false but statement S2 is true
C. Statement S1 is true but statement S2 is false
D. Both the statements S1 and S2 are true

ugcnetcse-dec2018-paper2 artificial-intelligence heuristics search-algorithms

Answer key☟

2.21.2 Heuristics: UGCNET CSE December 2022: 37

The A^* algorithm is optimal when,

A. It always finds the solution with the lowest total cost if the heuristic 'h' is admissible.

B. Always finds the solution with the highest total cost if the heuristic 'h' is admissible.
C. Finds the solution with the lowest total cost if the heuristic 'h' is not admissible.
D. It always finds the solution with the highest total cost if the heuristic 'h' is not admissible.

ugcnetcse-dec2022 artificial-intelligence algorithm-design heuristics searching

2.22 Language Processing (1)

2.22.1 Language Processing: UGCNET CSE December 2022: 75

Match List I with List II

List I	List II
A. Text planning	I. Natural language understanding.
B. Sentence planning	II. Natural language generation.
C. Sentence generation	
D. Map the input to useful representations	

Choose the correct answer from the options given below:

A. $\text{A-I, B-II, C-I, D-II}$
B. $\text{A-II, B-II, C-I, D-II}$
C. $\text{A-I, B-II, C-II, D-I}$
D. $\text{A-II, B-II, C-II, D-I}$

ugcnetcse-dec2022 artificial-intelligence language-processing matching multiple-choice

2.23 Linear Programming (1)

2.23.1 Linear Programming: UGC NET CSE | September 2013 | Part 3 | Question: 13

If an artificial variable is present in the 'basic variable' of optimal simplex table then the solution is

A. Alternative solution
B. Infeasible solution
C. Unbounded solution
D. Degenerate solution

ugcnetcse-sep2013-paper3 artificial-intelligence linear-programming

Answer key☟

2.24 Machine Learning (2)

2.24.1 Machine Learning: UGC NET CSE | December 2012 | Part 3 | Question: 73

Match the following:

a. Supervised learning	1. The decision system receives rewards for its action at the end of a sequence of steps
b. Unsupervised learning	2. Manual labels of inputs are not used
c. Re-inforcement learning	3. Manual labels of inputs are used

d. Inductive learning	4. System learns by example

	a	b	c	d
A	1	2	3	4
B	2	3	1	4
C	3	2	4	1
D	3	2	1	4

ugcnetcse-dec2012-paper3 machine-learning

Answer key

2.24.2 Machine Learning: UGC NET CSE | June 2014 | Part 3 | Question: 09

Perceptron learning, Delta learning and LMS learning are learning methods which falls under the category of

A. Error correction learning - learning with a teacher
B. Reinforcement learning - learning with a critic
C. Hebbian learning
D. Competitive learning - learning without a teacher

ugcnetjune2014iii machine-learning

Answer key

2.25 Map Coloring (1)

2.25.1 Map Coloring: UGC NET CSE | June 2013 | Part 3 | Question: 71

The map colouring problem can be solved using which of the following technique?

A. Means-end analysis
B. Constraint satisfaction
C. AO* search
D. Breadth first search

ugcnetcse-june2013-paper3 artificial-intelligence map-coloring

Answer key

2.26 Means End (1)

2.26.1 Means End: UGC NET CSE | September 2013 | Part 3 | Question: 6

Means-Ends Analysis process centres around the detection of difference between the current state and the goal state. Once such a difference is found, then to reduce the difference one applies

A. a forward search that can reduce the difference
B. a backward search that can reduce the difference
C. a bidirectional search that can reduce the difference
D. an operator that can reduce the difference

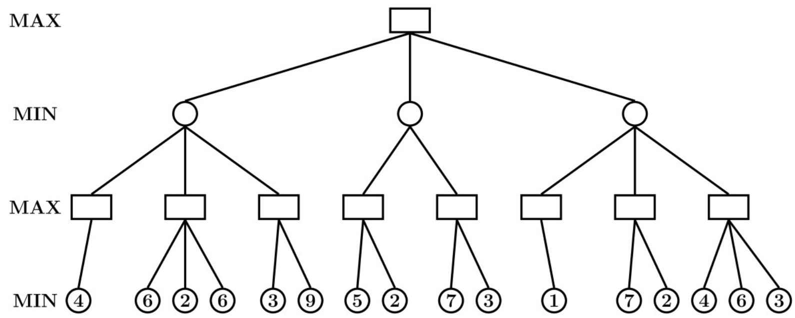
ugcnetcse-sep2013-paper3 artificial-intelligence means-end analysis

Answer key

2.27 Minimax Procedure (2)

2.27.1 Minimax Procedure: UGC NET CSE | December 2018 | Part 2 | Question: 97

Consider the following minimax game tree search



What will be the value probagated at the root?

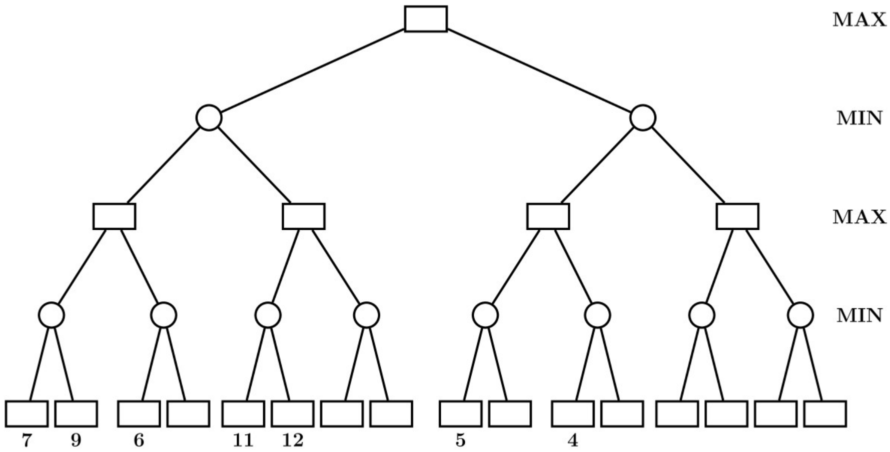
A. 3 B. 4 C. 5 D. 6

ugcnetcse-dec2018-paper2 artificial-intelligence minimax-procedure

Answer key

2.27.2 Minimax Procedure: UGC NET CSE | June 2019 | Part 2 | Question: 91

Consider the game tree given below:



Here ◯ and □ represents MIN and MAX nodes respectively. The value of the root node of the game tree is

A. 4 B. 7 C. 11 D. 12

ugcnetcse-june2019-paper2 artificial-intelligence minimax-procedure

Answer key

2.28 Neural Network (4)

2.28.1 Neural Network: UGC NET CSE | December 2012 | Part 3 | Question: 9

You are given an OR problem and XOR problem to solve. Then, which one of the following statements is true?

A. Both OR and XOR problems can be solved using single layer perception
B. OR can be solved using single layer perception and XOR problem can be solved using self organizing maps
C. OR problem can be solved using radial basis function and XOR problem can be solved using single layer perception
D. OR can be solved using single layer perception and XOR problem can be solved using radial basis function

ugcnetcse-dec2012-paper3 artificial-intelligence neural-network

Answer key

2.28.2 Neural Network: UGC NET CSE | June 2019 | Part 2 | Question: 98

Which of the following is an example of unsupervised neural network?

A. Back-propagation network
B. Hebb network
C. Associative memory network
D. Self-organizing feature map

ugcnetcse-june2019-paper2 artificial-intelligence neural-network

Answer key☟

2.28.3 Neural Network: UGC NET CSE | September 2013 | Part 3 | Question: 28

In a single perceptron, the updation rule of weight vector is given by

A. $w(n+1) = w(n) + \eta[d(n) - y(n)]$
B. $w(n+1) = w(n) - \eta[d(n) - y(n)]$
C. $w(n+1) = w(n) + \eta[d(n) - y(n)] * x(n)$
D. $w(n+1) = w(n) - \eta[d(n) - y(n)] * x(n)$

ugcnetcse-sep2013-paper3 neural-network machine-learning

Answer key☟

2.28.4 Neural Network: UGCNET CSE December 2022: 85

Choose the correct option describing the features of Artificial neural network

A. It is essentially machine learning algorithm.
B. It is useful when solving the problems for which the data set is very large.
C. They are able to extract features without input from the programmer.
D. These are systems modeled on the human brain and nervous system

Choose the correct answer from the options given below:

A. All the statements are correct.
B. Only B & C are correct.
C. Only A & D are correct.
D. All the statements are not correct.

ugcnetcse-dec2022 artificial-intelligence neural-network machine-learning

Answer key☟

2.29 Pattern Matching (1)

2.29.1 Pattern Matching: UGCNET CSE December 2022: 38

Which Artificial intelligence technique enables the computers to understand the associations and relationships between objects & Events?

A. Heuristic Processing.
B. Cognitive Science.
C. Relative symbolism.
D. Pattern Matching.

ugcnetcse-dec2022 artificial-intelligence pattern-matching cognitive-science heuristic-processing

2.30 Perceptron (1)

2.30.1 Perceptron: UGC NET CSE | July 2016 | Part 3 | Question: 66

A perceptron has input weights $W_1 = -3.9$ and $W_2 = 1.1$ with threshold value $T = 0.3.$ What output does it give for the input $x_1 = 1.3$ and $x_2 = 2.2?$

A. -2.65
B. -2.30
C. 0
D. 1

ugcnetcse-july2016-paper3 artificial-intelligence perceptron

Answer key☟

2.31 Planning (1)

2.31.1 Planning: UGC NET CSE | July 2018 | Part 2 | Question: 78

Consider the following two sentences:

a. The planning graph data structure can be used to give a better heuristic for a planning problem
b. Dropping negative effects from every action schema in a planning problem results in a relaxed problem

Which of the following is correct with respect to the above sentences?

A. Both sentence a and sentence b are false
B. Both sentence a and sentence b are true
C. Sentence a is true but sentence b is false
D. Sentence a is false but sentence b is true

ugcnetcse-july2018-paper2 planning

Answer key☟

2.32 Prolog (2)

2.32.1 Prolog: UGC NET CSE | June 2013 | Part 3 | Question: 67

Which one of the following is the correct implementation of the meta-predicate "not" in PROLOG (Here G represents a goal)?

A. not(G):- !, call(G), fail. not(G).
B. not(G):- call(G), !, fail. not(G).
C. not(G):- call(G), fail, !, not(G).
D. not(G):- call(G), !, fail.not(G):- !.

ugcnetcse-june2013-paper3 artificial-intelligence prolog

2.32.2 Prolog: UGC NET CSE | June 2014 | Part 3 | Question: 14

Which one of the following describes the syntax of prolog program?

I. Rules and facts are terminated by full stop(.)
II. Rules and facts are terminated by semi colon(;)
III. Variables names must start with upper case alphabets.
IV. Variables names must start with lower case alphabets.

A. I, II
B. III, IV
C. I, III
D. II, IV

ugcnetjune2014iii artificial-intelligence prolog

Answer key☟

2.33 Reinforcement Learning (1)

2.33.1 Reinforcement Learning: UGC NET CSE | June 2019 | Part 2 | Question: 100

Reinforcement learning can be formalized in terms of ____ in which the agent initially only knows the set of possible ______ and the set of possible actions.

A. Markov decision processes, objects
B. Hidden states, objects
C. Markov decision processes, states
D. objects, states

ugcnetcse-june2019-paper2 artificial-intelligence reinforcement-learning

Answer key☟

2.34 Search Algorithms (1)

2.34.1 Search Algorithms: UGCNET CSE December 2022: 39

Where does the values of alpha-beta search get updated?

A. Along the path of search.
B. Initial state itself.
C. At the end.
D. None of these.

ugcnetcse-dec2022 artificial-intelligence search-algorithms

2.35 Searches (1)

2.35.1 Searches: UGC NET CSE | June 2019 | Part 2 | Question: 92

Math List-I with List-II:

	List-I		List-II
(a)	Greedy best-first	(i)	Minimal cost $(p) + h(p)$
(b)	Lowest cost-first	(ii)	Minimal $h(p)$
(c)	A^* algorithm	(iii)	Minimal cost (p)

Choose the correct option from those given below:

A. (a) – (i) ; (b) – (ii); (c) – (iii)
B. (a) – (iii) ; (b) – (ii); (c) – (i)
C. (a) – (i) ; (b) – (iii); (c) – (ii)
D. (a) – (ii) ; (b) – (iii); (c) – (i)

ugcnetcse-june2019-paper2 artificial-intelligence searches

Answer key☟

2.36 Searching (1)

2.36.1 Searching: UGC NET CSE | December 2018 | Part 2 | Question: 94

Match List I with List II and choose the correct answer from the code given below.

	List I		List II
(a)	Greedy Best-First Search	(i)	Selects a node for expansion if optimal path to that node has been found
(b)	A* Search	(ii)	Avoids substantial overhead associated with keeping the sorted queue of nodes
(c)	Recursive Best-First Search	(iii)	Suffers from excessive node generation
(d)	Iterative-deepening A* Search	(iv)	Time complexity depends on the quality of heuristic

Code:

1. (a) – (i), (b)-(ii), (c)-(iii), (d)-(iv)
2. (a) – (iv), (b)-(i), (c)-(ii), (d)-(iii)
3. (a) – (iv), (b)-(iii), (c)-(ii), (d)-(i)
4. (a) – (i), (b)-(iv), (c)-(iii), (d)-(ii)

ugcnetcse-dec2018-paper2 artificial-intelligence searching algorithms

2.37 Security (1)

2.37.1 Security: UGC NET CSE | June 2023 | Part 1: 44

When you sign up something like a free e-mail account, you may be presented with a CAPTCHA. the most common form of CAPTCHA is an image of several distorted letters. CAPTCHA stands for:

A. "Coverage Analysis and Planning Tool for Computers and Humans Apart."
B. "Completely Automated Public Turing test to tell Computers and Humans Apart"
C. "Completely Applied Parallel Technologies for Communication and Hardware Apart".

D. "Comparable Additional Protected Turing test to cell Computers and Humans Apart".

ugcnetcse-june2023-paper1 artificial-intelligence security

2.38 Sigmoid Function (1)

2.38.1 Sigmoid Function: UGC NET CSE | June 2019 | Part 2 | Question: 99

The value of the derivative of Sigmoid function given by $f(x) = \dfrac{1}{1+e^{-2x}}$ at $x = 0$ is

A. 0 B. $\frac{1}{2}$ C. $\frac{1}{4}$ D. ∞

ugcnetcse-june2019-paper2 artificial-intelligence sigmoid-function

Answer key☟

2.39 Strips (1)

2.39.1 Strips: UGC NET CSE | June 2019 | Part 2 | Question: 93

The STRIPS representation is

A. a feature-centric representation
B. an action-centric representation
C. a combination of feature-centric and action-centric representations
D. a hierarchical feature-centric representation

ugcnetcse-june2019-paper2 artificial-intelligence strips

Answer key☟

Answer Keys

2.1.1	C	2.2.1	D	2.3.1	C	2.4.1	C	2.4.2	TBA
2.5.1	TBA	2.5.2	TBA	2.6.1	C	2.6.2	B	2.7.1	A
2.7.2	42	2.7.3	A;C	2.7.4	C	2.7.5	A	2.7.6	C
2.7.7	B	2.7.8	TBA	2.7.9	D	2.7.10	C	2.7.11	B
2.7.12	TBA	2.7.13	B	2.7.14	A	2.7.15	D	2.7.16	B
2.7.17	TBA	2.7.18	TBA	2.7.19	TBA	2.7.20	TBA	2.7.21	B
2.7.22	A	2.7.23	B	2.7.24	D	2.7.25	C	2.7.26	A
2.7.27	D	2.7.28	TBA	2.7.29	TBA	2.8.1	D	2.9.1	B
2.10.1	B	2.11.1	D	2.12.1	TBA	2.13.1	A	2.13.2	B
2.14.1	TBA	2.15.1	TBA	2.15.2	C	2.16.1	TBA	2.16.2	B
2.17.1	TBA	2.18.1	D	2.19.1	TBA	2.19.2	C	2.19.3	TBA
2.19.4	TBA	2.20.1	C	2.20.2	TBA	2.21.1	TBA	2.21.2	TBA
2.22.1	TBA	2.23.1	B	2.24.1	D	2.24.2	A	2.25.1	B
2.26.1	D	2.27.1	TBA	2.27.2	B	2.28.1	D	2.28.2	D
2.28.3	C	2.28.4	A	2.29.1	D	2.30.1	C	2.31.1	B
2.32.1	B	2.32.2	C	2.33.1	C	2.34.1	A	2.35.1	D
2.36.1	TBA	2.37.1	B	2.38.1	B	2.39.1	B		

3.0.1 UGC NET CSE | December 2015 | Part 2 | Question: 6

Which of the following arguments are not valid?

i. "If Gora gets the job and works hard, then he will be promoted. if Gora gets promotion, then he will be happy. He will not be happy, therefore, either he will not get the job or he will not work hard."
ii. "Either Puneet is not guilty or Pankaj is telling the truth. Pankaj is not telling the truth, therefore, Puneet is not guilty."
iii. If n is a real number such that $n > 1$, then $n^2 > 1$. Suppose that $n^2 > 1$, then $n > 1$.

A. i and iii B. ii and iii C. i,ii, and iii D. i and ii

ugcnetcse-dec2015-paper2 discrete-mathematics mathematical-logic

Answer key

3.0.2 UGC NET CSE | June 2014 | Part 3 | Question: 32

________ predicate calculus allows quantified variables to refer to objects in the domain of discourse and not to predicates or functions.

A. Zero-order
B. First-order
C. Second-order
D. High-order

ugcnetjune2014iii discrete-mathematics mathematical-logic

Answer key

3.0.3 UGC NET CSE | Junet 2015 | Part 2 | Question: 8

"If my computations are correct and I pay the electric bill, then I will run out of money. If I don't pay the electric bill, the power will be turned off. Therefore, If I don't run out of money and the power is still on then my computations are incorrect."

Convert this argument into logical notations using the variables c, b, r, p for propositions of computations, electric bills, out of money and the power respectively. (Where ¬ means NOT).

A. $\text{if } (c \wedge b) \rightarrow r \text{ and } \neg b \rightarrow \neg p, \text{ then } (\neg r \wedge p) \rightarrow \neg c$
B. $\text{if } (c \vee b) \rightarrow r\text{and } \neg b \rightarrow \neg p, \text{ then } (r \wedge p) \rightarrow c$
C. $\text{if } (c \wedge b) \rightarrow r \text{ and } \neg p \rightarrow \neg b, \text{ then } (\neg r \vee p) \rightarrow \neg c$
D. $\text{if } (c \vee b) \rightarrow r \text{ and } \neg b \rightarrow \neg p, \text{ then } (\neg r \wedge p) \rightarrow \neg c$

ugcnetcse-june2015-paper2 mathematical-logic

Answer key

3.0.4 UGC NET CSE | December 2014 | Part 3 | Question: 57

The resolvent of the set of clauses $(A \vee B, \sim A \vee D, C \vee \sim B)$ is

A. $A \vee B$
B. $C \vee D$
C. $A \vee C$
D. $A \vee D$

ugcnetcse-dec2014-paper3 mathematical-logic

Answer key

3.0.5 UGC NET CSE | Junet 2015 | Part 3 | Question: 22

The casual form of the disjunctive normal form $\neg A \vee \neg B \vee \neg C \vee D$ is:

A. $A \wedge B \wedge C \Rightarrow D$
B. $A \vee B \vee C \vee D \Rightarrow true$
C. $A \wedge B \wedge C \wedge D \Rightarrow true$
D. $A \wedge B \wedge C \wedge D \Rightarrow false$

ugcnetcse-june2015-paper3 mathematical-logic

Answer key

3.0.6 UGC NET CSE | December 2015 | Part 2 | Question: 7

Let P(m,n) be the statement "m divides n" where the universe of discourse for both the variable is the set of positive integers. Determine the truth values of each of the following propositions:

i. $\forall m \forall n P(m,n)$,
ii. $\forall n P(1,n)$
iii. $\exists m \forall n P(m,n)$

A. a-True, b-True, c-False
B. a-True, b-False, c-False
C. a-False, b-False, c-False
D. a-True, b-True, c-True

ugcnetcse-dec2015-paper2 discrete-mathematics mathematical-logic

Answer key

3.0.7 UGC NET CSE | December 2015 | Part 2 | Question: 9

Consider the compund propositions given below as:

i. $p \vee \sim (p \wedge q)$
ii. $(p \wedge \sim q) \vee \sim (p \wedge q)$
iii. $p \wedge (q \vee r)$

Which of the above propositions are tautologies

A. i and iii
B. ii and iii
C. i and ii
D. i, ii, and iii

ugcnetcse-dec2015-paper2 mathematical-logic

Answer key

3.0.8 UGC NET CSE | June 2011 | Part 2 | Question: 3

The proposition $\sim p \vee q$ is equivalent to

A. $p \to q$
B. $q \to p$
C. $p \leftrightarrow q$
D. $p \vee q$

ugcnetcse-june2011-paper2 discrete-mathematics mathematical-logic

Answer key

3.0.9 UGC NET CSE | November 2017 | Part 2 | Question: 8

Let P and Q be two propositions $\neg(P \leftrightarrow Q)$ is equivalent to

A. $P \leftrightarrow \neg Q$
B. $\neg P \leftrightarrow Q$
C. $\neg P \leftrightarrow \neg Q$
D. $Q \to P$

ugcnetcse-nov2017-paper2 discrete-mathematics mathematical-logic

Answer key

3.0.10 UGC NET CSE | January 2017 | Part 2 | Question: 2

Match the following :

	List – I		List – II
a.	Absurd	i.	Clearly impossible being contrary to some evident truth.
b.	Ambiguous	ii.	Capable of more than one interpretation or meaning.
c.	Axiom	iii.	An assertion that is accepted and used without a proof.
d.	Conjecture	iv.	An opinion preferably based on some experience or wisdom.

Codes:

	a	b	c	d
$A.$	i	ii	iii	iv
$B.$	i	iii	iv	ii
$C.$	ii	iii	iv	i
$D.$	ii	i	iii	iv

ugcnetjan2017ii mathematical-logic

Answer key

3.0.11 UGC NET CSE | October 2020 | Part 2 | Question: 53

Consider the following statements:

i. Any tree is 2-colorable
ii. A graph G has no cycles of even length if it is bipartite
iii. A graph G is 2-colorable if is bipartite
iv. A graph G can be colored with $d+1$ colors if d is the maximum degree of any vertex in the graph G
v. A graph G can be colored with $O(\log \mid v \mid)$ colors if it has $O(\mid v \mid)$ edges.

Choose the correct answer from the options given below:

A. (iii) and (v) are incorrect
B. (ii) and (iii) are incorrect
C. (ii) and (v) are incorrect
D. (i) and (iv) are incorrect

ugcnetcse-oct2020-paper2 discrete-mathematics graph-theory

Answer key

3.1 Clausal Form (2)

3.1.1 Clausal Form: GATE CSE 1988 | Question: 14i

Consider the following well-formed formula:

- $\exists x \forall y [\neg \exists z [p(y,z) \wedge p(z,y)] \equiv p(x,y)]$

Express the above well-formed formula in clausal form.

gate1988 descriptive first-order-logic clausal-form out-of-gatecse-syllabus

Answer key

3.1.2 Clausal Form: GATE CSE 1988 | Question: 14ii

Consider the following well-formed formula:

- $\exists x \forall y [\neg \exists z [p(y,z) \wedge p(z,y)] \equiv p(x,y)]$

Show using resolution principle that the well-formed formula, given above, cannot be satisfied for any interpretation.

gate1988 descriptive first-order-logic clausal-form out-of-gatecse-syllabus

Answer key

3.2 Countable Uncountable Set (1)

3.2.1 Countable Uncountable Set: UGC NET CSE | December 2015 | Part 2 | Question: 3

Which of the following is/are not true ?

i. The set of negative integers is countable.
ii. The set of integers that are multiples of 7 is countable.

iii. The set of even integers is countable.
iv. The set of real numbers between 0 and 1/2 is countable.

A. i and iii
B. ii and iv
C. ii only
D. iv only

ugcnetcse-dec2015-paper2 discrete-mathematics set-theory countable-uncountable-set

Answer key☟

3.3 First Order Logic (42)

3.3.1 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☟

3.3.2 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☟

3.3.3 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☟

3.3.4 First Order Logic: GATE CSE 2003 | Question: 32

Which of the following is a valid first order formula? (Here α and β 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☟

3.3.5 First Order Logic: GATE CSE 2003 | Question: 33

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

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

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 α, I_2 does not
B. I_2 satisfies α, I_1 does not
C. Neither I_1 nor I_2 satisfies α
D. Both I_1 and I_2 satisfies α

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

Answer key☟

3.3.6 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: $\text{taller}(x, y)$ 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☟

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

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

Answer key☟

3.3.8 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

3.3.9 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:

$$\text{“Not every graph is connected”}$$

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

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

Answer key

3.3.10 First Order Logic: GATE CSE 2008 | Question: 30

Let fsa and 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 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

3.3.11 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

3.3.12 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☟

3.3.13 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☟

3.3.14 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☟

3.3.15 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☟

3.3.16 First Order Logic: GATE CSE 2013 | Question: 27

What is the logical translation of the following statement?

"None of my friends are perfect."

A. $\exists x(F(x) \land \neg P(x))$
B. $\exists x(\neg F(x) \land P(x))$
C. $\exists x(\neg F(x) \land \neg P(x))$
D. $\neg \exists x(F(x) \land P(x))$

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

Answer key☟

3.3.17 First Order Logic: GATE CSE 2013 | Question: 47

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

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☟

3.3.18 First Order Logic: GATE CSE 2014 Set 1 | Question: 1

Consider the statement

"Not all that glitters is gold"

Predicate glitters(x) is true if x glitters and predicate 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. $\exists x : \text{gold}(x) \land \neg \text{glitters}(x)$
D. $\exists x : \text{glitters}(x) \land \neg \text{gold}(x)$

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

Answer key☟

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

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

A. $\forall d(\text{Rainy}(d) \land \sim\text{Cold}(d))$
B. $\forall d(\sim\text{Rainy}(d) \rightarrow \text{Cold}(d))$
C. $\exists d(\sim\text{Rainy}(d) \rightarrow \text{Cold}(d))$
D. $\exists d(\text{Rainy}(d) \land \sim\text{Cold}(d))$

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

Answer key☟

3.3.20 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. $[\forall x \, \exists y \, (P(x,y) \rightarrow R(x,y))] \leftrightarrow [\forall x \, \exists y \, (\neg P(x,y) \lor R(x,y))]$
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☟

3.3.21 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. $(\forall_x p(x) \implies \forall_x q(x)) \implies (\exists_x \neg p(x) \lor \forall_x q(x))$
B. $(\exists x p(x) \lor \exists x q(x)) \implies \exists x(p(x) \lor q(x))$

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☟

3.3.22 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 φ 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 φ with universe of size less than or equal to 3
B. There exists no model of φ with universe of size less than or equal to 3
C. There exists no model of φ with universe size of greater than 7
D. Every model of φ has a universe of size equal to 7

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

Answer key☟

3.3.23 First Order Logic: GATE CSE 2019 | Question: 35

Consider the first order predicate formula φ:

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

Here $a \mid b$ denotes that $'a \text{ divides } b'$, where a and b are integers. Consider the following sets:

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

Which of the above sets satisfy φ?

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☟

3.3.24 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. $\forall x(p(x) \vee W) \equiv \forall x\ (px) \vee W$
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☟

3.3.25 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. $\exists y \forall x(P(x) \Longrightarrow Q(x,y))$
D. $\exists x(P(x) \wedge \exists y Q(x,y))$

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

Answer key☟

3.3.26 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:

- mother (y,x) : y is the mother of x
- 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. $\forall x \forall y[\text{mother}(y,x) \rightarrow \exists z(\text{mother}(z,x) \wedge \neg\, \text{note}\, q(z,y))]$
D. $\forall x \exists y[\text{mother}(y,x) \wedge \neg \exists z(\text{note}\, q(z,y) \wedge \text{mother}(z,x))]$

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

Answer key☟

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

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

Answer key☟

3.3.28 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

3.3.29 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. $((\forall x\,(P\,(x) \vee Q\,(x)))) \implies ((\forall x P\,(x)) \vee (\forall x Q\,(x)))$
B. $(\forall x\,(P\,(x) \implies Q\,(x))) \implies ((\forall x P\,(x)) \implies (\forall x Q\,(x)))$
C. $(\forall x\,(P\,(x)) \implies \forall x\,(Q\,(x))) \implies (\forall x\,(P\,(x) \implies Q\,(x)))$
D. $(\forall x\,(P\,(x)) \Leftrightarrow (\forall x\,(Q\,(x)))) \implies (\forall x\,(P\,(x) \Leftrightarrow Q\,(x)))$

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

Answer key

3.3.30 First Order Logic: GATE IT 2006 | Question: 21

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

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

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

3.3.31 First Order Logic: GATE IT 2007 | Question: 21

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

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

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

Answer key

3.3.32 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 β 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

3.3.33 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☟

3.3.34 First Order Logic: UGC NET CSE | December 2019 | Part 2 | Question: 59

Consider the following statements:

S_1 : $\forall x P(x) \vee \forall x Q(x)$ and $\forall x(P(x) \vee Q(x))$ are not logically equivalent.

S_2 : $\exists x P(x) \wedge \exists x Q(x)$ and $\exists x(P(x) \wedge Q(x))$ are not logically equivalent

Which of the following statements is/are correct?

A. Only S_1

B. Only S_2

C. Both S_1 and S_2

D. Neither S_1 nor S_2

ugcnetcse-dec2019-paper2 propositional-logic first-order-logic logical-reasoning

3.3.35 First Order Logic: UGC NET CSE | January 2017 | Part 3 | Question: 60

The first order logic (FOL) statement $((R \vee Q) \wedge (P \vee \neg Q))$ is equivalent to which of the following?

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

ugcnetcse-jan2017-paper3 mathematical-logic first-order-logic

Answer key☟

3.3.36 First Order Logic: UGC NET CSE | July 2018 | Part 2 | Question: 77

Consider the following English sentence:

"Agra and Gwalior are both in India".

A student has written a logical sentence for the above English sentence in First-Order Logic using predicate IN(x, y), which means x is in y, as follows.

In(Agra, India) $\vee$ In(Gwalior, India)

Which one of the following is correct with respect to the above logical sentence?

A. It is syntactically valid but does not express the meaning of the English sentence
B. It is syntactically valid and expresses the meaning of the English sentence also
C. It is syntactically invalid but expresses the meaning of the English sentence
D. It is syntactically invalid and does not express the meaning of the English sentence

ugcnetcse-july2018-paper2 discrete-mathematics first-order-logic

Answer key☟

3.3.37 First Order Logic: UGC NET CSE | June 2013 | Part 2 | Question: 40

The truth value of the statements:

$\exists ! x P(x) \rightarrow \exists x P(x)$ and $\exists ! x \rceil P(x) \rightarrow \rceil \forall x P(x)$, (where the notation $\exists ! x P(x)$ denotes the proposition “There exists a unique x such that $P(x)$ is true”) are:

A. True and False

B. False and True

C. False and False

D. True and True

ugcnetcse-june2013-paper2 first-order-logic propositional-logic logical-reasoning

Answer key☟

3.3.38 First Order Logic: UGC NET CSE | June 2013 | Part 3 | Question: 69

If we convert

$\exists u \forall v \forall x \exists y (P(f(u), v, x, y) \to Q(u, v, y))$ to $\forall v \forall x (P(f(a), v, x, g(v, x)) \to Q(a, v, g(v, x)))$.

This process is known as

A. Simplification
B. Unification
C. Skolemization
D. Resolution

ugcnetcse-june2013-paper3 discrete-mathematics first-order-logic

Answer key☟

3.3.39 First Order Logic: UGC NET CSE | June 2014 | Part 2 | Question: 19

The notation $\exists ! x P(x)$ denotes the proposition "there exists a unique x such that $P(x)$ is true". Give the truth values of the following statements :

I. $\exists ! x P(x) \to \exists x P(x)$

II. $\exists ! x \neg P(x) \to \neg \forall x P(x)$

A. Both I & II are true.
B. Both I & II are false.
C. I - false, II - true
D. I - true, II - false

ugcnetcse-june2014-paper2 mathematical-logic first-order-logic

Answer key☟

3.3.40 First Order Logic: UGC NET CSE | November 2017 | Part 2 | Question: 9

Negation of the proposition $\exists\, x\, H(x)$ is

A. $\exists\, x \neg H(x)$
B. $\forall\, x \neg H(x)$
C. $\forall\, x\, H(x)$
D. $\neg\, x\, H(x)$

ugcnetcse-nov2017-paper2 propositional-logic first-order-logic logical-reasoning

Answer key☟

3.3.41 First Order Logic: UGC NET CSE | September 2013 | Part 3 | Question: 1

Which of the following is a correct predicate logic statement for "Every Natural number has one successor"?

A. $\forall x \exists y (succ(x, y) \wedge (\exists z\ succ(x, z) \Rightarrow equal(y, z)))$
B. $\forall x \exists y (succ(x, y) \vee (\exists z\ succ(x, z) \Rightarrow equal(y, z)))$
C. $\exists x \forall y (succ(x, y) \wedge (\exists z\ succ(x, z) \Rightarrow equal(y, z)))$
D. $\forall x \exists y (succ(x, y))$

first-order-logic ugcnetcse-sep2013-paper3

Answer key☟

3.3.42 First Order Logic: UGCNET CSE December 2022: 1

The negation of "Some students like hockey" is:

A. Some students dislike hockey
B. Every student dislike hockey
C. Every student like hockey
D. All students like hockey

ugcnetcse-dec2022 discrete-mathematics first-order-logic logical-reasoning propositional-logic

Answer key☟

3.4 Functions (1)

3.4.1 Functions: UGC NET CSE | July 2018 | Part 2 | Question: 87

Match the following in **List-I** and **List-II**, for a function f :

	List-I		**List-II**
(a)	$\forall x \forall y\, (f(x) = f(y) \rightarrow x = y)$	(i)	Constant
(b)	$\forall y \exists x\, (f(x) = y)$	(ii)	Injective
(c)	$\forall x\, f(x) = k$	(iii)	Surjective

Code :

A. (a)-(i), (b)-(ii), (c)-(iii)
B. (a)-(iii), (b)-(ii), (c)-(i)
C. (a)-(ii), (b)-(i), (c)-(iii)
D. (a)-(ii), (b)-(iii), (c)-(i)

ugcnetcse-july2018-paper2 discrete-mathematics functions

Answer key☟

3.5 Group Theory (1)

3.5.1 Group Theory: UGC NET CSE | December 2015 | Part 2 | Question: 10

Which of the following property/ies a Group G must hold, in order to be an Abelian group?

i. The distributive property
ii. The commutative property
iii. The symmetric property

A. i and ii
B. ii and iii
C. i only
D. ii only

ugcnetcse-dec2015-paper2 discrete-mathematics set-theory&algebra group-theory

Answer key☟

3.6 Logical Reasoning (12)

3.6.1 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☟

3.6.2 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☟

3.6.3 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☟

3.6.4 Logical Reasoning: UGC NET CSE | December 2018 | Part 2 | Question: 1

In mathematical logic, which of the following are statements?

i. There will be snow in January.
ii. What is the time now?
iii. Today is Sunday.
iv. You must study Discrete mathematics

Choose the correct answer from the code given below:

A. i and iii
B. i and ii
C. ii and iv
D. iii and iv

ugcnetcse-dec2018-paper2 mathematical-logic logical-reasoning

Answer key☟

3.6.5 Logical Reasoning: UGC NET CSE | December 2019 | Part 1 | Question: 25

According to classical Indian school of logic, what is the correct sequence of steps involved in Anum$\bar{a}$na (influence)?

A. Upanaya, Pratij$\tilde{n}$a, Hetu, Ud$\bar{a}$harana, Nigmana
B. Pratij$\tilde{n}$a, Hetu, Upanaya, Ud$\bar{a}$harana, Nigmana
C. Pratij$\tilde{n}$a, Upanaya, Hetu, Ud$\bar{a}$harana, Nigmana
D. Pratij$\tilde{n}$a, Hetu, Ud$\bar{a}$harana, Upanaya, Nigmana

ugcnetcse-dec2019-paper1 logical-reasoning

3.6.6 Logical Reasoning: UGC NET CSE | June 2006 | Part 2 | Question: 3

The preposition $(p \to q) \wedge (\sim q \vee p)$ is equivalent to :

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

ugcnetcse-june2006-paper2 propositional-logic logical-reasoning

3.6.7 Logical Reasoning: UGC NET CSE | June 2008 | Part 2 | Question: 6

An example of a tautology is :

A. $x \vee y$
B. $x \vee (\sim y)$
C. $x \vee (\sim x)$
D. $(x => y) \wedge (x <= y)$

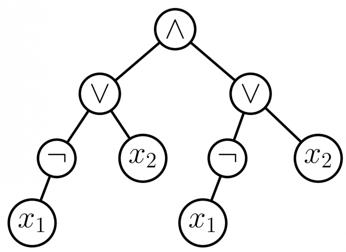
ugcnetcse-june2008-paper2 propositional-logic logical-reasoning

Answer key☟

3.6.8 Logical Reasoning: UGC NET CSE | June 2009 | Part 2 | Question: 25

The prepositional formula given by the tree :

is :



A. $x_2 \wedge x1 \vee \neg x_1 \vee \neg x_1$
B. $(x_2 \vee \neg x_2) \wedge (x_1 \vee x_2)$
C. $(\neg x_1 \vee x_2) \wedge (\neg x_1 \vee x_2)$
D. None

ugcnetcse-june2009-paper2 propositional-logic logical-reasoning

Answer key☟

3.6.9 Logical Reasoning: UGC NET CSE | June 2023 | Part 1: 7

Given below are two statements:

Statement I: A valid deductive argument that also has all true premises is called a "sound" argument.

Statement II: A strong inductive argument that has all true premises is called a "cogent" argument.

In the light of the above statements, choose the most appropriate answer from the options given below.

A. Both Statement I and Statement II are correct
B. Both Statement I and Statement II are incorrect
C. Statement I is correct but Statement II is incorrect
D. Statement I is incorrect but Statement II is correct

ugcnetcse-june2023-paper1 logical-reasoning mathematical-logic

3.6.10 Logical Reasoning: UGC NET CSE | November 2017 | Part 3 | Question: 57

Let P, Q, R and S be Propositions. Assume that the equivalences $P \Leftrightarrow (Q \vee \neg Q)$ and $Q \Leftrightarrow R$ hold. Then the truth value of the formula $(P \wedge Q) \Rightarrow ((P \wedge R) \vee S)$ is always

A. True
B. False
C. Same as truth table of Q
D. Same as truth table of S

ugcnetcse-nov2017-paper3 propositional-logic logical-reasoning

Answer key☟

3.6.11 Logical Reasoning: UGC NET CSE | October 2022 | Part 1 | Question: 75

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R) :

Assertion (A): $\bar{p}$

Reason (R) : $\quad (r \rightarrow \bar{q}, r \vee s, s \rightarrow \bar{q}, p \rightarrow q)$

In the light of the above statements, choose the correct answer from the options given below :

A. Both (A) and (R) are true and (R) is the correct explanation of (A)
B. Both (A) and (R) are true but (R) is (NOT) the correct explanation of (A)
C. (A) is true but (R) is false
D. (A) false but (R) is true

ugcnetcse-oct2022-paper1 propositional-logic logical-reasoning

3.6.12 Logical Reasoning: UGC NET CSE | October 2022 | Part 1 | Question: 85

Consider α, β, γ as logical variables. Identify which of the following represents correct logical equivalence :

(A) $(\alpha \wedge (\beta \vee \gamma)) \equiv ((\alpha \wedge \beta) \vee (\alpha \wedge \gamma))$
(B) $(\alpha \vee \beta) \equiv \neg \alpha \vee \beta$
(C) $(\alpha \Rightarrow \beta) \equiv (\neg \beta \Rightarrow -\alpha)$
(D) $(\neg(\alpha \vee \beta)) \equiv (\neg \alpha \Rightarrow -\beta)$

Choose the correct answer from the options given below :

A. (A) and (D) only
B. (B) and (C) only,
C. (A) and (C) only
D. (B) and (D) only

ugcnetcse-oct2022-paper1 propositional-logic logical-reasoning

3.7 Mathematics (1)

3.7.1 Mathematics: UGCNET CSE December 2022: 105

The following table shows the monthly income and various expenditures, of six friends A-F in absolute value or in percentage (in terms of monthly income) form. Some values (marked as $'-'$) are missing in the table which you are expected to calculate if required. Based on the data in the table, answer the question: Income and Expenditure Details

Friend	Monthly Income		Expenditure (in ₹) on			
	Salary (in ₹)	Incentive (in ₹)	Travel	Food	Accommodation	Shopping
A	92000	-	-	10960	10%	15%
B	-	14400	15280	17000	12400	-
C	-	12600	12%	8%	-	12%
D	88000	-	-	15120	9%	16800
E	80000	-	5%	-	8400	11240
F	-	11400	8400	8%	-	13720

Friend	Monthly Income		Expenditure (in ₹) on			
	Salary (in ₹)	Incentive (in ₹)	Travel	Food	Accomodation	Shopping
A	92000	-	-	10960	10%	15%
B	-	14400	15280	17000	12400	-
C	-	12600	12%	8%	-	12%
D	88000	-	-	15120	9%	16800
E	80000	-	5%	-	8400	11240
F		11400	8400	8%	-	13720

Note:

(a) Monthly Income $=$ Salary $+$ Incentive
(b) Incentive amounts to 15% of salary.
(c) All six friends save 40% of their monthly income.
(d) There is no expenditure other than those given in the table.

Expenditure by A on Travelling constitutes approximately $\%$ of the salary of F.

A. 30
B. 38
C. 32
D. 34

ugcnetcse-dec2022 data-interpretation percentage mathematics

3.8 Prolog (2)

3.8.1 Prolog: UGC NET CSE | December 2015 | Part 3 | Question: 7

Given the following set of prolog clauses:

```
father(X,Y) :
parent(X,Y),
male(X),
parent(Sally, Bob),
parent(Jim, Bob),
parent(Alice, Jane),
male(Bob),
male(Jim),
female(Salley),
female(Alice)
```

How many atoms are matched to the variable 'X' before the query father(X, Jane) reports a Result?

A. 1
B. 2
C. 3
D. 4

ugcnetcse-dec2015-paper3 mathematical-logic prolog non-gatecse

Answer key ☟

3.8.2 Prolog: UGC NET CSE | September 2013 | Part 3 | Question: 67

The tracing model in Prolog describes program execution in terms of certain events. These events are

A. call and exit
B. call and fail
C. call, exit and redo
D. call, exit, redo and fail

ugcnetcse-sep2013-paper3 mathematical-logic prolog

3.9 Propositional Logic (54)

3.9.1 Propositional Logic: GATE CSE 1987 | Question: 10e

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

gate1987 mathematical-logic propositional-logic proof descriptive

Answer key ☟

3.9.2 Propositional Logic: GATE CSE 1988 | Question: 2vii

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

gate1988 descriptive mathematical-logic propositional-logic

Answer key ☟

3.9.3 Propositional Logic: GATE CSE 1989 | Question: 3-v

Which of the following well-formed formulas are equivalent?

A. $P \to Q$
B. $\neg Q \to \neg P$
C. $\neg P \vee Q$
D. $\neg Q \to P$

gate1989 normal mathematical-logic propositional-logic multiple-selects

Answer key ☟

3.9.4 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

3.9.5 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

3.9.6 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

3.9.7 Propositional Logic: GATE CSE 1992 | Question: 15.a

Use Modus ponens $(A, A \rightarrow B| = B)$ 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

3.9.8 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

3.9.9 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

3.9.10 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 $p \to \neg q$

is **True** or **False**.

gate1994 mathematical-logic normal propositional-logic true-false

Answer key

3.9.11 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

3.9.12 Propositional Logic: GATE CSE 1995 | Question: 2.19

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

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

gate1995 mathematical-logic normal propositional-logic

Answer key

3.9.13 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, $\to$ as one way implication and $\leftrightarrow$ as two way implication)

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

gate1996 mathematical-logic normal propositional-logic

Answer key

3.9.14 Propositional Logic: GATE CSE 1997 | Question: 3.2

Which of the following propositions is a tautology?

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

gate1997 mathematical-logic easy propositional-logic

Answer key

3.9.15 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

3.9.16 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☟

3.9.17 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☟

3.9.18 Propositional Logic: GATE CSE 2001 | Question: 1.3

Consider two well-formed formulas in propositional logic

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

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☟

3.9.19 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☟

3.9.20 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☟

3.9.21 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☟

3.9.22 Propositional Logic: GATE CSE 2004 | Question: 70

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

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

gatecse-2004 mathematical-logic normal propositional-logic

Answer key☟

3.9.23 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☟

3.9.24 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☟

3.9.25 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☟

3.9.26 Propositional Logic: GATE CSE 2009 | Question: 24

The binary operation $\square$ is defined as follows

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

gatecse-2009 mathematical-logic easy propositional-logic

Answer key

3.9.27 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. $((p \to q) \wedge r) \vee (p \wedge q \wedge \sim r)$
D. $(\sim (p \leftrightarrow q) \wedge r) \wedge (p \wedge q \wedge \sim r)$

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

Answer key

3.9.28 Propositional Logic: GATE CSE 2014 Set 2 | Question: 53

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

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

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

Answer key

3.9.29 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.
B. Only M is TRUE.
C. Only N is TRUE.
D. L, M and N are TRUE.

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

Answer key

3.9.30 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☟

3.9.31 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 $\neg\left((p \Rightarrow q) \wedge (\neg r \vee \neg s)\right)$ is ___________.

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

Answer key☟

3.9.32 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☟

3.9.33 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☟

3.9.34 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

gatecse-2017-set1 mathematical-logic propositional-logic

Answer key☟

3.9.35 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. $(\neg p \wedge r) \vee (r \rightarrow (p \wedge q))$

gatecse-2017-set2 mathematical-logic propositional-logic

Answer key☟

3.9.36 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

gatecse-2021-set1 mathematical-logic propositional-logic one-mark

Answer key☟

3.9.37 Propositional Logic: GATE CSE 2021 Set 2 | Question: 15

Choose the correct choice(s) regarding the following proportional 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

gatecse-2021-set2 multiple-selects mathematical-logic propositional-logic one-mark

Answer key☟

3.9.38 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. $\neg p \rightarrow q$

gatecse2024-set2 mathematical-logic propositional-logic one-mark

Answer key☟

3.9.39 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

3.9.40 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

3.9.41 Propositional Logic: UGC NET CSE | December 2005 | Part 2 | Question: 2

If the proposition $7P \Rightarrow Q$ is true, then the truth value of the proportion $7PV\ (P \Rightarrow Q)$ is :

A. True
B. Multi – Valued
C. False
D. Can not determined

ugcnetcse-dec2005-paper2 propositional-logic

3.9.42 Propositional Logic: UGC NET CSE | December 2011 | Part 2 | Question: 43

The proposition $\sim q \vee p$ is equivalent to

A. $p \rightarrow q$
B. $q \rightarrow p$
C. $p \leftrightarrow q$
D. $p \vee q$

ugcnetcse-dec2011-paper2 discrete-mathematics propositional-logic

Answer key

3.9.43 Propositional Logic: UGC NET CSE | December 2013 | Part 2 | Question: 34

Let P(m,n) be the statement "m divides n" where the universe of discourse for both the variable is the set of positive integers. Determine the truth values of each of the following propositions:

I. $\forall m \forall n P(m,n)$,
II. $\exists m \forall n P(m,n)$

A. Both I and II are true
B. Both I and II are false
C. I-false & II-true
D. I-true& II-false

ugcnetcse-dec2013-paper2 discrete-mathematics propositional-logic

Answer key

3.9.44 Propositional Logic: UGC NET CSE | December 2015 | Part 3 | Question: 44

In propositional logic, given P and $P \rightarrow Q$, we can infer ________

A. $\sim Q$
B. Q
C. $P \wedge Q$
D. $\sim P \wedge Q$

ugcnetcse-dec2015-paper3 propositional-logic mathematical-logic

Answer key

3.9.45 Propositional Logic: UGC NET CSE | December 2018 | Part 2 | Question: 2

Match List-I with List-II and choose the correct answer from the code given below :

	List I		List II
(a)	Equivalence	(i)	$p \Rightarrow q$
(b)	Contrapositive	(ii)	$p \Rightarrow q; q \Rightarrow p$
(c)	Converse	(iii)	$p \Rightarrow q : \sim q \Rightarrow \sim p$
(d)	Implication	(iv)	$p \Leftrightarrow q$

A. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
B. (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)
C. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
D. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

ugcnetcse-dec2018-paper2 mathematical-logic propositional-logic

Answer key

3.9.46 Propositional Logic: UGC NET CSE | January 2017 | Part 2 | Question: 6

In propositional logic if $(P \rightarrow Q) \wedge (R \rightarrow S)$ and $(P \vee R)$ are two premises such that

$$\begin{array}{c} (P \rightarrow Q) \wedge (R \rightarrow S) \\ P \vee R \\ \hline Y \\ \hline \end{array}$$

Y is the premise :

A. $P \vee R$
B. $P \vee S$
C. $Q \vee R$
D. $Q \vee S$

ugcnetjan2017ii discrete-mathematics propositional-logic

Answer key

3.9.47 Propositional Logic: UGC NET CSE | January 2017 | Part 3 | Question: 59

Which of the following statements is true?

A. The sentence S is a logical consequence of $S_1, \ldots, S_n$ if and only if $S_1 \wedge S_2 \wedge \cdots \wedge S_n \rightarrow S$ is satisfiable.
B. The sentence S is a logical consequence of $S_1, \ldots, S_n$ if and only if $S_1 \wedge S_2 \wedge \cdots \wedge S_n \rightarrow S$ is valid.
C. The sentence S is a logical consequence of $S_1, \ldots, S_n$ if and only if $S_1 \wedge S_2 \wedge \cdots \wedge S_n \neg S$ is consistent.
D. The sentence S is a logical consequence of $S_1, \ldots, S_n$ if and only if $S_1 \wedge S_2 \wedge \cdots \wedge S_n \wedge S$ is inconsistent.

ugcnetcse-jan2017-paper3 mathematical-logic propositional-logic

Answer key

3.9.48 Propositional Logic: UGC NET CSE | June 2014 | Part 2 | Question: 20

Give a compound proposition involving propositions p, q and r that is true when exactly two of p, q and r are true and is false otherwise

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

ugcnetcse-june2014-paper2 mathematical-logic propositional-logic

Answer key

3.9.49 Propositional Logic: UGC NET CSE | June 2019 | Part 2 | Question: 6

Which of the following is principal conjunctive normal form for $[(p \vee q) \wedge \neg p \rightarrow \neg q]$?

A. $p \vee \neg q$
B. $p \vee q$
C. $\neg p \vee q$
D. $\neg p \vee \neg q$

ugcnetcse-june2019-paper2 propositional-logic

Answer key

3.9.50 Propositional Logic: UGC NET CSE | June 2019 | Part 2 | Question: 8

Match List-I with List-II:

	List-I		List-II
(a)	$p \rightarrow q$	(i)	$\rceil(q \rightarrow \rceil p)$
(b)	$p \vee q$	(ii)	$p \wedge \rceil q$
(c)	$p \wedge q$	(iii)	$\rceil p \rightarrow q$
(d)	$\rceil(p \rightarrow q)$	(iv)	$\rceil p \vee q$

Choose the correct option from those given below:

A. (a) – (ii); (b) – (iii); (c) – (i); (d) – (iv)
B. (a) – (ii); (b) – (i); (c) – (iii); (d) – (iv)
C. (a) – (iv); (b) – (i); (c) – (iii); (d) – (ii)
D. (a) – (iv); (b) – (iii); (c) – (i); (d) – (ii)

ugcnetcse-june2019-paper2 propositional-logic

Answer key

3.9.51 Propositional Logic: UGC NET CSE | Junet 2015 | Part 2 | Question: 10

Consider a proposition given as:

$x \geq 6$, if $x^2 \geq 25$ and and its proof as:

If $x \geq 6$, then $x^2 = x.x \geq 6.6 = 36 \geq 25$

Which of the following is correct with respect to the given proposition and its proof?

i. The proof shows the converse
ii. The proof starts by assuming what is to be shown
iii. The proof is correct and there is nothing wrong

A. i only
B. iii only
C. i and ii
D. ii only

ugcnetcse-june2015-paper2 discrete-mathematics propositional-logic

Answer key

3.9.52 Propositional Logic: UGC NET CSE | Junet 2015 | Part 2 | Question: 9

Match the following :

	List-I		**List-II**
(a)	$(p \rightarrow q) \Leftrightarrow (\neg q \rightarrow \neg p)$	(i)	Contrapositive
(b)	$[(p \wedge q) \rightarrow r] \Leftrightarrow [p \rightarrow (q \rightarrow r)]$	(ii)	Exportation law
(c)	$(p \rightarrow q) \Leftrightarrow [(p \wedge \neg q) \rightarrow o]$	(iii)	Reduction as absurdum
(d)	$(p \leftrightarrow q) \Leftrightarrow [(p \rightarrow q) \wedge (q \rightarrow p)]$	(iv)	Equivalence

Codes :

A. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
B. (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)
C. (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
D. (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

ugcnetcse-june2015-paper2 mathematical-logic propositional-logic

Answer key

3.9.53 Propositional Logic: UGC NET CSE | October 2020 | Part 2 | Question: 61

Consider the statement below.

A person who is radical (R) is electable (E) if he/she is conservative (C), but otherwise not electable.

Few probable logical assertions of the above sentence are given below.

i. $(R \wedge E) \Leftrightarrow C$
ii. $R \rightarrow (E \leftrightarrow C)$
iii. $R \Rightarrow ((C \Rightarrow E) \vee \neg E)$
iv. $(\neg R \vee \neg E \vee C) \wedge (\neg R \vee \neg C \vee E)$

Which of the above logical assertions are true?

Choose the correct answer from the options given below:

A. (ii) only B. (iii) only C. (i) and (iii) only D. (ii) and (iv) only

ugcnetcse-oct2020-paper2 discrete-mathematics propositional-logic

Answer key

3.9.54 Propositional Logic: UGC NET CSE | September 2013 | Part 2 | Question: 24

The quantification $\exists! x P(x)$ denotes the proposition "There exists a unique x such that P(x) is true", express he quantification using universal and existential quantifications and logical operators?

A. $\exists x P(x) \vee \forall x \forall y ((P(x) \vee P(y)) \rightarrow x = y)$
B. $\forall x P(x) \wedge \forall x \forall y ((P(x) \vee P(y)) \rightarrow x = y)$
C. $\exists x P(x) \wedge \forall x \forall y ((P(x) \wedge P(y)) \rightarrow x = y)$
D. $\exists x P(x) \wedge \forall x \forall y ((P(x) \vee P(y)) \rightarrow x = y)$

ugcnetsep2013ii discrete-mathematics propositional-logic

Answer key

3.10 Qod Cse 3 (1)

3.10.1 Qod Cse 3: 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. $\exists y (\exists x R(x, y))$
II. $\exists y (\forall x R(x, y))$
III. $\forall y (\exists x R(x, y))$
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 qod-cse-3 qod-cse

Answer key

3.11 Quantifiers (1)

3.11.1 Quantifiers: UGC NET CSE | July 2018 | Part 2 | Question: 85

The equivalence of $\neg \exists x\ Q(x)$ is

A. $\exists x\ \neg Q(x)$
B. $\forall x\ \neg Q(x)$
C. $\neg \exists\ x\ \neg Q(x)$

D. $\forall x\, Q(x)$

ugcnetcse-july2018-paper2 discrete-mathematics quantifiers

Answer key

3.12 Question Fixed (1)

3.12.1 Question Fixed: UGC NET CSE | December 2006 | Part 2 | Question: 2

The proposition $\neg q \vee p$ is equivalent to :

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

ugcnetcse-dec2006-paper2 mathematical-logic propositional-logic question-fixed

3.13 Relations (2)

3.13.1 Relations: UGC NET CSE | December 2019 | Part 2 | Question: 5

Let P be the set of all people. Let R be a binary relation on P such that (a, b) is in R if a is a brother of b. Is R symmetric, transitive, an equivalence relation, a partial order relation?

A. NO, NO, NO, NO
B. NO, NO, YES, NO
C. NO, YES, NO, NO
D. NO, YES, YES, NO

ugcnetcse-dec2019-paper2 relations mathematical-logic set-theory

Answer key

3.13.2 Relations: UGC NET CSE | October 2020 | Part 2 | Question: 39

Consider the following properties:

i. Reflexive
ii. Antisymmetric
iii. Symmetric

Let $A=\{a,b,c,d,e,f,g\}$ and $R=\{(a,a),(b,b),(c,d),(c,g),(d,g),(e,e),(f,f),(g,g)\}$ be a relation on A. Which of the following property (properties) is (are) satisfied by the relation R?

A. Only i
B. Only iii
C. Both i and ii
D. ii and not i

ugcnetcse-oct2020-paper2 discrete-mathematics set-theory&algebra relations

Answer key

3.14 Savings (1)

3.14.1 Savings: UGCNET CSE December 2022: 103

The following table shows the monthly income and various expenditures, of six friends A-F in absolute value or in percentage (in terms of monthly income) form. Some values (marked as "-") are missing in the table which you are expected to calculate if required. Based on the data in the table, answer the question: Income and Expenditure Details

Friend	Monthly Income		Expenditure (in ₹) on			
	Salary (in ₹)	Incentive (in ₹)	Travel	Food	Accommodation	Shopping
A	92000	-	-	10960	10%	15%
B	-	14400	15280	17000	12400	-
C	-	12600	12%	8%	-	12%
D	88000	-	-	15120	9%	16800
E	80000	-	5%	-	8400	11240
F	-	11400	8400	8%	-	13720

Friend	Monthly Income		Expenditure (in ₹) on			
	Salary (in ₹)	Incentive (in ₹)	Travel	Food	Accomodation	Shopping
A	92000	-	-	10960	10%	15%

B	-	14400	15280	17000	12400	-
C	-	12600	12%	8%	-	12%
D	88000	-	-	15120	9%	16800
E	80000	-	5%	-	8400	11240
F		11400	8400	8%	-	13720

Note:

(a) Monthly Income $=$ Salary $+$ Incentive.
(b) Incentive amounts to 15% of salary.
(c) All six friends save 40% of their monthly income.
(d) There is no expenditure other than those given in the table.

What is the amount saved (in ₹) by all the six friends together?

A. 223760 B. 237360 C. 237630 D. 273360

ugcnetcse-dec2022 data-interpretation mathematics percentage savings problem-solving

3.15 Set Theory (2)

3.15.1 Set Theory: UGC NET CSE | June 2013 | Part 2 | Question: 39

Which of the following shall be a compound proposition involving the propositions p, q and r, that is true when exactly two of the p, q and r are true and is false otherwise?

A. $(p \vee q \wedge \rceil r) \vee (p \wedge q \wedge r) \wedge (\rceil p \wedge q \vee r)$
B. $(p \wedge q \vee r) \wedge (p \wedge q \wedge r) \vee (\rceil q \wedge \rceil q \wedge \rceil r)$
C. $(p \wedge q \wedge \rceil r) \vee (p \wedge \rceil q \wedge r) \vee (\rceil p \wedge q \wedge r)$
D. $(p \vee r \wedge q) \vee (p \wedge q \wedge r) \vee (\rceil p \wedge q \wedge r)$

ugcnetcse-june2013-paper2 propositional-logic logical-reasoning set-theory

Answer key☟

3.15.2 Set Theory: UGC NET CSE | June 2023 | Part 2: 13

Consider universe positive integer $X = \{1 \leq n \leq 8\}$, proposition $P =$ " n is an even integers", Q=" $(3 \leq n \leq 7) \wedge (n \neq 6)$ ". Then truth set of $P \leftrightarrow \mathrm{Q}$ is

A. $\{1, 4\}$ B. $\{2, 6\}$ C. $\{3, 4, 5\}$ D. $\{1\}$

ugcnetcse-june2023-paper2 propositional-logic set-theory logical-reasoning

Answer key☟

3.16 Well Formed Formula (2)

3.16.1 Well Formed Formula: UGC NET CSE | December 2007 | Part 2 | Question: 6

A WFF that is equivalent to the WFF $x => y$ is :

A. $y => x$ B. ~$y => x$ C. ~$y =>$ ~x D. $y =>$ ~x

ugcnetcse-dec2007-paper2 propositional-logic well-formed-formula

Answer key☟

3.16.2 Well Formed Formula: UGC NET CSE | December 2014 | Part 3 | Question: 55

Equivalent logical expression for the Well Formed Formula (WFF),

$\sim (\forall x) F[x]$

is

A. $\forall x (\sim F[x])$
B. $\sim (\exists x) F[x]$
C. $\exists x (\sim F[x])$
D. $\forall x F[x]$

ugcnetcse-dec2014-paper3 mathematical-logic well-formed-formula

Answer key☟

Answer Keys

3.0.1	B	3.0.2	B	3.0.3	A	3.0.4	B	3.0.5	A
3.0.6	A	3.0.7	X	3.0.8	A	3.0.9	A;B	3.0.10	A
3.0.11	C	3.1.1	N/A	3.1.2	N/A	3.2.1	D	3.3.1	N/A
3.3.2	N/A	3.3.3	A	3.3.4	D	3.3.5	D	3.3.6	D
3.3.7	B	3.3.8	D	3.3.9	D	3.3.10	X	3.3.11	D
3.3.12	B	3.3.13	B	3.3.14	A	3.3.15	C	3.3.16	D
3.3.17	X	3.3.18	D	3.3.19	D	3.3.20	C	3.3.21	D
3.3.22	A	3.3.23	C	3.3.24	C	3.3.25	B;C	3.3.26	B;D
3.3.27	A	3.3.28	C	3.3.29	B	3.3.30	B	3.3.31	A
3.3.32	C	3.3.33	D	3.3.34	C	3.3.35	B	3.3.36	A
3.3.37	D	3.3.38	C	3.3.39	A	3.3.40	B	3.3.41	A
3.3.42	B	3.4.1	D	3.5.1	D	3.6.1	B	3.6.2	C
3.6.3	A	3.6.4	A	3.6.5	D	3.6.6	TBA	3.6.7	C
3.6.8	C	3.6.9	A	3.6.10	A	3.6.11	TBA	3.6.12	C
3.7.1	D	3.8.1	A	3.8.2	D	3.9.1	N/A	3.9.2	N/A
3.9.3	A;B;C	3.9.4	A	3.9.5	B	3.9.6	B	3.9.7	N/A
3.9.8	N/A	3.9.9	B	3.9.10	True	3.9.11	N/A	3.9.12	D
3.9.13	D	3.9.14	C	3.9.15	A	3.9.16	N/A	3.9.17	A
3.9.18	A	3.9.19	A	3.9.20	N/A	3.9.21	B	3.9.22	A
3.9.23	B	3.9.24	D	3.9.25	B	3.9.26	B	3.9.27	B
3.9.28	B	3.9.29	D	3.9.30	C	3.9.31	11	3.9.32	4
3.9.33	D	3.9.34	D	3.9.35	A	3.9.36	B	3.9.37	B;D
3.9.38	A	3.9.39	B;C;D	3.9.40	C	3.9.41	TBA	3.9.42	B
3.9.43	C	3.9.44	B;C	3.9.45	D	3.9.46	A;B;C;D	3.9.47	B
3.9.48	D	3.9.49	A	3.9.50	D	3.9.51	C	3.9.52	A
3.9.53	D	3.9.54	C	3.10.1	B	3.11.1	B	3.12.1	D
3.13.1	A	3.13.2	D	3.14.1	B	3.15.1	C	3.15.2	A
3.16.1	C	3.16.2	C						

4 Engineering Mathematics: Calculus (70)

4.1 Continuity (9)

4.1.1 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

4.1.2 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
B. continuous but not differentiable
C. differentiable but not continuous
D. neither continuous nor differentiable

gate1998 calculus continuity differentiation easy

Answer key

4.1.3 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.
B. P is false and Q is true.
C. Both P and Q are true.
D. Both P and Q are false.

gatecse-2007 calculus continuity differentiation easy

Answer key

4.1.4 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

4.1.5 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☟

4.1.6 Continuity: GATE CSE 2015 Set 2 | Question: 26

Let $f(x) = x^{-\left(\frac{1}{3}\right)}$ 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☟

4.1.7 Continuity: GATE CSE 2021 Set 2 | Question: 25

Suppose that $f : \mathbb{R} \to \mathbb{R}$ 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☟

4.1.8 Continuity: GATE DS&AI 2024 | Question: 27

Let $f : \mathbb{R} \to \mathbb{R}$ 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☟

4.1.9 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

4.2 Convergence (2)

4.2.1 Convergence: GATE CSE 1993 | Question: 01.6

Which of the following improper integrals is (are) convergent?

A. $\int_0^1 \frac{\sin x}{1-\cos x} dx$
B. $\int_0^\infty \frac{\cos x}{1+x} dx$
C. $\int_0^\infty \frac{x}{1+x^2} dx$
D. $\int_0^1 \frac{1-\cos x}{\frac{x^5}{2}} dx$

gate1993 calculus integration convergence out-of-gatecse-syllabus multiple-selects

Answer key

4.2.2 Convergence: GATE CSE 1993 | Question: 02.2

The radius of convergence of the power series

$$\sum^{\infty} \frac{(3m)!}{(m!)^3} x^{3m}$$

is: ______________

gate1993 calculus convergence normal out-of-gatecse-syllabus fill-in-the-blanks

4.3 Definite Integral (3)

4.3.1 Definite Integral: GATE CSE 2023 | Question: 21

The value of the definite integral

$$\int_{-3}^{3} \int_{-2}^{2} \int_{-1}^{1} \left(4x^2 y - z^3\right) \mathrm{d}z \, \mathrm{d}y \, \mathrm{d}x$$

is _________. (Rounded off to the nearest integer)

gatecse-2023 calculus definite-integral numerical-answers one-mark

Answer key

4.3.2 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

4.3.3 Definite Integral: GATE CSE 2025 | Set 2 | Question: 2

The value of x such that $x > 1$, satisfying teh 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☟

4.4 Differential Equation (1)

4.4.1 Differential Equation: GATE CSE 1993 | Question: 01.2

The differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} + \sin y = 0$ is:

A. linear
B. non- linear
C. homogeneous
D. of degree two

gate1993 calculus differential-equation easy out-of-gatecse-syllabus multiple-selects

Answer key☟

4.5 Differentiation (10)

4.5.1 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☟

4.5.2 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☟

4.5.3 Differentiation: GATE CSE 2014 Set 1 | Question: 6

Let the function

$$f(\theta) = \begin{vmatrix} \sin\theta & \cos\theta & \tan\theta \\ \sin(\frac{\pi}{6}) & \cos(\frac{\pi}{6}) & \tan(\frac{\pi}{6}) \\ \sin(\frac{\pi}{3}) & \cos(\frac{\pi}{3}) & \tan(\frac{\pi}{3}) \end{vmatrix}$$

where

$\theta \in \left[\frac{\pi}{6}, \frac{\pi}{3}\right]$ and $f'(\theta)$ denote the derivative of f with respect to θ. 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 $\theta \in \left(\frac{\pi}{6}, \frac{\pi}{3}\right)$ 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

4.5.4 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

4.5.5 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

4.5.6 Differentiation: GATE CSE 2024 | Set 1 | Question: 1

Let $f : \mathbb{R} \to \mathbb{R}$ be a function such that $f(x) = \max\left\{x, x^3\right\}, x \in \mathbb{R}$, 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

4.5.7 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

4.5.8 Differentiation: GATE DA 2025 | Question: 14

Consider two functions $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to (1, \infty)$. 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

4.5.9 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

4.5.10 Differentiation: GATE DA 2025 | Question: 41

Let $f:\mathbb{R}\to\mathbb{R}$ 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

4.6 Integration (11)

4.6.1 Integration: GATE CSE 1993 | Question: 02.6

The value of the double integral $\int_0^1 \int_0^{\frac{1}{x}} \frac{x}{1+y^2} dxdy$ is_________.

gate1993 calculus integration normal fill-in-the-blanks

Answer key

4.6.2 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

4.6.3 Integration: GATE CSE 2000 | Question: 2.3

Let $S=\sum_{i=3}^{100} i\log_2 i$, and $T=\int_2^{100} x\log_2 xdx$.
Which of the following statements is true?

A. $S>T$ B. $S=T$
C. $S<T$ and $2S>T$ D. $2S\leq T$

gatecse-2000 calculus integration normal

Answer key

4.6.4 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

4.6.5 Integration: GATE CSE 2011 | Question: 31

Given $i = \sqrt{-1}$, what will be the evaluation of the definite integral $\int\limits_0^{\pi/2} \dfrac{\cos x + i \sin x}{\cos x - i \sin x} dx$?

A. 0
B. 2
C. $-i$
D. i

gatecse-2011 calculus integration normal

Answer key

4.6.6 Integration: GATE CSE 2014 Set 3 | Question: 47

The value of the integral given below is

$$\int\limits_0^{\pi} x^2 \ \cos x \, dx$$

A. -2π
B. π
C. $-\pi$
D. 2π

gatecse-2014-set3 calculus limits integration normal

Answer key

4.6.7 Integration: GATE CSE 2014 Set 3 | Question: 6

If $\int\limits_0^{2\pi} |x \ \sin x| dx = k\pi$, then the value of k is equal to ______.

gatecse-2014-set3 calculus integration limits numerical-answers easy

Answer key

4.6.8 Integration: GATE CSE 2015 Set 1 | Question: 44

Compute the value of:

$$\int\limits_{\frac{1}{\pi}}^{\frac{2}{\pi}} \frac{\cos(1/x)}{x^2} dx$$

gatecse-2015-set1 calculus integration normal numerical-answers

Answer key

4.6.9 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 $\int\limits_1^2 f(x)dx$ is

A. $\frac{1}{a^2-b^2}\left[a(\ln 2 - 25) + \frac{47b}{2}\right]$
B. $\frac{1}{a^2-b^2}\left[a(2\ln 2 - 25) - \frac{47b}{2}\right]$
C. $\frac{1}{a^2-b^2}\left[a(2\ln 2 - 25) + \frac{47b}{2}\right]$
D. $\frac{1}{a^2-b^2}\left[a(\ln 2 - 25) - \frac{47b}{2}\right]$

gatecse-2015-set3 calculus integration normal

Answer key

4.6.10 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

4.6.11 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. π

gateit-2005 calculus integration normal

Answer key

4.7 Limits (15)

4.7.1 Limits: GATE CSE 1993 | Question: 02.1

$\lim\limits_{x\to 0}\dfrac{x(e^x-1)+2(\cos x-1)}{x(1-\cos x)}$ is ________

gate1993 limits calculus normal fill-in-the-blanks

Answer key

4.7.2 Limits: GATE CSE 1995 | Question: 7(B)

Compute without using power series expansion $\lim\limits_{x\to 0}\dfrac{\sin x}{x}$.

gate1995 calculus limits numerical-answers

Answer key

4.7.3 Limits: GATE CSE 2008 | Question: 1

$\lim\limits_{x\to\infty}\dfrac{x-\sin x}{x+\cos x}$ equals

A. 1
B. -1
C. ∞
D. $-\infty$

gatecse-2008 calculus limits easy

Answer key

4.7.4 Limits: GATE CSE 2010 | Question: 5

What is the value of $\lim\limits_{n\to\infty}\left(1-\dfrac{1}{n}\right)^{2n}$?

A. 0
B. e^{-2}
C. $e^{-1/2}$
D. 1

gatecse-2010 calculus limits normal

Answer key

4.7.5 Limits: GATE CSE 2015 Set 1 | Question: 4

$\lim\limits_{x\to\infty} x^{\frac{1}{x}}$ is

A. ∞
B. 0
C. 1
D. Not defined

gatecse-2015-set1 calculus limits normal

Answer key

4.7.6 Limits: GATE CSE 2015 Set 3 | Question: 9

The value of $\lim\limits_{x\to\infty}(1+x^2)^{e^{-x}}$ is

A. 0 B. $\frac{1}{2}$ C. 1 D. ∞

gatecse-2015-set3 calculus limits normal

Answer key☟

4.7.7 Limits: GATE CSE 2016 Set 1 | Question: 3

$$\lim_{x \to 4} \frac{\sin(x-4)}{x-4} = \_\_\_\_\_\_\_\_\_\_$$

gatecse-2016-set1 calculus limits easy numerical-answers

Answer key☟

4.7.8 Limits: GATE CSE 2017 Set 1 | Question: 28

The value of $\lim\limits_{x \to 1} \frac{x^7 - 2x^5 + 1}{x^3 - 3x^2 + 2}$

A. is 0 B. is -1 C. is 1 D. does not exist

gatecse-2017-set1 calculus limits normal

Answer key☟

4.7.9 Limits: GATE CSE 2019 | Question: 13

Compute $\lim\limits_{x \to 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$

A. 1
B. $53/12$
C. $108/7$
D. Limit does not exist

gatecse-2019 engineering-mathematics calculus limits one-mark

Answer key☟

4.7.10 Limits: GATE CSE 2021 Set 1 | Question: 20

Consider the following expression.

$$\lim_{x \to -3} \frac{\sqrt{2x+22} - 4}{x+3}$$

The value of the above expression (rounded to 2 decimal places) is __________.

gatecse-2021-set1 calculus limits numerical-answers one-mark

Answer key☟

4.7.11 Limits: GATE CSE 2022 | Question: 24

The value of the following limit is __________.

$$\lim_{x \to 0^+} \frac{\sqrt{x}}{1 - e^{2\sqrt{x}}}$$

gatecse-2022 numerical-answers calculus limits one-mark

Answer key☟

4.7.12 Limits: GATE DA 2025 | Question: 22

$$\lim_{t \to +\infty} \sqrt{t^2 + t} - t =$$

(Round off to one decimal place)

gateda-2025 calculus limits numerical-answers one-mark

Answer key

4.7.13 Limits: GATE DA 2025 | Question: 49

Let $f: \mathbb{R} \to \mathbb{R}$ be such that $|f(x) - f(y)| \leq (x-y)^2$ for all $x, y \in \mathbb{R}$. Then $f(1) - f(0) =$ ________
(Answer in integer)

gateda-2025 calculus limits numerical-answers two-marks

Answer key

4.7.14 Limits: GATE DS&AI 2024 | Question: 50

Evaluate the following limit:

$$\lim_{x \to 0} \frac{\ln\left(\left(x^2+1\right)\cos x\right)}{x^2} =$$

gate-ds-ai-2024 calculus numerical-answers limits engineering-mathematics two-marks

Answer key

4.7.15 Limits: GATE Data Science and Artificial Intelligence 2024 | Sample Paper | Question: 5

$\lim_{x \to 2} \frac{\sqrt{x}-\sqrt{2}}{x-2}$

A. 0

B. $\sqrt{2}$

C. $\frac{1}{2\sqrt{2}}$

D. $\frac{1}{\sqrt{2}}$

gateda-sample-paper-2024 calculus limits

Answer key

4.8 Maxima Minima (13)

4.8.1 Maxima Minima: GATE CSE 1987 | Question: 1-xxvi

If $f(x_i).\, f(x_{i+1}) < 0$ 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

4.8.2 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

4.8.3 Maxima Minima: GATE CSE 1995 | Question: 25a

Find the minimum value of $3 - 4x + 2x^2$.

gate1995 calculus maxima-minima easy descriptive

Answer key☟

4.8.4 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☟

4.8.5 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☟

4.8.6 Maxima Minima: GATE CSE 2012 | Question: 9

Consider the function $f(x) = \sin(x)$ in the interval $x = \left[\frac{\pi}{4}, \frac{7\pi}{4}\right]$. The number and location(s) of the local minima of this function are

A. One, at $\dfrac{\pi}{2}$
B. One, at $\dfrac{3\pi}{2}$
C. Two, at $\dfrac{\pi}{2}$ and $\dfrac{3\pi}{2}$
D. Two, at $\dfrac{\pi}{4}$ and $\dfrac{3\pi}{2}$

gatecse-2012 calculus maxima-minima normal

Answer key☟

4.8.7 Maxima Minima: GATE CSE 2015 Set 2 | Question: GA-3

Consider a function $f(x) = 1 - |x| \text{ on } -1 \leq x \leq 1$. 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☟

4.8.8 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☟

4.8.9 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☟

4.8.10 Maxima Minima: GATE DA 2025 | Question: 39

Consider the function $f(x) = \dfrac{x^3}{3} + \dfrac{7}{2}x^2 + 10x + \dfrac{133}{2}, x \in [-8, 0]$. 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 $\dfrac{133}{2}$
D. The minimum value of the derivative of f is attained at $x = -\dfrac{7}{2}$

gateda-2025 calculus maxima-minima multiple-selects two-marks

4.8.11 Maxima Minima: GATE DS&AI 2024 | Question: 40

Consider the function $f : \mathbb{R} \to \mathbb{R}$ 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☟

4.8.12 Maxima Minima: GATE DS&AI 2024 | Question: 5

For any twice differentiable function $f : \mathbb{R} \to \mathbb{R}$, 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☟

4.8.13 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☟

4.9 Out of Gatecse Syllabus (4)

4.9.1 Out of Gatecse Syllabus: GATE CSE 1993 | Question: 01.5

Fourier series of the periodic function (period 2π) defined by

$$f(x) = \begin{cases} 0, -p < x < 0 \\ x, 0 < x < p \end{cases} \text{ is}$$

$$\frac{\pi}{4} + \sum \left[\frac{1}{\pi n^2} (\cos n\pi - 1) \cos nx - \frac{1}{n} \cos n\pi \sin nx \right]$$

But putting $x = \pi$, we get the sum of the series

$$1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots \text{ is}$$

A. $\frac{\pi^2}{4}$

B. $\frac{\pi^2}{6}$

C. $\frac{\pi^2}{8}$

D. $\frac{\pi^2}{12}$

gate1993 calculus normal out-of-gatecse-syllabus multiple-selects

Answer key☟

4.9.2 Out of Gatecse Syllabus: GATE CSE 1993 | Question: 01.7

The function $f(x, y) = x^2y - 3xy + 2y + x$ has

A. no local extremum

B. one local minimum but no local maximum

C. one local maximum but no local minimum

D. one local minimum and one local maximum

gate1993 calculus maxima-minima normal out-of-gatecse-syllabus multiple-selects

Answer key☟

4.9.3 Out of Gatecse Syllabus: GATE CSE 1993 | Question: 02.8

Given $\vec{v} = x \cos^2 y\hat{i} + x^2 e^z \hat{j} + z \sin^2 y\hat{k}$ and S the surface of a unit cube with one corner at the origin and edges parallel to the coordinate axes, the value of integral $\int^1 \int_s \vec{V}.\hat{n}dS$ is __________.

gate1993 calculus normal out-of-gatecse-syllabus fill-in-the-blanks

4.9.4 Out of Gatecse Syllabus: GATE CSE 1995 | Question: 2.18

The solution of differential equation $y'' + 3y' + 2y = 0$ is of the form

A. $C_1e^x + C_2e^{2x}$

B. $C_1e^{-x} + C_2e^{3x}$

C. $C_1e^{-x} + C_2e^{-2x}$

D. $C_1e^{-2x} + C_2e^{-x}$

gate1995 calculus out-of-gatecse-syllabus

Answer key☟

4.10 Polynomials (2)

4.10.1 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
B. At least one real root
C. Four pairs of imaginary roots
D. None of the above

gate1987 calculus polynomials

Answer key

4.10.2 Polynomials: GATE CSE 1995 | Question: 2.8

If the cube roots of unity are $1, \omega$ and ω^2, then the roots of the following equation are

$$(x-1)^3 + 8 = 0$$

A. $-1, 1+2\omega, 1+2\omega^2$
B. $1, 1-2\omega, 1-2\omega^2$
C. $-1, 1-2\omega, 1-2\omega^2$
D. $-1, 1+2\omega, -1+2\omega^2$

gate1995 calculus normal polynomials

Answer key

Answer Keys

4.1.1	N/A	4.1.2	B	4.1.3	A	4.1.4	A	4.1.5	A
4.1.6	C	4.1.7	19 : 19	4.1.8	A	4.1.9	C	4.2.1	B
4.2.2	N/A	4.3.1	0	4.3.2	B	4.3.3	A	4.4.1	A
4.5.1	D	4.5.2	-2	4.5.3	C	4.5.4	9	4.5.5	C
4.5.6	D	4.5.7	-2.1:-1.9	4.5.8	A;B;C	4.5.9	A	4.5.10	B;C;D
4.6.1	N/A	4.6.2	N/A	4.6.3	A	4.6.4	D	4.6.5	D
4.6.6	A	4.6.7	4	4.6.8	-1	4.6.9	A	4.6.10	0.288 : 0.289
4.6.11	B	4.7.1	1	4.7.2	1	4.7.3	A	4.7.4	B
4.7.5	C	4.7.6	C	4.7.7	1	4.7.8	C	4.7.9	C
4.7.10	0.25 : 0.25	4.7.11	-0.5	4.7.12	0.5:0.5	4.7.13	0:0	4.7.14	0.5
4.7.15	C	4.8.1	A	4.8.2	B	4.8.3	1	4.8.4	B
4.8.5	B	4.8.6	D	4.8.7	C	4.8.8	A	4.8.9	B;D
4.8.10	C;D	4.8.11	A;B	4.8.12	A	4.8.13	B	4.9.1	C
4.9.2	A	4.9.3	N/A	4.9.4	C	4.10.1	B	4.10.2	C

5 Engineering Mathematics: Discrete Mathematics (35)

5.0.1 UGC NET CSE | June 2012 | Part 3 | Question: 17

Let $Q(x, y)$ denote "x+y=0" and let there be two quantifications given as

I. $\exists y \forall x Q(x, y)$
II. $\forall x \exists y Q(x, y)$

where x and y are real numbers. Then which of the following is valid?

A. I is true and II is false
B. I is false and II is true
C. I is false and II is also false
D. both I and II are true

ugcnetcse-june2012-paper3 discrete-mathematics mathematical-logic

Answer key☟

5.0.2 UGC NET CSE | June 2012 | Part 3 | Question: 50

How many relations are there on a set with n elements that are symmetric and a set with n elements that are reflexive and symmetric?

A. $2^{n(n+1)/2}$ and $2^n.3^{n(n-1)/2}$
B. $3^{n(n-1)/2}$ and $2^{n(n-1)}$
C. $2^{n(n+1)/2}$ and $3^{n(n-1)/2}$
D. $2^{n(n+1)/2}$ and $2^{n(n-1)/2}$

ugcnetcse-june2012-paper3 discrete-mathematics set-theory&algebra

Answer key☟

5.0.3 UGC NET CSE | December 2014 | Part 2 | Question: 01

Consider a set $A = \{1, 2, 3, \dots\dots\dots, 1000\}$.
How many members of A shall be divisible by 3 or by 5 or by both 3 and 5?

A. 533
B. 599
C. 467
D. 66

ugcnetcse-dec2014-paper2 discrete-mathematics set-theory&algebra

Answer key☟

5.0.4 UGC NET CSE | December 2013 | Part 3 | Question: 24

The objective of ____ procedure is to discover at least one ____ that causes two literals to match.

A. unification, validation
B. unification, substituion
C. substitution, unification
D. minimax, maximum

ugcnetcse-dec2013-paper3 discrete-mathematics mathematical-logic

Answer key☟

5.0.5 UGC NET CSE | Junet 2015 | Part 3 | Question: 24

Which one of the following is true?

A. The resolvent of two Horn clauses is not a Horn clause
B. The resolvent of two Horn clauses is a Horn clause
C. If we resolve a negated goal G against a fact or rule A to get clause C then C has positive literal or non-null goal
D. If we resolve a negated goal G against a fact or rule A to get clause C then C has positive literal or null goal

ugcnetcse-june2015-paper3 discrete-mathematics mathematical-logic

Answer key☟

5.0.6 UGC NET CSE | July 2018 | Part 2 | Question: 86

If $A_i = \{-i, \dots, -2, -1, 0, 1, 2, \dots, i\}$ then $\cup_{i=1}^{\infty} A_i$ is

A. Z
B. Q
C. R
D. C

ugcnetcse-july2018-paper2 discrete-mathematics

Answer key

5.0.7 UGC NET CSE | October 2020 | Part 2 | Question: 86

Let G be a simple undirected graph, T_D be a DFS tree on G, and T_B be the BFS tree on G. Consider the following statements.

Statement I: No edge of G is a cross with respect to T_D

Statement II: For every edge (u, v) of G, if u is at depth i and v is at depth j in T_B then $|i - j| = 1$

In the light of the above statements, choose the correct answer from the options given below

A. Both Statement I and Statement II are true
B. Both Statement I and Statement II are false
C. Statement I is correct but Statement II is false
D. Statement I is incorrect but Statement II is true

ugcnetcse-oct2020-paper2 discrete-mathematics graph-theory

5.0.8 UGC NET CSE | October 2020 | Part 2 | Question: 38

What kind of clauses are available in conjunctive normal form?

A. Disjunction of literals
B. Disjunction of variables
C. Conjunction of literals
D. Conjunction of variables

ugcnetcse-oct2020-paper2 discrete-mathematics mathematical-logic

Answer key

5.0.9 UGC NET CSE | October 2020 | Part 2 | Question: 37

If $f(x) = x$ is my friend, and $p(x) = x$ is perfect, then correct logical translation of the statement "some of my friends are not perfect" is ______

A. $\forall_x(f(x) \wedge \neg p(x))$
B. $\exists_x(f(x) \wedge \neg p(x))$
C. $\neg(f(x) \wedge \neg p(x))$
D. $\exists_x(\neg f(x) \wedge \neg p(x))$

ugcnetcse-oct2020-paper2 discrete-mathematics mathematical-logic

Answer key

5.0.10 UGC NET CSE | October 2020 | Part 2 | Question: 26

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 if and only if 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. 23
B. 99
C. 4
D. 7

ugcnetcse-oct2020-paper2 discrete-mathematics graph-theory

Answer key

5.0.11 UGC NET CSE | October 2020 | Part 2 | Question: 3

Which of the following pairs of propositions are not logically equivalent?

A. $((p \to r) \wedge (q \to r))$ and $((p \vee q) \to r)$
B. $p \leftrightarrow q$ and $(\neg p \leftrightarrow \neg q)$
C. $((p \wedge q) \vee (\neg p \wedge \neg q))$ and $p \leftrightarrow q$
D. $((p \wedge q) \to r)$ and $((p \to r) \wedge (q \to r))$

ugcnetcse-oct2020-paper2 discrete-mathematics mathematical-logic

Answer key

5.1 Boolean Function (1)

5.1.1 Boolean Function: UGC NET CSE | August 2016 | Part 2 | Question: 1

The Boolean function $[\sim(\sim p \wedge q) \wedge \sim(\sim p \wedge \sim q)] \vee (p \wedge r)$ is equal to the Boolean function :

A. q B. $p \wedge r$ C. $p \vee q$ D. p

ugcnetcse-aug2016-paper2 discrete-mathematics boolean-function

Answer key

5.2 Combinatory (2)

5.2.1 Combinatory: UGC NET CSE | December 2012 | Part 3 | Question: 21

How many solutions do the following equations have?

$x_1 + x_2 + x_3 = 11$

where $x_1 \geq 1, x_2 \geq 2, x_3 \geq 3$

A. $C(7,11)$ B. $C(11,3)$ C. $C(14,11)$ D. $C(7,5)$

ugcnetcse-dec2012-paper3 discrete-mathematics combinatory

Answer key

5.2.2 Combinatory: UGC NET CSE | December 2015 | Part 2 | Question: 48

How many solutions are there for the equation $x + y + z + u = 29$ subject to the constraints that $x \geq 1,\ y \geq 2\ z \geq 3\ and\ u \geq 0$?

A. 4960 B. 2600 C. 23751 D. 8855

ugcnetcse-dec2015-paper2 discrete-mathematics combinatory

Answer key

5.3 Equivalence Class (1)

5.3.1 Equivalence Class: UGC NET CSE | July 2018 | Part 2 | Question: 89

Which of the following is an equivalence relation on the set of all functions from Z to Z?

A. $\{f,\ g) \mid f(x) - g(x) = 1\ \forall\, x \in\ Z\}$
B. $\{f,\ g) \mid f(0) = g(0) \text{ or } f(1) = g(1)\}$
C. $\{f,\ g) \mid f(0) = g(1) \text{ and } f(1) = g(0)\}$
D. $\{f,\ g) \mid f(x) - g(x) = k \text{ for some } k \in Z\}$

ugcnetcse-july2018-paper2 discrete-mathematics equivalence-class

Answer key

5.4 First Order Logic (2)

5.4.1 First Order Logic: UGC NET CSE | December 2012 | Part 3 | Question: 58

Skolmization is the process of

A. bringing all the quantifiers in the beginning of a formula in FDL
B. removing all the universal quantifiers
C. removing all the extential quantifiers
D. all of the above

ugcnetcse-dec2012-paper3 engineering-mathematics discrete-mathematics first-order-logic

Answer key

5.4.2 First Order Logic: UGC NET CSE | October 2020 | Part 2 | Question: 40

Consider the following argument with premise $\forall_x(P(x) \vee Q(x))$ and conclusion $(\forall_x P(x)) \wedge (\forall_x Q(x))$

(A)	$\forall_x(P(x) \vee Q(x))$	Premise
(B)	$P(c) \vee Q(c)$	Universal instantiation from (A)
(C)	$P(c)$	Simplification from (B)
(D)	$\forall_x P(x)$	Universal Generalization of (C)
(E)	$Q(c)$	Simplification from (B)
(F)	$\forall_x Q(x)$	Universal Generalization of (E)
(G)	$(\forall_x P(x)) \wedge (\forall_x Q(x))$	Conjuction of (D) and (F)

A. This is a valid argument
B. Steps (C) and (E) are not correct inferences
C. Steps (D) and (F) are not correct inferences
D. Step (G) is not a correct inference

ugcnetcse-oct2020-paper2 discrete-mathematics first-order-logic

Answer key☟

5.5 Functions (2)

5.5.1 Functions: UGC NET CSE | December 2011 | Part 2 | Question: 4

Domain and Range of the function $Y = -\sqrt{-2x+3}$ is

A. $x \geq \frac{3}{2}, y \geq 0$
B. $x > \frac{3}{2}, y \leq 0$
C. $x \geq \frac{3}{2}, y \leq 0$
D. $x \leq \frac{3}{2}, y \leq 0$

ugcnetcse-dec2011-paper2 discrete-mathematics functions

Answer key☟

5.5.2 Functions: UGC NET CSE | December 2012 | Part 3 | Question: 19

Identify the following activation function:

$\Phi(V) = Z + \frac{1}{1+exp(-x*V+Y)}$, Z, X, Y are parameters.

A. Step function
B. Ramp function
C. Sigmoid function
D. Gaussian function

ugcnetcse-dec2012-paper3 discrete-mathematics functions

Answer key☟

5.6 Group Theory (1)

5.6.1 Group Theory: UGC NET CSE | June 2012 | Part 3 | Question: 67

Let a*H and b*H be two cosets of H.

I. Either a*H and b*H are disjoint
II. a*H and b*H are identical

Then,

A. Only I is true
B. Only II is true
C. I or II is true
D. I and II is false

ugcnetcse-june2012-paper3 discrete-mathematics set-theory&algebra group-theory

Answer key☟

5.7 Linear Programming (1)

5.7.1 Linear Programming: UGC NET CSE | July 2016 | Part 3 | Question: 70

Consider the statement

"Either $-2 \leq x \leq -1$ or $1 \leq x \leq 2$"

The negation of this statement is

A. x<-2 or 2<x or -1<x<1
B. x<-2 or 2<x
C. -1<x<1
D. x $\leq$ -2 or 2 $\leq$ x or -1<x<1

ugcnetcse-july2016-paper3 linear-programming

Answer key

5.8 Number Representation (1)

5.8.1 Number Representation: UGC NET CSE | December 2011 | Part 2 | Question: 34

Negative numbers cannot be represented in

A. Signed magnitude form
B. $1's$ complement form
C. $2's$ complement form
D. None of the above

ugcnetcse-dec2011-paper2 discrete-mathematics number-representation

Answer key

5.9 Partial Order (2)

5.9.1 Partial Order: UGC NET CSE | December 2010 | Part 2 | Question: 3

A partially ordered set is said to be a lattice if every two elements in the set have

A. A unique least upper bound
B. A unique greatest lower bound
C. Both (A) and (B)
D. None of the above

ugcnetcse-dec2010-paper2 discrete-mathematics partial-order

Answer key

5.9.2 Partial Order: UGC NET CSE | July 2018 | Part 2 | Question: 90

Which of the following statements is true?

A. $(Z, \leq)$ is not totally ordered
B. The set inclusion relation $\subseteq$ is a partial ordering on the power set of a set S
C. $(Z, \neq)$ is a poset
D. The directed graph  is not a partial order

ugcnetcse-july2018-paper2 discrete-mathematics partial-order

Answer key

5.10 Propositional Logic (7)

5.10.1 Propositional Logic: UGC NET CSE | August 2016 | Part 2 | Question: 2

Let us assume that you construct ordered tree to represent the compound proposition $(\sim(p \wedge q)) \leftrightarrow (\sim p \vee \sim q)$.

Then, the prefix expression and post-fix expression determined using this ordered tree are given as ______ and ______ respectively.

A. $\leftrightarrow \sim \wedge pq \vee \sim \sim pq, pq \wedge \sim p \sim q \sim \vee \leftrightarrow$
B. $\leftrightarrow \sim \wedge pq \vee \sim p \sim q, pq \wedge \sim p \sim q \sim \vee \leftrightarrow$
C. $\leftrightarrow \sim \wedge pq \vee \sim \sim pq, pq \wedge \sim p \sim \sim q \vee \leftrightarrow$
D. $\leftrightarrow \sim \wedge pq \vee \sim p \sim q, pq \wedge \sim p \sim \sim q \vee \leftrightarrow$

ugcnetcse-aug2016-paper2 discrete-mathematics propositional-logic

Answer key☟

5.10.2 Propositional Logic: UGC NET CSE | August 2016 | Part 3 | Question: 70

Let $\nu(x)$ mean x is a vegetarian, $m(y)$ for y is meat, and $e(x, y)$ for x eats y. Based on these, consider the following sentences :

I. $\forall x \vee (x) \Leftrightarrow (\forall y e(x, y) \implies \neg m(y))$

II.$\forall x \vee (x) \Leftrightarrow (\neg(\exists y m(y) \wedge e(x, y)))$

III.$\forall x (\exists y m(y) \wedge e(x, y)) \Leftrightarrow (x) \Leftrightarrow \neg \vee (x)$

One can determine that

A. Only I and II are equivalent sentences
B. Only II and III are equivalent sentences.
C. Only I and III are equivalent sentence .
D. $I, II,$ and III are equivalent sentences.

ugcnetcse-aug2016-paper3 discrete-mathematics propositional-logic

Answer key☟

5.10.3 Propositional Logic: UGC NET CSE | August 2016 | Part 3 | Question: 74

Consider the following logical inferences :

I_1 : If it is Sunday then school will not open.

The school was open.

Inference : It was not Sunday.

I_2 : If it is Sunday then school will not open.

It was not Sunday.

Inference : The school was open.

Which of the following is correct ?

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.

ugcnetcse-aug2016-paper3 discrete-mathematics propositional-logic

Answer key☟

5.10.4 Propositional Logic: UGC NET CSE | December 2012 | Part 3 | Question: 75

Let $\theta(x, y, z)$ be the statement "x+y=z" and let there be two quantification given as

I. $\forall x \forall y \exists z \theta(x, y, z)$
II. $\exists z \forall x \forall y \theta(x, y, z)$

where x, y, z are real numbers, then which one of the following is correct?

A. I is true and II is true
B. I is true and II is false
C. I is false and II is true
D. I is false and II is false

ugcnetcse-dec2012-paper3 discrete-mathematics propositional-logic

Answer key☟

5.10.5 Propositional Logic: UGC NET CSE | December 2015 | Part 2 | Question: 8

Match the following :

	List-I		List-II
(a)	Vacuous proof	(i)	A proof that the implication $p \rightarrow q$ is true based on the fact that p is false.
(b)	Trivial proof	(ii)	A proof that the implication $p \rightarrow q$ is true based on the fact that q is true.
(c)	Direct proof	(iii)	A proof that the implication $p \rightarrow q$ is true that proceeds by showing that q must be true when p is true.
(d)	Indirect proof	(iv)	A proof that the implication $p \rightarrow q$ is true that proceeds by showing that p must be false when q is false.

Codes :

A. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
B. (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)
C. (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
D. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

ugcnetcse-dec2015-paper2 discrete-mathematics propositional-logic

Answer key

5.10.6 Propositional Logic: UGC NET CSE | July 2018 | Part 2 | Question: 76

Consider the following statements:

a. False $\models$ True
b. If $\alpha \models (\beta \wedge \gamma$ then $\alpha \models \gamma$

Which of the following is correct with respect to above statements?

A. Both statement a and statement b are false
B. Statement a is true and statement b is false
C. Statement a is false and statement b is true
D. Both statement a and statement b are true

ugcnetcse-july2018-paper2 discrete-mathematics propositional-logic

Answer key

5.10.7 Propositional Logic: UGC NET CSE | Junet 2015 | Part 3 | Question: 57

In propositional language $P \leftrightarrow Q$ is equivalent to (where $\sim$ denotes NOT)

A. $\sim (P \vee Q) \wedge \sim (Q \vee P)$
B. $(\sim P \vee Q) \wedge (\sim Q \vee P)$
C. $(P \vee Q) \wedge (Q \vee P)$
D. $\sim (P \vee Q) \rightarrow \sim (Q \vee P)$

ugcnetcse-june2015-paper3 discrete-mathematics propositional-logic

Answer key

5.11 Relations (2)

5.11.1 Relations: UGC NET CSE | December 2019 | Part 2 | Question: 8

How many reflexive relations are there on a set with 4 elements?

A. 2^4
B. 2^{12}
C. 4^2
D. 2

ugcnetcse-dec2019-paper2 set-theory relations counting

Answer key

5.11.2 Relations: UGC NET CSE | July 2018 | Part 2 | Question: 88

Which of the relations on {0, 1, 2, 3} is an equivalence relation?

A. { (0, 0) (0, 2) (2, 0) (2, 2) (2, 3) (3, 2) (3, 3) }
B. { (0, 0) (1, 2) (2, 2) (3, 3) }

C. { (0, 0) (0, 1) (0, 2) (1, 0) (1, 1) (1, 2) (2, 0) }
D. { (0, 0) (0, 2) (2, 3) (1, 1) (2, 2)

ugcnetcse-july2018-paper2 discrete-mathematics relations

Answer key

5.12 Set Theory (2)

5.12.1 Set Theory: UGC NET CSE | August 2016 | Part 2 | Question: 3

Let A and B be sets in a finite universal set U. Given the following : $|A-B|, |A \bigoplus B|, |A|+|B|$ and $|A \cup B|$ Which of the following is in order of increasing size ?

A. $|A-B|<|A \bigoplus B|<|A|+|B|<|A \cup B|$
B. $|A \bigoplus B|<|A-B|<|A \cup B|<|A|+|B|$
C. $|A \bigoplus B|<|A|+|B|<|A-B|<|A \cup B|$
D. $|A-B|<|A \bigoplus B|<|A \cup B|<|A|+|B|$

ugcnetcse-aug2016-paper2 discrete-mathematics set-theory

Answer key

5.12.2 Set Theory: UGC NET CSE | December 2012 | Part 3 | Question: 34

The power set of AUB, where A={2, 3, 5, 7} and B={2, 5, 8, 9}is

A. 256 B. 64 C. 16 D. 4

ugcnetcse-dec2012-paper3 engineering-mathematics discrete-mathematics set-theory

Answer key

Answer Keys

5.0.1	B	5.0.2	D	5.0.3	C	5.0.4	B	5.0.5	B
5.0.6	A	5.0.7	C	5.0.8	A	5.0.9	B	5.0.10	D
5.0.11	D	5.1.1	D	5.2.1	D	5.2.2	B	5.3.1	D
5.4.1	C	5.4.2	B	5.5.1	D	5.5.2	C	5.6.1	C
5.7.1	A	5.8.1	D	5.9.1	C	5.9.2	B	5.10.1	B
5.10.2	TBA	5.10.3	B	5.10.4	B	5.10.5	A	5.10.6	D
5.10.7	B	5.11.1	B	5.11.2	TBA	5.12.1	D	5.12.2	B

6 Engineering Mathematics: Linear Algebra (109)

6.1 Boolean Algebra (2)

6.1.1 Boolean Algebra: UGC NET CSE | December 2004 | Part 2 | Question: 1

$AVA = A$ is called :

A. Identity law
B. De Morgan's law
C. Idempotent law
D. Complement law

ugcnetcse-dec2004-paper2 boolean-algebra

Answer key☟

6.1.2 Boolean Algebra: UGC NET CSE | November 2017 | Part 2 | Question: 3

Let $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$ Find the boolean product $A \odot B$ of the two matrices.

A.
$$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

B.
$$\begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

C.
$$\begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

D.
$$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

ugcnetcse-nov2017-paper2 boolean-algebra matrix

6.2 Cartesian Coordinates (1)

6.2.1 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

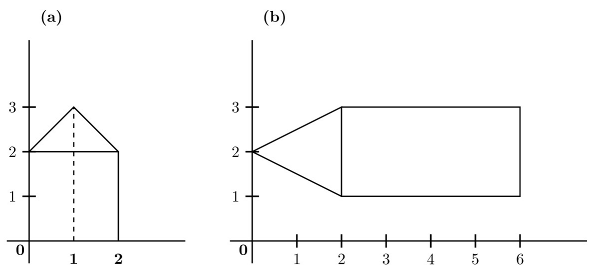
gateit-2007 linear-algebra cartesian-coordinates

Answer key

6.3 Computer Graphics (1)

6.3.1 Computer Graphics: UGC NET CSE | December 2018 | Part 2 | Question: 42

Which homogeneous $2D$ matrix transforms the figure (a) on the left side to figure (b) on the right?



A. $\begin{pmatrix} 0 & 2 & -6 \\ 2 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 0 & -2 & 6 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 1 & -2 & 6 \\ 1 & 0 & 2 \\ 0 & 0 & 1 \end{pmatrix}$

D. $\begin{pmatrix} 0 & 2 & 6 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$

ugcnetcse-dec2018-paper2 computer-graphics matrix

Answer key

6.4 Determinant (11)

6.4.1 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

6.4.2 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

6.4.3 Determinant: GATE CSE 2013 | Question: 3

Which one of the following does NOT equal

$$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} \quad ?$$

A. $\begin{vmatrix} 1 & x(x+1) & x+1 \\ 1 & y(y+1) & y+1 \\ 1 & z(z+1) & z+1 \end{vmatrix}$

B. $\begin{vmatrix} 1 & x+1 & x^2+1 \\ 1 & y+1 & y^2+1 \\ 1 & z+1 & z^2+1 \end{vmatrix}$

C. $\begin{vmatrix} 0 & x-y & x^2-y^2 \\ 0 & y-z & y^2-z^2 \\ 1 & z & z^2 \end{vmatrix}$

D. $\begin{vmatrix} 2 & x+y & x^2+y^2 \\ 2 & y+z & y^2+z^2 \\ 1 & z & z^2 \end{vmatrix}$

gatecse-2013 linear-algebra normal determinant

Answer key

6.4.4 Determinant: GATE CSE 2014 Set 2 | Question: 4

If the matrix A is such that

$$A = \begin{bmatrix} 2 \\ -4 \\ 7 \end{bmatrix} \begin{bmatrix} 1 & 9 & 5 \end{bmatrix}$$

then the determinant of A is equal to ______.

gatecse-2014-set2 linear-algebra numerical-answers easy determinant

Answer key

6.4.5 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

6.4.6 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☟

6.4.7 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☟

6.4.8 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 deteminant of $(M - N)$?

A. 0 B. 1 C. 2 D. 3

gatecse2025-set2 linear-algebra determinant easy one-mark

Answer key☟

6.4.9 Determinant: GATE DS&AI 2024 | Question: 25

Consider the 3×3 matrix $\boldsymbol{M} = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & 3 \\ 4 & 3 & 6 \end{bmatrix}$.

The determinant of $\left(\boldsymbol{M}^2 + 12\boldsymbol{M}\right)$ is _________.

gate-ds-ai-2024 numerical-answers matrix determinant linear-algebra easy one-mark

Answer key

6.4.10 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

6.4.11 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

6.5 Eigen Value (32)

6.5.1 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

6.5.2 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

6.5.3 Eigen Value: GATE CSE 2005 | Question: 49

What are the eigenvalues of the following 2×2 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

gatecse-2005 linear-algebra eigen-value easy

Answer key

6.5.4 Eigen Value: GATE CSE 2007 | Question: 25

Let A be a 4×4 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 4×4 identity matrix?

A. -5 B. -7 C. 2 D. 1

gatecse-2007 eigen-value linear-algebra difficult

Answer key

6.5.5 Eigen Value: GATE CSE 2008 | Question: 28

How many of the following matrices have an eigenvalue 1?
$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$ and $\begin{bmatrix} -1 & 0 \\ 1 & -1 \end{bmatrix}$

A. one B. two C. three D. four

gatecse-2008 eigen-value linear-algebra easy

Answer key

6.5.6 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. $x = -4, y = 10$

gatecse-2010 linear-algebra eigen-value easy

Answer key

6.5.7 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. $1,2,3$

gatecse-2011 linear-algebra eigen-value easy

Answer key

6.5.8 Eigen Value: GATE CSE 2012 | Question: 11

Let A be the 2×2 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
B. $1024\sqrt{2}$ and $-1024\sqrt{2}$
C. $4\sqrt{2}$ and $-4\sqrt{2}$
D. $512\sqrt{2}$ and $-512\sqrt{2}$

gatecse-2012 linear-algebra eigen-value

Answer key

6.5.9 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 $4-by-4$ symmetric positive definite matrix is ___________

gatecse-2014-set1 linear-algebra eigen-value numerical-answers normal

Answer key

6.5.10 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

6.5.11 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

6.5.12 Eigen Value: GATE CSE 2015 Set 1 | Question: 36

Consider the following 2×2 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

6.5.13 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

6.5.14 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. $\left\{a\left(\sqrt{2}, 0, 1\right) \mid a \neq 0, a \in \mathbb{R}\right\}$
D. $\left\{a\left(-\sqrt{2}, 0, 1\right) \mid a \neq 0, a \in \mathbb{R}\right\}$

gatecse-2015-set3 linear-algebra eigen-value normal

Answer key

6.5.15 Eigen Value: GATE CSE 2016 Set 1 | Question: 05

Two eigenvalues of a 3×3 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

6.5.16 Eigen Value: GATE CSE 2016 Set 2 | Question: 06

Suppose that the eigenvalues of matrix A are $1, 2, 4$. The determinant of $\left(A^{-1}\right)^T$ is _________.

gatecse-2016-set2 linear-algebra eigen-value normal numerical-answers

Answer key

6.5.17 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☟

6.5.18 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☟

6.5.19 Eigen Value: GATE CSE 2017 Set 2 | Question: 52

If the characteristic polynomial of a 3×3 matrix M over $\mathbb{R}$ (the set of real numbers) is $\lambda^3 - 4\lambda^2 + a\lambda + 30, \quad a \in \mathbb{R}$, 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☟

6.5.20 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☟

6.5.21 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☟

6.5.22 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

6.5.23 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

6.5.24 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. $\begin{pmatrix} -1 \\ 0 \\ 2 \\ 2 \end{pmatrix}$

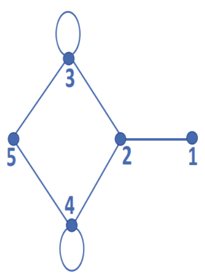
D. $\begin{pmatrix} 0 \\ 1 \\ -3 \\ 0 \end{pmatrix}$

gatecse-2022 linear-algebra eigen-value multiple-selects two-marks

Answer key

6.5.25 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 λ_5 be the five eigenvalues of A. Note that these eigenvalues need not be distinct.
The value of $\lambda_1 + \lambda_2 + \lambda_3 + \lambda_4 + \lambda_5 =$___________

gatecse-2023 linear-algebra eigen-value numerical-answers one-mark

Answer key

6.5.26 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☟

6.5.27 Eigen Value: GATE CSE 2025 | Set 1 | Question: 31

Let A be a 2×2 matrix as given.

$$A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

What are the eigenvalues of the matrix A^{13} ?

A. $1, -1$
B. $2\sqrt{2}, -2\sqrt{2}$
C. $4\sqrt{2}, -4\sqrt{2}$
D. $64\sqrt{2}, -64\sqrt{2}$

gatecse2025-set1 linear-algebra matrix eigen-value easy two-marks

Answer key☟

6.5.28 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
B. A is invertible
C. 0 is an eigenvalue of A
D. A^{-1} has a negative eigenvalue

gateda-2025 linear-algebra matrix eigen-value multiple-selects one-mark

Answer key☟

6.5.29 Eigen Value: GATE DS&AI 2024 | Question: 3

Consider the matrix $\boldsymbol{M} = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$.
Which ONE of the following statements is TRUE?

A. The eigenvalues of $\boldsymbol{M}$ are non-negative and real.
B. The eigenvalues of $\boldsymbol{M}$ are complex conjugate pairs.
C. One eigenvalue of $\boldsymbol{M}$ is positive and real, and another eigenvalue of $\boldsymbol{M}$ is zero.
D. One eigenvalue of $\boldsymbol{M}$ is non-negative and real, and another eigenvalue of $\boldsymbol{M}$ is negative and real.

gate-ds-ai-2024 eigen-value linear-algebra one-mark

Answer key☟

6.5.30 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☟

6.5.31 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☟

6.5.32 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 $x^T Ax$ 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☟

6.6 Gaussian Elimination (1)

6.6.1 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☟

6.7 Inequality (1)

6.7.1 Inequality: GATE CSE 1987 | Question: 1-xxi

If a, b, and c are constants, which of the following is a linear inequality?

A. $ax + bcy = 0$ B. $ax^2 + cy^2 = 21$ C. $abx + a^2y \geq 15$ D. $xy + ax \geq 20$

gate1987 linear-algebra inequality out-of-gatecse-syllabus

Answer key☟

6.8 Lu Decomposition (1)

6.8.1 Lu Decomposition: GATE CSE 2025 | Set 2 | Question: 34

Consider a system of linear equations $PX = Q$ where $P \in \mathbb{R}^{3\times3}$ and $\text{Q} \in \mathbb{R}^{3\times1}$. 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

6.9 Matrix (22)

6.9.1 Matrix: GATE CSE 1987 | Question: 1-xxiii

A square matrix is singular whenever

A. The rows are linearly independent
B. The columns are linearly independent
C. The row are linearly dependent
D. None of the above

gate1987 linear-algebra matrix

Answer key

6.9.2 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

6.9.3 Matrix: GATE CSE 1993 | Question: 02.7

I f $A = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & -1 & 0 & -1 \\ 0 & 0 & i & i \\ 0 & 0 & 0 & -i \end{pmatrix}$ 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

6.9.4 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

6.9.5 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

6.9.6 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

6.9.7 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

6.9.8 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

6.9.9 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 Δ?

A. $a+b$
B. $a-b$
C. $a+b+c$
D. abc

gate1998 linear-algebra matrix normal

Answer key

6.9.10 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
B. $S1$ is true, $S2$ is false
C. $S1$ is false, $S2$ is true
D. $S1$ and $S2$ both are false

gatecse-2001 linear-algebra normal matrix

Answer key

6.9.11 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: $\text{power}\,(2, X)$ is same as 2^X)

A. $\text{power}\,(2, n)$
B. $\text{power}\,(2, n^2)$
C. $\text{power}\left(2, \frac{(n^2+n)}{2}\right)$
D. $\text{power}\left(2, \frac{(n^2-n)}{2}\right)$

gatecse-2004 linear-algebra normal matrix

Answer key

6.9.12 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. $D^{-1}C^{-1}A^{-1}$
B. CDA
C. ADC
D. Does not necessarily exist

gatecse-2004 linear-algebra normal matrix

Answer key

6.9.13 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. $\leq a + b$
B. $\leq \max(a, b)$
C. $\leq \min(M - a, N - b)$
D. $\leq \min(a, b)$

gatecse-2004 linear-algebra normal matrix

Answer key

6.9.14 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

6.9.15 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

6.9.16 Matrix: GATE CSE 2015 Set 2 | Question: 27

Perform the following operations on the matrix $\begin{bmatrix} 3 & 4 & 45 \\ 7 & 9 & 105 \\ 13 & 2 & 195 \end{bmatrix}$

i. Add the third row to the second row
ii. 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

6.9.17 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 $1: tr(\mathrm{AB}) = tr(\mathrm{BA})$

Statement $2: tr(\mathrm{CD}) = tr(\mathrm{DC})$

where $tr()$ represents the trace of a matrix. Which one of the following holds?

A. Statement 1 is correct and Statement 2 is wrong.
B. Statement 1 is wrong and Statement 2 is correct.
C. Both Statement 1 and Statement 2 are correct.
D. Both Statement 1 and Statement 2 are wrong.

gatecse-2022 linear-algebra matrix one-mark

Answer key

6.9.18 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. $\begin{pmatrix} 25 & 0 \\ 0 & 25 \end{pmatrix}$
B. $\begin{pmatrix} 125 & 0 \\ 0 & 125 \end{pmatrix}$
C. $\begin{pmatrix} 625 & 0 \\ 0 & 625 \end{pmatrix}$
D. $\begin{pmatrix} 3125 & 0 \\ 0 & 3125 \end{pmatrix}$

gatecse2025-set2 linear-algebra matrix easy one-mark

Answer key

6.9.19 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
B. Determinant of A is 0
C. The sum of the diagonal elements of A is 1
D. A and A^2 have the same rank

gateda-2025 linear-algebra matrix two-marks

Answer key

6.9.20 Matrix: GATE DA 2025 | Question: 42

A n $n \times n$ 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
B. $A = I$, where I denotes the identity matrix, is the only solution
C. The eigenvalues of A are either $+1$ or -1
D. A has full rank

gateda-2025 linear-algebra matrix multiple-selects two-marks

Answer key

6.9.21 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. $\begin{bmatrix} 1-a & -1 \\ a^2 & a \end{bmatrix}$

B. $\begin{bmatrix} 1-a & -1 \\ a^2-a+1 & a \end{bmatrix}$

C. $\begin{bmatrix} -a & 1 \\ -a^2+a-1 & 1-a \end{bmatrix}$

D. $\begin{bmatrix} a^2-a+1 & a \\ 1 & 1-a \end{bmatrix}$

gateit-2004 linear-algebra matrix normal

Answer key

6.9.22 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

6.10 Numerical Methods (2)

6.10.1 Numerical Methods: GATE IT 2006 | Question: 76

- $x + y/2 = 9$
- $3x + y = 10$

The value of the Frobenius norm for the above system of equations is

A. 0.5

B. 0.75

C. 1.5

D. 2.0

gateit-2006 linear-algebra normal numerical-methods non-gatecse

Answer key

6.10.2 Numerical Methods: GATE IT 2006 | Question: 77

- $x + y/2 = 9$
- $3x + y = 10$

What can be said about the Gauss-Siedel iterative method for solving the above set of linear equations?

A. it will converge

B. It will diverse

C. It will neither converge nor diverse

D. It is not applicable

gateit-2006 linear-algebra normal numerical-methods non-gatecse

Answer key

6.11 Orthonormality (2)

6.11.1 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

6.11.2 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 $A = x_1 x_1^\top + \ldots + x_5 x_5^\top$. Which of the following statements is/are correct?

A. Singular values of A are also its eigenvalues
B. Singular values of A are either 0 or 1
C. Determinant of A is 1
D. A is invertible

gateda-2025 linear-algebra orthonormality vector-space matrix multiple-selects two-marks

Answer key

6.12 Out of Gatecse Syllabus (2)

6.12.1 Out of Gatecse Syllabus: GATE CSE 1988 | Question: 16ii-iii

If $x\|\underline{x}\|\infty = 1 < i^{max} < n\ max\ (|\ x1\ |)$ for the vector $\underline{x} = (x1, x2 \ldots x_n)$ and $\|A\|\infty = x^{Sup\ \frac{\|A\underline{x}\|\infty}{\|\underline{x}\|\infty}}$ is the corresponding matrix norm, calculate $\|A\|_o$ for the matrix $A = \begin{bmatrix} 2 & 5 & 9 \\ 4 & 6 & 5 \\ 8 & 2 & 3 \end{bmatrix}$ using a known property of this norm.

Although this norm is very easy to calculate for any matrix, explain why the condition number is difficult (i.e. expensive) to calculate.

gate1988 linear-algebra descriptive matrix out-of-gatecse-syllabus

6.12.2 Out of Gatecse Syllabus: GATE CSE 1993 | Question: 02.3

If the linear velocity $\vec{V}$ is given by

$$\vec{V} = x^2 y\,\hat{i} + xyz\,\hat{j} - yz^2\,\hat{k}$$

The angular velocity $\vec{\omega}$ at the point $(1, 1, -1)$ is ________

gate1993 linear-algebra normal vector-space out-of-gatecse-syllabus fill-in-the-blanks

Answer key

6.13 Rank of Matrix (6)

6.13.1 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

6.13.2 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

6.13.3 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

6.13.4 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

6.13.5 Rank of Matrix: GATE CSE 2020 | Question: 27

Let A and B be two $n \times n$ matrices over real numbers. Let 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

gatecse-2020 linear-algebra matrix two-marks rank-of-matrix

Answer key

6.13.6 Rank of Matrix: GATE CSE 2021 Set 2 | Question: 24

Suppose that P is a 4×5 matrix such that every solution of the equation Px=0 is a scalar multiple of $\begin{bmatrix} 2 & 5 & 4 & 3 & 1 \end{bmatrix}^T$. The rank of P is __________ gatecse-2021-set2 numerical-answers linear-algebra matrix rank-of-matrix one-mark

Answer key

6.14 Singular Value Decomposition (1)

6.14.1 Singular Value Decomposition: GATE DS&AI 2024 | Question: 51

Let $\mathbf{u} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix}$, and let $\sigma_1, \sigma_2, \sigma_3, \sigma_4, \sigma_5$ be the singular values of the matrix $\mathrm{M} = \mathbf{u}\mathbf{u}^{\mathrm{T}}$ (where $\mathbf{u}^{\mathrm{T}}$ is the transpose of $\mathbf{u}$). The value of $\sum_{i=1}^{5} \sigma_i$ is ________

gate-ds-ai-2024 linear-algebra singular-value-decomposition numerical-answers two-marks

Answer key

6.15 Subspace (1)

6.15.1 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. $\left\{ \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \in \mathbb{R}^3 : 5x_1 + 2x_3 + 4 = 0 \right\}$

gate-ds-ai-2024 linear-algebra vector-space subspace multiple-selects two-marks

Answer key

6.16 System of Equations (17)

6.16.1 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☟

6.16.2 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☟

6.16.3 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☟

6.16.4 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 α, 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☟

6.16.5 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☟

6.16.6 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

6.16.7 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 α 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

6.16.8 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

6.16.9 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

6.16.10 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

6.16.11 System of Equations: GATE CSE 2017 Set 1 | Question: 3

Let $c_1 \dots \dots c_n$ 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 $A = [a_1 \dots \dots a_n]$ and $b = \sum_{i=1}^{n} a_i$. 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

6.16.12 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

6.16.13 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

6.16.14 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☟

6.16.15 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☟

6.16.16 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 $\mathrm{M} \in \mathbb{R}^{3\times 3}, \mathrm{p} \in \mathbb{R}^3,$ and $\mathrm{q} \in \mathbb{R}^3$ such that $\mathrm{M\,x} = \mathrm{p}$ has a unique solution and $\mathrm{M\,x} = \mathrm{q}$ has infinite solutions.
B. There exist $\mathrm{M} \in \mathbb{R}^{3\times 3}, \mathrm{p} \in \mathbb{R}^3,$ and $\mathrm{q} \in \mathbb{R}^3$ such that $\mathrm{M\,x} = \mathrm{p}$ has no solutions and $\mathrm{M\,x} = \mathrm{q}$ has infinite solutions.
C. There exist $\mathrm{M} \in \mathbb{R}^{2\times 3}, \mathrm{p} \in \mathbb{R}^2,$ and $\mathrm{q} \in \mathbb{R}^2$ such that $\mathrm{M\,x} = \mathrm{p}$ has a unique solution and $\mathrm{M\,x} = \mathrm{q}$ has infinite solutions.
D. There exist $\mathrm{M} \in \mathbb{R}^{3\times 2}, \mathrm{p} \in \mathbb{R}^3,$ and $\mathrm{q} \in \mathbb{R}^3$ such that $\mathrm{Mx} = \mathrm{p}$ has a unique solution and $\mathrm{M\,x} = \mathrm{q}$ has no solutions.

linear-algebra system-of-equations gate-ds-ai-2024 multiple-selects two-marks

Answer key☟

6.16.17 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☟

6.17 Vector Space (6)

6.17.1 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☟

6.17.2 Vector Space: GATE CSE 2007 | Question: 27

Consider the set of (column) vectors defined by

$$X = \left\{x \in R^3 \mid x_1 + x_2 + x_3 = 0, \text{ where } x^T = [x_1, x_2, x_3]^T\right\}$$

.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 R^3.
D. None of the above

gatecse-2007 linear-algebra normal vector-space

Answer key☟

6.17.3 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☟

6.17.4 Vector Space: GATE CSE 2017 Set 1 | Question: 30

Let u and v be two vectors in $\mathbf{R}^2$ whose Euclidean norms satisfy $||u|| = 2\,||v||$. What is the value of α 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☟

6.17.5 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 $A_{ij} = x_i^\top x_j, 1 \leq i, j \leq n$. 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. $z^\top Az = 0$ for some non-zero $z \in \mathbb{R}^n$

gateda-2025 linear-algebra vector-space matrix two-marks

Answer key☟

6.17.6 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 $\mathrm{M} \in \mathbb{R}^{3\times 3}$ 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	TBA	6.1.2	A	6.2.1	A	6.3.1	TBA	6.4.1	B
6.4.2	A	6.4.3	A	6.4.4	0	6.4.5	D	6.4.6	B
6.4.7	A;B	6.4.8	A	6.4.9	0	6.4.10	D	6.4.11	A
6.5.1	B;D	6.5.2	N/A	6.5.3	B	6.5.4	C	6.5.5	A
6.5.6	D	6.5.7	A	6.5.8	D	6.5.9	0	6.5.10	6
6.5.11	A	6.5.12	D	6.5.13	6	6.5.14	B	6.5.15	15
6.5.16	0.125	6.5.17	B	6.5.18	2	6.5.19	5	6.5.20	3
6.5.21	D	6.5.22	12	6.5.23	3 : 3	6.5.24	A;C;D	6.5.25	2
6.5.26	B	6.5.27	D	6.5.28	A;B	6.5.29	B	6.5.30	B
6.5.31	A	6.5.32	B	6.6.1	B	6.7.1	C	6.8.1	A;B;C
6.9.1	C	6.9.2	N/A	6.9.3	N/A	6.9.4	D	6.9.5	N/A
6.9.6	N/A	6.9.7	A	6.9.8	C	6.9.9	B	6.9.10	A
6.9.11	C	6.9.12	B	6.9.13	D	6.9.14	D	6.9.15	5
6.9.16	0	6.9.17	C	6.9.18	C	6.9.19	D	6.9.20	A;D
6.9.21	B	6.9.22	D	6.10.1	D	6.10.2	A	6.11.1	B;D
6.11.2	A;B	6.12.1	N/A	6.12.2	N/A	6.13.1	C	6.13.2	A
6.13.3	A	6.13.4	C	6.13.5	C	6.13.6	4 : 4	6.14.1	55
6.15.1	A;C	6.16.1	C	6.16.2	B	6.16.3	N/A	6.16.4	B
6.16.5	C	6.16.6	B	6.16.7	X	6.16.8	1	6.16.9	C
6.16.10	C	6.16.11	C	6.16.12	D	6.16.13	A	6.16.14	A;D
6.16.15	C	6.16.16	B;D	6.16.17	C	6.17.1	A	6.17.2	A
6.17.3	2	6.17.4	A	6.17.5	A	6.17.6	B;C;D		

7 Engineering Mathematics: Optimization (8)

7.1 Linear Programming (5)

7.1.1 Linear Programming: UGC NET CSE | December 2018 | Part 2 | Question: 9

Use Dual Simplex Method to solve the following problem:

$$Maximize \quad z = -2x_1 - 3x_2$$

subject to:

$$x_1 + x_2 \geq 2$$
$$2x_1 + x_2 \leq 10$$
$$x_2 + x_2 \leq 8$$
$$x_1, x_2 \geq 0$$

A. $x_1 = 2, x_2 = 0,$ and $z = -4$
B. $x_1 = 2, x_2 = 6,$ and $z = -22$
C. $x_1 = 0, x_2 = 2,$ and $z = -6$
D. $x_1 = 6, x_2 = 2,$ and $z = -18$

ugcnetcse-dec2018-paper2 linear-programming optimization

7.1.2 Linear Programming: UGC NET CSE | December 2019 | Part 2 | Question: 1

A basic feasible solution of an $m \times n$ transportation problem is said to be non-degenerate, if basic feasible solution contains exactly _______ number of individual allocation in ______ positions.

A. $m + n + 1$, independent
B. $m + n - 1$, independent
C. $m + n - 1$, appropriate
D. $m - n + 1$, independent

ugcnetcse-dec2019-paper2 linear-programming

Answer key☟

7.1.3 Linear Programming: UGC NET CSE | December 2019 | Part 2 | Question: 2

Consider the following Linear programming problem (LPP):

Maximize $z = x_1 + x_2$

Subject to the constraints:

$$x_1 + 2x_2 \leq 2000$$
$$x_1 + x_2 \leq 1500$$
$$x_2 \leq 600$$
$$\text{and } x_1, x_2 \geq 0$$

The solution of the above LPP is

A. $x_1 = 750, x_2 = 750, z = 1500$
B. $x_1 = 500, x_2 = 1000, z = 1500$
C. $x_1 = 1000, x_2 = 500, z = 1500$
D. $x_1 = 900, x_2 = 600, z = 1500$

ugcnetcse-dec2019-paper2 linear-programming optimization

Answer key☟

7.1.4 Linear Programming: UGC NET CSE | December 2019 | Part 2 | Question: 67

Consider the following statements with respect to duality in LPP:

i. The final simplex table giving optimal solution of the primal also contains optimal solution of its dual in itself
ii. If either the primal or the dual problem has a finite optimal solution, then the other problem also has a finite optimal solution
iii. If either problem has an unbounded optimum solution, then the other problem has no feasible solution at all

Which of the statements is (are) correct?

A. Only (i) and (ii)
B. Only (i) and (iii)
C. Only (ii) and (iii)
D. (i), (ii) and (iii)

ugcnetcse-dec2019-paper2 linear-programming optimization

Answer key☟

7.1.5 Linear Programming: UGC NET CSE | November 2017 | Part 3 | Question: 68

Consider the following LPP:

Max $Z = 15x_1 + 10x_2$

Subject to the constraints

$4x_1 + 6x_2 \leq 360$

$3x_1 + 0x_2 \leq 180$

$0x_1 + 5x_2 \leq 200$

$x_1, x_2 \geq 0$

The solution of the LPP using Graphical solution technique is

A. $x_1 = 60, x_2 = 0$ and $Z = 900$
B. $x_1 = 60, x_2 = 20$ and $Z = 1100$
C. $x_1 = 60, x_2 = 30$ and $Z = 1200$
D. $x_1 = 50, x_2 = 40$ and $Z = 1150$

ugcnetcse-nov2017-paper3 linear-programming optimization

Answer key☟

7.2 Optimization (2)

7.2.1 Optimization: UGC NET CSE | November 2017 | Part 3 | Question: 67

Which of the following is a valid reason for causing degeneracy in a transportation problem? Here m is number of rows and n is number of columns in transportation table.

A. When the number of allocations is $m + n - 1$
B. When two or more occupied cells become unoccupied simultaneously
C. When the number of allocations is less than $m + n - 1$
D. When a loop cannot be drawn without using unoccupied cells, except the starting cell of the loop

ugcnetcse-nov2017-paper3 optimization quantitative-aptitude

Answer key☟

7.2.2 Optimization: UGC NET CSE | November 2017 | Part 3 | Question: 69

Consider the following LPP:

Min $Z = 2x_1 + x_2 + 3x_3$

Subject to:

$x_1 - 2x_2 + x_3 \geq 4$

$2x_1 + x_2 + x_3 \leq 8$

$x_1 - x_3 \geq 0$

$x_1, x_2, x_3 \geq 0$

The solution of this LPP using Dual Simplex Method is

A. $x_1 = 0, x_2 = 0, x_3 = 3$ and $Z = 9$
B. $x_1 = 0, x_2 = 6, x_3 = 0$ and $Z = 6$
C. $x_1 = 4, x_2 = 0, x_3 = 0$ and $Z = 8$
D. $x_1 = 2, x_2 = 0, x_3 = 2$ and $Z = 10$

ugcnetcse-nov2017-paper3 optimization

Answer key☟

7.3 Simplex (1)

7.3.1 Simplex: UGC NET CSE | October 2022 | Part 1 | Question:: 13

Consider the primal problem :
Maximize $z = 5x_1 + 12x_2 + 4x_3$
Subject to

$$
\begin{aligned}
x_1 + 2x_2 + x_3 &= 10 \\
2x_1 - x_2 + 3x_3 &= 8 \\
x_1, x_2, x_3 &\geq 0
\end{aligned}
$$

its dual problem is
Minimize $w = 10y_1 + 8y_2$
Subject to

$$
\begin{aligned}
y_1 + 2y_2 &\geq 5 \\
2y_1 - y_2 &\geq 12 \\
y_1 + 3y_2 &\geq 4
\end{aligned}
$$

Which of the following is correct?

A. $y_1 \geq 0, y_2$ unrestricted
B. $y_1 \geq 0, y_2 \geq 0$
C. y_1 is unrestricted, $y_2 \geq 0$
D. y_1 is unrestricted. y_2 restricted

ugcnetcse-oct2022-paper1 simplex linear-programming optimization

Answer key☟

Answer Keys

7.1.1	TBA	7.1.2	TBA	7.1.3	TBA	7.1.4	TBA	7.1.5	B
7.2.1	C	7.2.2	C	7.3.1	TBA				

8 Machine Learning (31)

8.1 Algorithm Design (1)

8.1.1 Algorithm Design: UGCNET CSE December 2022: 79

Select the correct order of DBSCAN algorithm.

A. Find recursively all its den[illegible]

Choose the correct answer from the following :

A. $\mathrm{B, D, C, A}$ B. $\mathrm{D, B, C, A}$ C. $\mathrm{B, D, A, C}$ D. $\mathrm{D, B, A, C}$

ugcnetcse-dec2022 machine-learning algorithm-design

8.2 Artificial Intelligence (1)

8.2.1 Artificial Intelligence: UGC NET CSE | November 2017 | Part 3 | Question: 72

The Sigmoid activation function $f(t)$ is defined as

A. $\dfrac{1}{\exp(t)+\exp(-t)}$

B. $t\exp(-t)$

C. $\dfrac{1}{1+\exp(t)}$

D. $\dfrac{1}{1+\exp(-t)}$

ugcnetcse-nov2017-paper3 machine-learning artificial-intelligence

Answer key☟

8.3 Bayesian Network (1)

8.3.1 Bayesian Network: GATE DA 2025 | Question: 16

Which of the following statements is/are correct in a Bayesian network?

A. Variable elimination is an approximate inference algorithm
B. Gibbs sampling is an exact inference algorithm
C. Variable elimination is used to determine conditional probabilities
D. Rejection sampling is an approximate inference algorithm

gateda-2025 machine-learning bayesian-network multiple-selects one-mark

8.4 Classification (1)

8.4.1 Classification: UGC NET CSE | December 2019 | Part 2 | Question: 81

Consider the following learning algorithms:

a. Logistic repression
b. Back propogation
c. Linear repression

Which of the following option represents classification algorithms?

A. (a) and (b) only
B. (a) and (c) only
C. (b) and (c) only
D. (a), (b) and (c)

ugcnetcse-dec2019-paper2 machine-learning classification logistic-regression backpropagation

8.5 Classification Algorithms (1)

8.5.1 Classification Algorithms: UGCNET CSE December 2022: 64

Consider the following Learning algorithms.

A. Logistic regression.
B. Back propagation.

C. Linear regression.
D. Forward propagation.

Which of the following options represents classification algorithm?

Choose the correct answer from the options given below:

A. A & C only
B. B & D only
C. A & B only
D. C & D only

ugcnetcse-dec2022 machine-learning logistic-regression linear-regression classification-algorithms

Answer key☟

8.6 Clustering (1)

8.6.1 Clustering: GATE DA 2025 | Question: 20

Let C_1 and C_2 be two sets of objects. Let $D(x, y)$ be a measure of dissimilarity between two objects x and y. Consider the following definitions of dissimilarity between C_1 and C_2.

$$\text{DIS-1}(C_1, C_2) = \max_{x \in C_1, y \in C_2} D(x, y)$$
$$\text{DIS-2}(C_1, C_2) = \min_{x \in C_1, y \in C_2} D(x, y)$$

Which of the following statements is/are correct?

A. Single Linkage Clustering uses **DIS-1**
B. Single Linkage Clustering uses **DIS-2**
C. Complete Linkage Clustering uses **DIS-2**
D. Complete Linkage Clustering uses **DIS-1**

gateda-2025 machine-learning clustering multiple-selects one-mark

8.7 Decision Trees (1)

8.7.1 Decision Trees: GATE DS&AI 2024 | Question: 52

Details of ten international cricket games between two teams "Green" and "Blue" are given in Table C. This table consists of matches played on different pitches, across formats along with their winners. The attribute Pitch can take one of two values: spin-friendly (represented as S) or pace-friendly (represented as F). The attribute Format can take one of two values: one-day match (represented as O) or test match (represented as T).

A cricket organization would like to use the information given in Table C to develop a decision-tree model to predict outcomes of future games between these two teams.

To develop such a model, the computed InformationGain(C, Pitch) with respect to the Target is _________ (rounded off to two decimal places).

Table C

Match Number	Pitch	Format	Winner (Target)
1	S	T	Green
2	S	T	Blue
3	F	O	Blue
4	S	O	Blue

5	F	T	Green
6	F	O	Blue
7	S	O	Green
8	F	T	Blue
9	F	O	Blue
10	S	O	Green

gate-ds-ai-2024 machine-learning decision-trees numerical-answers two-marks

Answer key☟

8.8 Fisher Linear Discriminant (1)

8.8.1 Fisher Linear Discriminant: GATE DS&AI 2024 | Question: 12

For any binary classification dataset, let $S_B \in \mathbb{R}^{d \times d}$ and $S_W \in \mathbb{R}^{d \times d}$ be the between-class and within-class scatter (covariance) matrices, respectively. The Fisher linear discriminant is defined by $u^* \in \mathbb{R}^d$, that maximizes

$$J(u) = \frac{u^T S_B u}{u^T S_W u}$$

If $\lambda = J(u^*)$, S_W is non-singular and $S_B \neq 0$, then (u^*, λ) must satisfy which ONE of the following equations?

Note: $\mathbb{R}$ denotes the set of real numbers.

A. $S_W^{-1} S_B u^* = \lambda u^*$

B. $S_W u^* = \lambda S_B u^*$

C. $S_B S_W u^* = \lambda u^*$

D. $u^{*T} u^* = \lambda^2$

gate-ds-ai-2024 machine-learning fisher-linear-discriminant one-mark

Answer key☟

8.9 Gradient Descent (1)

8.9.1 Gradient Descent: UGC NET CSE | December 2019 | Part 2 | Question: 63

Let $\mathbf{W}_{ij}$ represents weight between node i at layer k and node j at layer $(k-1)$ of a given multilayer perceptron. The weight updation using gradient descent method is given by

A. $\mathbf{W}_{ij}(t+1) = \mathbf{W}_{ij}(t) + \alpha \frac{\partial \mathbf{E}}{\partial \mathbf{W}_{ij}}, 0 \leq \alpha \leq 1$

B. $\mathbf{W}_{ij}(t+1) = \mathbf{W}_{ij}(t) - \alpha \frac{\partial \mathbf{E}}{\partial \mathbf{W}_{ij}}, 0 \leq \alpha \leq 1$

C. $\mathbf{W}_{ij}(t+1) = \alpha \frac{\partial \mathbf{E}}{\partial \mathbf{W}_{ij}}, 0 \leq \alpha \leq 1$

D. $\mathbf{W}_{ij}(t+1) = -\alpha \frac{\partial \mathbf{E}}{\partial \mathbf{W}_{ij}}, 0 \leq \alpha \leq 1$

Where α and E represents learning rate and Error in the output respectively.

ugcnetcse-dec2019-paper2 machine-learning gradient-descent neural-network

8.10 K Means Clustering (1)

8.10.1 K Means Clustering: GATE DS&AI 2024 | Question: 9

Euclidean distance based k-means clustering algorithm was run on a dataset of 100 points with $k = 3$. If the points $\begin{bmatrix}1\\1\end{bmatrix}$ and $\begin{bmatrix}-1\\1\end{bmatrix}$ are both part of cluster 3, then which ONE of the following points is necessarily also part of cluster 3?

A. $\begin{bmatrix}0\\0\end{bmatrix}$ B. $\begin{bmatrix}0\\2\end{bmatrix}$ C. $\begin{bmatrix}2\\0\end{bmatrix}$ D. $\begin{bmatrix}0\\1\end{bmatrix}$

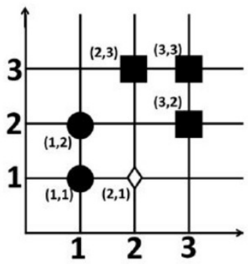
gate-ds-ai-2024 machine-learning k-means-clustering one-mark

Answer key☟

8.11 K Nearest Neighbour (1)

8.11.1 K Nearest Neighbour: GATE DS&AI 2024 | Question: 53

Given the two-dimensional dataset consisting of 5 data points from two classes (circles and squares) and assume that the Euclidean distance is used to measure the distance between two points. The minimum odd value of k in k-nearest neighbor algorithm for which the diamond $(\diamond)$ shaped data point is assigned the label square is _______.



gate-ds-ai-2024 machine-learning k-nearest-neighbour numerical-answers two-marks

Answer key☟

8.12 Linear Binary Classifier (1)

8.12.1 Linear Binary Classifier: GATE DA 2025 | Question: 43

Consider designing a linear binary classifier $f(x) = \text{sign}\left(w^{\top}x + b\right), x \in \mathbb{R}^2$ on the following training data:

$$\text{Class-1: } \left\{ \begin{pmatrix}2\\0\end{pmatrix}, \begin{pmatrix}0\\2\end{pmatrix}, \begin{pmatrix}2\\2\end{pmatrix} \right\}, \text{ Class-2: } \left\{ \begin{pmatrix}0\\0\end{pmatrix} \right\}$$

Hard-margin support vector machine (SVM) formulation is solved to obtain w and b. Which of the following options is/are correct?

A. $w = \binom{4}{4}$ and $b = 1$

B. The number of support vectors is 3

C. The margin is $\sqrt{2}$

D. Training accuracy is 98%

gateda-2025 machine-learning support-vector-machine linear-binary-classifier multiple-selects two-marks

Answer key☟

8.13 Linear Classifier (1)

8.13.1 Linear Classifier: GATE DA 2025 | Question: 12

Consider designing a linear classifier

$$y = \text{sign}(f(x; w, b)), \quad f(x; w, b) = w^{\top}x + b$$

on a dataset $D=\{(x_1,y_1),(x_2,y_2),\ldots,(x_N,y_N)\}, x_i\in\mathbb{R}^d, y_i\in\{+1,-1\}, i=1,2,\ldots,N$. Recall that the sign function outputs $+1$ if the argument is positive, and -1 if the argument is non-positive. The parameters w and b are updated as per the following training algorithm:

$$w_{\text{new}}=w_{\text{old}}+y_n x_n, \quad b_{\text{new}}=b_{\text{old}}+y_n$$

whenever $\operatorname{sign}(f(x_n;w_{\text{old}},b_{\text{old}}))\neq y_n$. In other words, whenever the classifier wrongly predicts a sample (x_n,y_n) from the dataset, w_{old} gets updated to w_{new}, and likewise b_{old} gets updated to b_{new}. Consider the case $(x_n,+1), f(x_n;w_{\text{old}},b_{old})<0$. Then

A. $f(x_n;w_{\text{new}},b_{\text{new}})>f(x_n;w_{\text{old}},b_{\text{old}})$
B. $f(x_n;w_{\text{new}},b_{\text{new}})<f(x_n;w_{\text{old}},b_{\text{old}})$
C. $f(x_n;w_{\text{new}},b_{\text{new}})=f(x_n;w_{\text{old}},b_{\text{old}})$
D. $y_n f(x_n;w_{\text{old}},b_{\text{old}})>1$

gateda-2025 machine-learning linear-classifier supervised-learning perceptron-algorithm one-mark

Answer key

8.14 Linear Regression (1)

8.14.1 Linear Regression: GATE DA 2025 | Question: 24

Given data $\{(-1,1),(2,-5),(3,5)\}$ of the form (x,y), we fit a model $y=wx$ using linear least-squares regression. The optimal value of w is __________ (Round off to three decimal places)

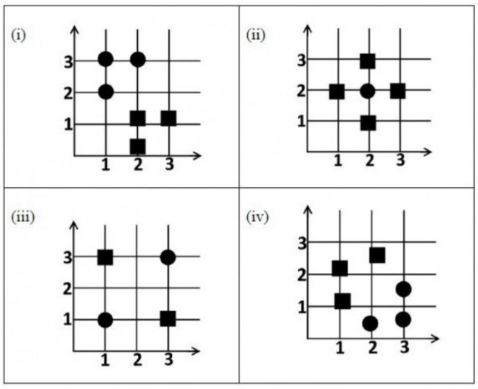
gateda-2025 machine-learning linear-regression numerical-answers one-mark

Answer key

8.15 Linear Separability (1)

8.15.1 Linear Separability: GATE DS&AI 2024 | Question: 43

Consider the following figures representing datasets consisting of two-dimensional features with two classes denoted by circles and squares.



Which of the following is/are TRUE?

A. (i) is linearly separable.
B. (ii) is linearly separable.
C. (iii) is linearly separable.
D. (iv) is linearly separable.

gate-ds-ai-2024 machine-learning linear-separability multiple-selects two-marks

Answer key

8.16 Naive Bayes Classifier (2)

8.16.1 Naive Bayes Classifier: GATE DA 2025 | Question: 25

The naive Bayes classifier is used to solve a two-class classification problem with class-labels y_1, y_2. Suppose the prior probabilities are $P(y_1) = \frac{1}{3}$ and $P(y_2) = \frac{2}{3}$. Assuming a discrete feature space with

$$P(x \mid y_1) = \frac{3}{4} \quad \text{and} \quad P(x \mid y_2) = \frac{1}{4}$$

for a specific feature vector x. The probability of misclassifying x is ___________ (Round off to two decimal places)

gateda-2025 machine-learning naive-bayes-classifier numerical-answers one-mark

Answer key☟

8.16.2 Naive Bayes Classifier: GATE DS&AI 2024 | Question: 10

Given a dataset with K binary-valued attributes (where $K > 2$) for a two-class classification task, the number of parameters to be estimated for learning a naïve Bayes classifier is

A. $2^K + 1$
B. $2K + 1$
C. $2^{K+1} + 1$
D. $K^2 + 1$

gate-ds-ai-2024 machine-learning naive-bayes-classifier one-mark

Answer key☟

8.17 Neural Network (5)

8.17.1 Neural Network: GATE DA 2025 | Question: 32

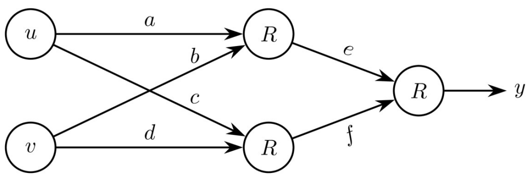
Consider the neural network shown in the figure with

inputs : u, v

weights : a, b, c, d, e, f

output : y

R denotes the ReLU function, $R(x) = \max(0, x)$.



Given $u = 2, v = 3$,

$a = 1, b = 1, c = 1, d = -1, e = 4, f = -1,$

which one of the following is correct?

A. $\frac{\partial y}{\partial a} = 8, \frac{\partial y}{\partial f} = 0$
B. $\frac{\partial y}{\partial a} = 1, \frac{\partial y}{\partial f} = 0$
C. $\frac{\partial y}{\partial a} = 1, \frac{\partial y}{\partial f} = -1$
D. $\frac{\partial y}{\partial a} = 2, \frac{\partial y}{\partial f} = -1$

gateda-2025 machine-learning neural-network two-marks

Answer key☟

8.17.2 Neural Network: GATE DA 2025 | Question: 38

Which of the following statements is/are correct about the rectified linear unit (ReLU) activation function defined as $\mathrm{ReLU}(x) = \max(x, 0)$, where $x \in \mathbb{R}$?

A. ReLU is continuous everywhere
B. ReLU is differentiable everywhere
C. ReLU is not differentiable at $x = 0$
D. $\mathrm{ReLU}(x) = \mathrm{ReLU}(ax)$, for all $a \in \mathbb{R}$

gateda-2025 machine-learning neural-network multiple-selects two-marks

Answer key☟

8.17.3 Neural Network: GATE DS&AI 2024 | Question: 33

Consider the two neural networks (NNs) shown in Figures 1 and 2, with $ReLU$ activation $(\mathrm{ReLU}(z) = \max\{0, z\}, \forall z \in \mathrm{R})$. The connections and their corresponding weights are shown in the Figures. The biases at every neuron are set to 0.

For what values of p, q, r in Figure 2 are the two NNs equivalent, when x_1, x_2, x_3 are positive?

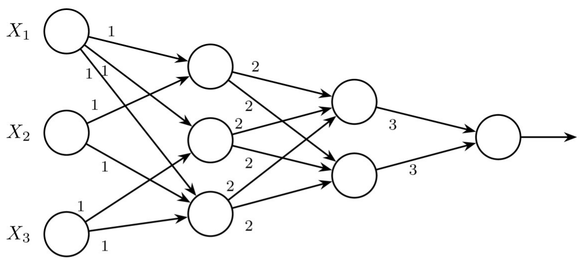


Figure 1

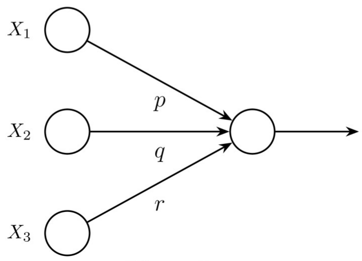


Figure 2

Note: $\mathbb{R}$ denotes the set of real numbers.

A. $p = 36, q = 24, r = 24$
B. $p = 24, q = 24, r = 36$
C. $p = 18, q = 36, r = 24$
D. $p = 36, q = 36, r = 36$

gate-ds-ai-2024 machine-learning neural-network two-marks

Answer key☟

8.17.4 Neural Network: UGC NET CSE | January 2017 | Part 3 | Question: 72

A neuron with inputs has the weight vector $[0.2 \quad -0.1 \quad 0.1]^T$ and a bias $\theta = 0$. If the input vector is $X = [0.2 \quad 0.4 \quad 0.2]^T$. Then the total input to the neuron is:

A. 0.20
B. 1.0
C. 0.02
D. -1.0

ugcnetcse-jan2017-paper3 machine-learning neural-network

Answer key☟

8.17.5 Neural Network: UGCNET CSE December 2022: 40

A 4-input neuron has weights $1, 2, 3, 4$. The transfer function is linear with the constant of proportionality being equal to 3. The inputs are $5, 7, 10, 30$, respectively

Then the output will be,

A. 120 B. 213 C. 410 D. 507

ugcnetcse-dec2022 machine-learning neural-network functions

Answer key

8.18 Overfitting (1)

8.18.1 Overfitting: UGCNET CSE December 2022: 13

Overfitting is expected when we observe that?

A. With training iterations error on training set as well as test set decreases
B. With training iterations error on training set decreases but test set increases
C. With training iterations error on training set as well as test set increases
D. With training iterations training set as well as test error remains constant

ugcnetcse-dec2022 overfitting training-set test-set error-analysis machine-learning

Answer key

8.19 Perceptron (1)

8.19.1 Perceptron: UGC NET CSE | November 2017 | Part 3 | Question: 71

Consider a single perceptron with sign activation function. The perceptron is represented by weight vector $[0.4 \quad -0.3 \quad 0.1]^t$ and a bias $\theta = 0$. If the input vector to the perceptron is $X = [0.2 \quad 0.6 \quad 0.5]$ then the output of the perceptron is

A. 1 B. 0 C. -0.05 D. -1

ugcnetcse-nov2017-paper3 machine-learning perceptron

Answer key

8.20 Principal Component Analysis (1)

8.20.1 Principal Component Analysis: GATE DA 2025 | Question: 50

Let $D = \left\{x^{(1)}, \ldots, x^{(n)}\right\}$ be a dataset of n observations where each $x^{(i)} \in \mathbb{R}^{100}$. It is given that $\sum_{i=1}^{n} x^{(i)} = 0$. The covariance matrix computed from D has eigenvalues $\lambda_i = 100^{2-i}, 1 \leq i \leq 100$. Let $u \in \mathbb{R}^{100}$ be the direction of maximum variance with $u^\top u = 1$.

The value of

$$\frac{1}{n} \sum_{i=1}^{n} \left(u^\top x^{(i)}\right)^2 =$$

(Answer in integer)

gateda-2025 machine-learning principal-component-analysis numerical-answers two-marks

Answer key

8.21 Sigmoid Activation Function (1)

8.21.1 Sigmoid Activation Function: GATE DS&AI 2024 | Question: 23

Let $f : \mathbb{R} \to \mathbb{R}$ be the function $f(x) = \frac{1}{1+e^{-x}}$.

The value of the derivative of f at x where $f(x) = 0.4$ is ________. (rounded off to two decimal places).

Note: $\mathbb{R}$ denotes the set of real numbers.

gate-ds-ai-2024 machine-learning sigmoid-activation-function numerical-answers one-mark

Answer key

8.22 Supervised Learning (1)

8.22.1 Supervised Learning: GATE DS&AI 2024 | Question: 8

Match the items in **Column** 1 with the items in **Column** 2 in the following table:

Column 1	Column 2
(p) Principal Component Analysis	(i) Discriminative Model
(q) Naïve Bayes Classification	(ii) Dimensionality Reduction
(r) Logistic Regression	(iii) Generative Model

A. $(\mathrm{p}) - (\mathrm{iii}), (\mathrm{q}) - (\mathrm{i}), (\mathrm{r}) - (\mathrm{ii})$
B. $(\mathrm{p}) - (\mathrm{ii}), (\mathrm{q}) - (\mathrm{i}), (\mathrm{r}) - (\mathrm{iii})$
C. $(\mathrm{p}) - (\mathrm{ii}), (\mathrm{q}) - (\mathrm{iii}), (\mathrm{r}) - (\mathrm{i})$
D. $(\mathrm{p}) - (\mathrm{iii}), (\mathrm{q}) - (\mathrm{ii}), (\mathrm{r}) - (\mathrm{i})$

gate-ds-ai-2024 machine-learning supervised-learning one-mark

Answer key

8.23 Support Vector Machine (1)

8.23.1 Support Vector Machine: GATE DS&AI 2024 | Question: 7

Consider the dataset with six datapoints: $\{(\mathrm{x}_1, \mathrm{y}_1), (\mathrm{x}_2, \mathrm{y}_2), \ldots, (\mathrm{x}_6, \mathrm{y}_6)\}$, where $x_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, x_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, x_3 = \begin{bmatrix} 0 \\ -1 \end{bmatrix}, x_4 = \begin{bmatrix} -1 \\ 0 \end{bmatrix}, x_5 = \begin{bmatrix} 2 \\ 2 \end{bmatrix}, x_6 = \begin{bmatrix} -2 \\ -2 \end{bmatrix}$ and the labels are given by $\mathrm{y}_1 = \mathrm{y}_2 = \mathrm{y}_5 = 1$, and $\mathrm{y}_3 = \mathrm{y}_4 = \mathrm{y}_6 = -1$. A hard margin linear support vector machine is trained on the above dataset.

Which ONE of the following sets is a possible set of support vectors?

A. $\{x_1, x_2, x_5\}$
B. $\{x_3, x_4, x_5\}$
C. $\{x_4, x_5\}$
D. $\{x_1, x_2, x_3, x_4\}$

gate-ds-ai-2024 machine-learning support-vector-machine one-mark

Answer key

8.24 Two Class Problem (1)

8.24.1 Two Class Problem: GATE DA 2025 | Question: 45

Consider a two-class problem in $\mathbb{R}^d$ with class labels red and $green$. Let μ_{red} and μ_{green} green be the means of the two classes. Given test sample $x \in \mathbb{R}^d$, a classifier calculates the squared Euclidean distance (denoted by $\|\cdot\|^2$) between x and the means of the two classes and assigns the class label that the sample x is closest to. That is, the classifier computes

$$f(x) = ||\mu_{\text{red}} - x||^2 - ||\mu_{\text{green}} - x||^2$$

and assigns the label red to x if $f(x) < 0$, and $green$ otherwise. Which of the following statements is/are correct?

A. The sample $x = 0$ is assigned the label green if $||\mu_{\text{red}}|| < ||\mu_{\text{green}}||$
B. f is a linear function of x
C. $f(x) = w^\top x + b$, where w and b are functions of μ_{red} and μ_{green}
D. f is a quadratic polynomial in x

gateda-2025 machine-learning two-class-problem multiple-selects two-marks

Answer key☟

8.25 Underfitting Overfitting (1)

8.25.1 Underfitting Overfitting: UGC NET CSE | June 2023 | Part 2: 6

Consider the following statements

A. C-Fuzzy means clustering is a supervised method of learning
B. PCA is used for dimension reduction
C. Apriori is not a supervised technique
D. When a machine learning model becomes so specially tuned to its exact input data that it fails to generalize to other similar data it is called underfitting

Choose the correct answer from the options given below:

A. A and B
B. B and C
C. C and D
D. D and A

ugcnetcse-june2023-paper2 machine-learning clustering principal-component-analysis underfitting-overfitting

Answer key☟

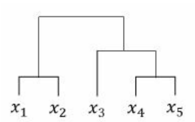
8.26 Unsupervised Learning (1)

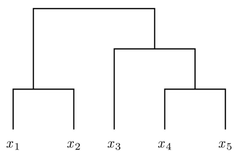
8.26.1 Unsupervised Learning: GATE DS&AI 2024 | Question: 32

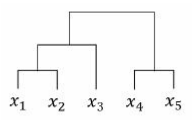
Consider the table below, where the $(i, j)^{th}$ element of the table is the distance between points x_i and x_j. Single linkage clustering is performed on data points, x_1, x_2, x_3, x_4, x_5.

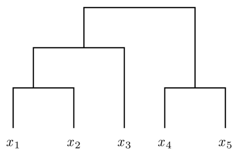
	x_1	x_2	$x3$	x_4	x_5
x_1	0	1	4	3	6
x_2	1	0	3	5	3
x_3	4	3	0	2	5
x_4	3	5	2	0	1
x_5	6	3	5	1	0

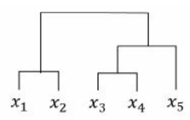
Which ONE of the following is the correct representation of the clusters produced?

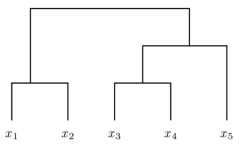
A. 

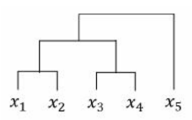
B. 

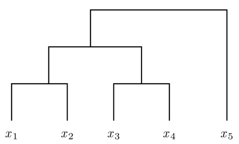
C. 

D. 

E. 

F. 

G. 

H. 

gate-ds-ai-2024 machine-learning unsupervised-learning single-linkage-clustering two-marks

Answer key☟

Answer Keys

8.1.1	TBA	8.2.1	D	8.3.1	C;D	8.4.1	TBA	8.5.1	TBA
8.6.1	B;D	8.7.1	0.12:0.13	8.8.1	A	8.9.1	TBA	8.10.1	D
8.11.1	5	8.12.1	B;C	8.13.1	A	8.14.1	0.285:0.287	8.15.1	A;D
8.16.1	0.39:0.41	8.16.2	B	8.17.1	A	8.17.2	A;C	8.17.3	A
8.17.4	C	8.17.5	TBA	8.18.1	TBA	8.19.1	D	8.20.1	100:100
8.21.1	0.24:0.24	8.22.1	C	8.23.1	D	8.24.1	B;C	8.25.1	TBA
8.26.1	A								

9 Non GATE CSE: Optimization (20)

9.1 Assignment Problem (2)

9.1.1 Assignment Problem: UGC NET CSE | June 2014 | Part 3 | Question: 59

The given maximization assignment problem can be converted into a minimization problem by

A. Subtracting each entry in a column from the maximum value in that column.
B. Subtracting each entry in the table from the maximum value in that table.
C. Adding each entry in a column from the maximum value in that column.
D. Adding maximum value of the table to each entry in the table.

ugcnetjune2014iii optimization assignment-problem

Answer key

9.1.2 Assignment Problem: UGC NET CSE | Junet 2015 | Part 3 | Question: 67

In the Hungarian method for solving assignment problem, an optimal assignment requires that the maximum number of lines that can be drawn through squares with zero opportunity cost be equal to the number of

A. rows or columns
B. rows + columns
C. rows + columns -1
D. rows + columns +1

ugcnetcse-june2015-paper3 assignment-problem optimization

Answer key

9.2 Dual Linear Programming (1)

9.2.1 Dual Linear Programming: UGC NET CSE | December 2012 | Part 3 | Question: 24

If dual has an unbounded solution, then its corresponding primal has

A. no feasible solution
B. unbounded solution
C. feasible solution
D. none of these

ugcnetcse-dec2012-paper3 optimization dual-linear-programming

Answer key

9.3 Linear Programming (7)

9.3.1 Linear Programming: UGC NET CSE | December 2012 | Part 3 | Question: 18

In a Linear Programming Problem, suppose there are three basic variables and 2 non-basic variables, then the possible number of basic solutions are

A. 6
B. 8
C. 10
D. 12

ugcnetcse-dec2012-paper3 optimization linear-programming

Answer key

9.3.2 Linear Programming: UGC NET CSE | December 2013 | Part 3 | Question: 2

Given the problem to maximize $f(x), X = (x_1, x_2, \dots, x_n)$ subject to m number of in equality constraints. $g_i(x) \leq b_i$, i=1, 2, ... m including the non-negativity constrains $x \geq 0$. Which of the following conditions is a Kuhn-Tucker necessary condition for a local maxima at $\bar{x}$?

A. $\frac{\partial L(\bar{X}, \bar{\lambda}, \bar{S})}{\partial x_j} = 0, j = 1, 2 \dots m$
B. $\bar{\lambda}_i [g_i(\bar{X}) - b_i] = 0, i = 1, 2 \dots m$
C. $g_i(\bar{X}) \leq b_i, i = 1, 2 \dots m$
D. All of these

ugcnetcse-dec2013-paper3 optimization linear-programming

Answer key☟

9.3.3 Linear Programming: UGC NET CSE | December 2013 | Part 3 | Question: 3

The following Linear Programming problem has:

$$\text{Max} \quad Z = x_1 + x_2$$

Subject to $\quad x_1 - x_2 \geq 0$

$$3x_1 - x_2 \leq -3$$

and $\quad x_1, x_2 \geq 0$

A. Feasible solution
B. No feasible solution
C. Unbounded solution
D. Single point as solution

ugcnetcse-dec2013-paper3 optimization linear-programming

Answer key☟

9.3.4 Linear Programming: UGC NET CSE | December 2015 | Part 3 | Question: 52

A basic feasible solution of a linear programming problem is said to be ______ if at least one of the basic variable is zero

A. generate
B. degenerate
C. infeasible
D. unbounded

ugcnetcse-dec2015-paper3 optimization linear-programming

Answer key☟

9.3.5 Linear Programming: UGC NET CSE | June 2012 | Part 3 | Question: 46

The feasible region represented by the constraints $x_1 - x_2 \leq 1, x_1 + x_2 \geq 3, x_1 \geq 0, x_2 \geq 0$ of the objective function Max $Z = 3x_1 + 2x_2$ is

A. A polygon
B. Unbounded feasible region
C. A point
D. None of these

ugcnetcse-june2012-paper3 optimization linear-programming

Answer key☟

9.3.6 Linear Programming: UGC NET CSE | Junet 2015 | Part 3 | Question: 69

Given the following statements with respect to linear programming problem:

S1: The dual of the dual linear programming problem is again the primal problem

S2: If either the primal or the dual problem has an unbounded objective function value, the other problem has no feasible solution

S3: If either the primal or the dual problem has a finite optimal solution, the other one also possess the same, and the optimal value of the objective functions of the two problems are equal.

Which of the following is true?

A. S1 and S2
B. S1 and S3
C. S2 and S3
D. S1, S2 and S3

ugcnetcse-june2015-paper3 optimization linear-programming

Answer key☟

9.3.7 Linear Programming: UGC NET CSE | October 2020 | Part 2 | Question: 4

Consider the following linear programming (LP):

$$\begin{aligned} \text{Max.} \quad & z = 2x_1 + 3x_2 \\ \text{Such that} \quad & 2x_1 + x_2 \leq 4 \\ & x_1 + 2x_2 \leq 5 \\ & x_1, x_2 \geq 0 \end{aligned}$$

The optimum value of the LP is

A. 23
B. 9.5
C. 13
D. 8

ugcnetcse-oct2020-paper2 non-gatecse linear-programming

Answer key

9.4 Linear Programming Problem (1)

9.4.1 Linear Programming Problem: UGC NET CSE | December 2013 | Part 3 | Question: 1

If the primal Linear Programming problem has unbounded solution, then it's dual problem will have

A. feasible solution
B. alternative solution
C. no feasible solution at all
D. no alternative solution at all

ugcnetcse-dec2013-paper3 optimization linear-programming-problem

Answer key

9.5 Optimization (3)

9.5.1 Optimization: UGC NET CSE | December 2015 | Part 3 | Question: 47

In constraint satisfaction problem, constraints can be stated as

A. Arithmetic equations and inequalities that bind the values of variables
B. Arithmetic equations and inequalities that does not bind any restriction over variables
C. Arithmetic equations that impose restrictions over variables
D. Arithmetic equations that discard constraints over the given variables

ugcnetcse-dec2015-paper3 optimization

Answer key

9.5.2 Optimization: UGC NET CSE | January 2017 | Part 3 | Question: 68

With respect to a loop in the transportation table, which one of following is not correct?

A. Every loop has an odd no.of cells and atleast 5.
B. Closed loops may or may not be square in shape.
C. All the cells in the loop that have a plus or minus sign, except the starting cell, must be occupied cells.
D. Every loop has an even no.of cells and atleast four.

ugcnetcse-jan2017-paper3 loop optimization

Answer key

9.5.3 Optimization: UGC NET CSE | June 2014 | Part 3 | Question: 58

Which of the following special cases does not require reformulation of the problem in order to obtain a solution ?

A. Alternate optimality
B. Infeasibility
C. Unboundedness
D. All of the above

ugcnetjune2014iii optimization

Answer key

9.6 Transportation Problem (6)

9.6.1 Transportation Problem: UGC NET CSE | December 2012 | Part 3 | Question: 28

The initial basic feasible solution to the following transportation problem using Vogel's approximation method is

	D_1	D_2	D_3	D_4	**Supply**
S_1	1	2	1	4	30
S_2	3	3	2	1	50
S_3	4	2	5	9	20
Demand	20	40	30	10	

A. $x_{11} = 20, x_{13} = 10, x_{21} = 20, x_{23} = 20, x_{24} = 10, x_{32} = 10$, Total cost $= 180$
B. $x_{11} = 20, x_{12} = 20, x_{13} = 10, x_{22} = 20, x_{23} = 20, x_{24} = 10$, Total cost $= 180$
C. $x_{11} = 20, x_{13} = 10, x_{22} = 20, x_{23} = 20, x_{24} = 10, x_{32} = 10$, Total cost $= 180$
D. None of the above

ugcnetcse-dec2012-paper3 optimization transportation-problem

Answer key

9.6.2 Transportation Problem: UGC NET CSE | December 2015 | Part 3 | Question: 53

Consider the following conditions:

i. The solution must be feasible, i.e. it must satisfy all the supply and demand constraints
ii. The number of positive allocations must be equal to $m + n - 1$, where m is the number of rows and n is the number of columns
iii. All the positive allocations must be in independent positions

The initial solution of a transportation problem is said to be non-degenerate basic feasible solution if it satisfies:

A. i and ii only
B. i and iii only
C. ii and iii only
D. i, ii and iii

ugcnetcse-dec2015-paper3 optimization transportation-problem

Answer key

9.6.3 Transportation Problem: UGC NET CSE | December 2015 | Part 3 | Question: 54

Consider the following transportation problem:

	Stores					
		I	**II**	**III**	**IV**	**Supply**
Factories	**A**	4	6	8	13	50
	B	13	11	10	8	70
	C	14	4	10	13	30
	D	9	11	13	8	50
	Demand	25	35	105	20	

The transportation cost in the initial basic feasible solution of the above transportation problem using Vogel's Approximation method is

A. 1450
B. 1465
C. 1480
D. 1520

ugcnetcse-dec2015-paper3 optimization transportation-problem

Answer key

9.6.4 Transportation Problem: UGC NET CSE | January 2017 | Part 3 | Question: 69

At which of the following stage(s), the degeneracy do not occur in transportation problem?
(m, n represents number of sources and destinations respectively)

i. While the values of dual variables u_i and v_j cannot be computed
ii. While obtaining an initial solution, we may have less than $m + n - 1$ allocations
iii. At any stage while moving towards optimal solution, when two or more occupied cells with the same minimum allocation become unoccupied simultaneously.

iv. At a stage when the no, of $+$ve allocation is exactly $m+n-1$.

A. (i), (ii) and (iii)
B. (i),(iii) and (iv)
C. (i) and (iv)
D. (i),(ii),(iii) and (iv)

ugcnetcse-jan2017-paper3 transportation-problem optimization

Answer key

9.6.5 Transportation Problem: UGC NET CSE | June 2014 | Part 3 | Question: 60

The initial basic feasible solution of the following transportion problem:

		Destination			
		D_1	D_2	D_3	Supply
	O_1	2	7	4	5
Origins	O_2	3	3	1	8
	O_3	5	4	7	7
	O_4	1	6	2	14
Demand		7	9	18	

is given as

5		
		8
	7	
2	2	10

then the minimum cost is

A. 76
B. 78
C. 80
D. 82

ugcnetjune2014iii optimization transportation-problem

Answer key

9.6.6 Transportation Problem: UGC NET CSE | Junet 2015 | Part 3 | Question: 68

Consider the following transportation problem:

$\longrightarrow$ **Warehouse**

$\downarrow$ **Factory**

	W_1	W_2	W_3	Supply
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Demand	180	120	150	

The initial basic feasible solution of the above transportation problem using Vogel's Approximation method (VAM) is given below:

$\longrightarrow$ **Warehouse**

$\downarrow$ **Factory**

	W_1	W_2	W_3	Supply
F_1	16(140)	20	12(60)	200
F_2	14(40)	8(120)	18	160
F_3	26	24	16(90)	90
Demand	180	120	150	

The solution of the above problem:

A. is degenerate solution
B. is optimum solution
C. needs to improve
D. is infeasible solution

ugcnetcse-june2015-paper3 transportation-problem optimization

Answer key

Answer Keys

9.1.1	B	9.1.2	A	9.2.1	A	9.3.1	C	9.3.2	D
9.3.3	B	9.3.4	A	9.3.5	B	9.3.6	D	9.3.7	D
9.4.1	C	9.5.1	A	9.5.2	A	9.5.3	A	9.6.1	D
9.6.2	A	9.6.3	B	9.6.4	C	9.6.5	A	9.6.6	B

10 Programming and DS (55)

10.1 Array (5)

10.1.1 Array: UGC NET CSE | December 2006 | Part 2 | Question: 14

When one-dimensional character array of unspecified length is assigned an initial value :

A. an arbitrary character is automatically added to the end of the string
B. 'o' is added to the end of the string
C. length of the string is added to the end of the string
D. 'end' is added to the end of the string

ugcnetcse-dec2006-paper2 programming-in-c array

10.1.2 Array: UGC NET CSE | December 2014 | Part 2 | Question: 14

When an array is passed as parameter to a function, which of the following statements is correct ?

A. The function can change values in the original array.
B. In C, parameters are passed by value, the function cannot change the original value in the array.
C. It results in compilation error when the function tries to access the elements in the array.
D. Results in a run time error when the function tries to access the elements in the array.

ugcnetcse-dec2014-paper2 programming-in-c array

Answer key

10.1.3 Array: UGC NET CSE | June 2013 | Part 3 | Question: 32

Arrays in C language can have ____ with reference to memory representation.

A. n-subscripts
B. two-subscripts
C. only one subscript
D. three subscripts only

ugcnetcse-june2013-paper3 programming-in-c array

Answer key

10.1.4 Array: UGC NET CSE | June 2023 | Part 2: 1

What is the output of following code?

```
main ()
struct s1
{ char * z;
int i;
struct s1 * p;
}
static struct s 1 a []}={
   {"Nagpur", 1, a+1}
{"Raipur', 2, a+2}
{"Kanpur', 3, a}
};
struct s 1* ptr =a;
printf (%s %s %s\n", a[0].z. ptr $/rightarrow$ z, a [2]. p $/rightarrow$ z;)
```

A. Nagpur Raipur Kanpur
B. Nagpur Nagpur Nagpur
C. Kanpur Kanpur Kanpur
D. Error

ugcnetcse-june2023-paper2 programming-in-c array output

Answer key

10.1.5 Array: UGC NET CSE | June 2023 | Part 2: 85

What is the output of following code?

```
main ()
{ static float a[]=\{13.24,1.5,4.5,5.4,3.5}
float * j, * k;
j= a};
k= a + 4
j=j * 2;
k = k / 2;
printf ("% f % f",* j,*k);
}
```

A. $13.25, 4.5$

B. $1.5, 3.5$

C. $13.24, 1.5, 4.5, 5.4, 3.5$

D. Illegal use of pointer in main function

ugcnetcse-june2023-paper2 programming-in-c array output

10.2 Array of Pointers (1)

10.2.1 Array of Pointers: UGC NET CSE | August 2016 | Part 2 | Question: 12

The following $'C'$ statement :

int * f[]()

declares :

A. A function returning a pointer to an array of integers.
B. Array of functions returning pointers to integers.
C. A function returning an array of pointers to integers.
D. An illegal statement.

ugcnetcse-aug2016-paper2 programming-in-c array-of-pointers pointers

Answer key☟

10.3 Call By Value (1)

10.3.1 Call By Value: UGC NET CSE | December 2018 | Part 2 | Question: 47

Consider the following two $C++$ programs $P1$ and $P2$ and two statements $S1$ and $S2$ about these programs:

$P1$	$P2$

void f(int a, int *b, int &c)
{
a=1;
*b=2;
c=3;
}
int main()
{
int i=0;
f(i, &i, i);
count <<i;
}
	double a=1, b=2;
	double &f(double &d)
	{
	d=4;
	return b;
	}
	int main()
	{
	f(a)=5;
	count < < a< < “:” < < b;
	}

$S1$: $P1$ prints out 3.

$S2$: $P2$ prints out $4:2$

What can you say about the statements $S1$ and $S2$?

$Code$:

A. Only $S1$ is true
B. Only $S2$ is true
C. Both $S1$ and $S2$ are true
D. Neither $S1$ nor $S2$ is true

ugcnetcse-dec2018-paper2 programming-in-c parameter-passing call-by-value call-by-reference programming-language-concepts

Answer key☟

10.4 Compiler tokenization (1)

10.4.1 Compiler tokenization: UGC NET CSE | June 2023 | Part 2: 90

The compiler for high level language that runs on one machine and produces code for other machine is called-

A. Cross compiler
B. Multipass compiler
C. Optimizing Compiler
D. One pass Compiler

ugcnetcse-june2023-paper2 compiler-tokenization programming-in-c

Answer key☟

10.5 Dangling Pointer (1)

10.5.1 Dangling Pointer: UGC NET CSE | September 2013 | Part 3 | Question: 65

Consider the following sequence of operations:

- Pointer p1 is set to point at a new heap-dynamic variable.
- Pointer p2 is assigned p1's value
- The heap dynamic variable pointed to by p1 is explicitly de-allocated but p2 is not changed by the operation

This situation leads to which of the following:

A. p1 becomes a dangling pointer
B. p2 becomes a dangling pointer
C. Both p1 and p2 are now dangling pointers
D. Neither p1 nor p2 is now a dangling pointer

ugcnetcse-sep2013-paper3 programming-in-c dangling-pointer

10.6 Data Structures (1)

10.6.1 Data Structures: UGC NET CSE | November 2017 | Part 2 | Question: 15

Which of the following is **not** correct (in C++)?

A. Class templates and function templates are instantiated in the same way
B. Class templates differ from function templates in the way they are initiated
C. Class template is initiated by defining an object using the template argument
D. Class templates are generally used for storage classes

ugcnetcse-nov2017-paper2 programming-in-c data-structures

Answer key☟

10.7 Data Types (1)

10.7.1 Data Types: UGC NET CSE | December 2011 | Part 2 | Question: 33

If an integer needs two bytes of storage, then the maximum value of unsigned integer is

A. $2^{16}-1$ B. $2^{15}-1$ C. 2^{16} D. 2^{15}

ugcnetcse-dec2011-paper2 programming-in-c data-types

Answer key

10.8 Deterministic Pushdown Automata (1)

10.8.1 Deterministic Pushdown Automata: UGC NET CSE | June 2023 | Part 2: 79

Consider following statements:

A. A context free language is generated by $\mathrm{LR}(\mathrm{o})$ grammar if and only if it is accepted by a deterministic pushdown automata and has prefix property

B. If $\mathrm{M1}$ is the single tape TM simulating multilape TM M, then time taken by $\mathrm{M1}$ to simulate n moves is (n^3)

C. Push down automata behaves like a Turning machine when it has one auxiliary memory.

D. $\mathrm{L} = \{\mathrm{a^n b^n c^n} : \mathrm{n} \geq 1\}$ is not context free but context sensitive.

Choose the correct answer from the options given below:

A. A, B and C only B. A, B only C. C, D only D. B, C only

ugcnetcse-june2023-paper2 programming-in-c context-free-language deterministic-pushdown-automata machine-learning regular-language turing-machine memory-management parsing context-free-grammar recursion pushdown-automata

10.9 Logical Reasoning (1)

10.9.1 Logical Reasoning: UGC NET CSE | October 2022 | Part 1 | Question: 35

The condition $\mathrm{num}! = 65$ cannot be replaced by

A. $\mathrm{num} > 65$ || $\mathrm{num} < 65$
B. $!($ num $== 65)$
C. num -65
D. $!(\mathrm{num} - 65)$

ugcnetcse-oct2022-paper1 programming-in-c logical-reasoning

Answer key

10.10 Loop (1)

10.10.1 Loop: UGC NET CSE | June 2006 | Part 2 | Question: 13

If the following loop is implemented

```
{
    int num =0;
    do {-- num; printf ("%d", num); num++;}
     while(num>=0)
}
```

A. the loop will run infinitely many times
B. the program will not enter the loop
C. there will be compilation error reported
D. a run time error will be reported

ugcnetcse-june2006-paper2 programming-in-c loop

10.11 Memory Management (1)

10.11.1 Memory Management: UGC NET CSE | June 2023 | Part 2: 30

How will you free the memory allocated by the following program?

```
# include < stdio.h>
#include < stdlib. h >
#define MAXROW 3
#define MAXCOL 4
int main ( )
{
int ** p, i, j;
p= (int **) malloc (MAXROW * size of (int*));
return $0 ;$
}
# include $<$ stdio.h $>$
#include $<$ stdlib. h $>$
#define MAXROW 3
#define MAXCOL 4
int main ( )
{
int ** p $, \mathrm{i}, \mathrm{j}$;
p=(int **) malloc (MAXROW * size of (int*));
return 0;
}
```

A. memfree $(\operatorname{int} p)$;
B. dealloc (p);
C. malloc $(p, 0)$;
D. free (p):

ugcnetcse-june2023-paper2 programming-in-c memory-management

10.12 Number System (1)

10.12.1 Number System: UGC NET CSE | June 2023 | Part 2: 75

What will be the output of the following code? What will be the output of the following code?

```
# include  <stdio.h>
int main ( ) {
int a, b, c;
a=ox10; b=010;
c=a+b;
printf ( %d", c);
return 0 ;
}
```

A. 20
B. 24
C. Garbage
D. error

ugcnetcse-june2023-paper2 programming-in-c output number-system

Answer key

10.13 Operator Precedence (2)

10.13.1 Operator Precedence: UGC NET CSE | December 2010 | Part 2 | Question: 12

The value of the following expression $(13/4*3)$ is

A. 5.75
B. 2.95
C. 1.4875
D. 5

ugcnetcse-dec2010-paper2 programming-in-c operator-precedence

Answer key

10.13.2 Operator Precedence: UGC NET CSE | December 2011 | Part 2 | Question: 36

$X- = Y+1$ means

A. $X = X–Y+1$
B. $X = -X-Y-1$
C. $X = -X+Y+1$
D. $X = X-Y-1$

ugcnetcse-dec2011-paper2 programming-in-c operator-precedence

Answer key

10.14 Operators (3)

10.14.1 Operators: UGC NET CSE | December 2012 | Part 2 | Question: 45

What is the result of the following expression?
(1 & 2) + (3 & 4)

A. 1 B. 3 C. 2 D. 0

ugcnetcse-dec2012-paper2 programming-in-c operators

Answer key

10.14.2 Operators: UGC NET CSE | June 2010 | Part 2 | Question: 11

The statement print
f (" % d", 10 ? 0 ? 5 : 1 : 12);
will print

A. 10 B. 0 C. 12 D. 1

ugcnetcse-june2010-paper2 programming-in-c operators

Answer key

10.14.3 Operators: UGC NET CSE | June 2013 | Part 2 | Question: 8

What is the result of the expression(1&2)+(3/4)?

A. 1 B. 2 C. 3 D. 0

ugcnetcse-june2013-paper2 programming-in-c operators

Answer key

10.15 Output (5)

10.15.1 Output: UGC NET CSE | December 2019 | Part 2 | Question: 14

What is the output of the following C program?

```
# include <stdio.h>
main ()
{
   int i, j, x=0;
   for (i=0; i<5; ++i)
   for (j=0; j<i; ++j)
   {
   x+=(i+j-1);
   break;
   }
printf("%d", x);
}
```

A. 6 B. 5 C. 4 D. 3

ugcnetcse-dec2019-paper2 programming-in-c output

Answer key

10.15.2 Output: UGC NET CSE | June 2006 | Part 2 | Question: 11

What is the output of the following program segment?

```
main()
{
int count, digit=0;
count=1;
while (digit<=9)
   {
printf ("%d/n",++count);++digit;
   }
}
```

A. 10 B. 9 C. 12 D. 11

ugcnetcse-june2006-paper2 programming-in-c output

10.15.3 Output: UGC NET CSE | June 2007 | Part 2 | Question: 14

What is the output of the following 'C' program?

```
main()
{
    printf("%x",-1>>4);
}
```

A. ffff B. 0fff C. 0000 D. fff0

ugcnetcse-june2007-paper2 programming-in-c output

Answer key☟

10.15.4 Output: UGC NET CSE | June 2008 | Part 2 | Question: 11

What is the effect of the following C code?

```
for(int i=1 ; i ≤ 5 ; i = i + 1/2)
printf(" % d,", i);
```

A. It prints $1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5$, and stops
B. It prints $1, 2, 3, 4, 5$, and stops
C. It prints $1, 2, 3, 4, 5$, and repeats forever
D. It prints $1, 1, 1, 1, 1$, and repeats forever

ugcnetcse-june2008-paper2 programming-in-c output

10.15.5 Output: UGC NET CSE | June 2008 | Part 2 | Question: 13

Consider the following C code :

```
{int a = 5, b=9;
float r;
r= b /a ;}
```

What is the value of r ?

A. 1.8 B. 1.0 C. 2.0 D. 0.0

ugcnetcse-june2008-paper2 programming-in-c output

Answer key☟

10.16 Page Replacement (1)

10.16.1 Page Replacement: UGC NET CSE | June 2023 | Part 2: 93

Consider the following program fragment that deals with a table T with 17 rows and 1024 columns, computing an average for each column and printing it to screen (i is row index and j is column index):

for $\mathrm{j} = [0 \ldots 1023]\{$
temp $= 0$
for $\mathrm{i} = [0 \ldots 16]$
temp $=$ temp $+T[i][j]$
print (temp/ 17.0); }

T [i] [j] and temp are 32 bit floating point values and memory is word addressable. The temporary variable temp is kept in a processor register so access to temp does not involve a memory reference. The main memory is page and holds 16 pages of size 1024 words, the page replacement policy is "least recently used ", If T is stored in the virtual address space in row major format.

How many page faults will be encountered?

A. $16,402$ B. $17,408$ C. $18,208$ D. $18,608$

ugcnetcse-june2023-paper2 page-replacement programming-in-c array output memory-management

10.17 Parameter Passing (1)

10.17.1 Parameter Passing: UGC NET CSE | December 2012 | Part 3 | Question: 44

The Default Parameter Passing Mechanism is called as

A. Call by Value
B. Call by Reference
C. Call by Address
D. Call by Name

ugcnetcse-dec2012-paper3 programming-in-c parameter-passing

Answer key☟

10.18 Pointer Declaration (1)

10.18.1 Pointer Declaration: UGC NET CSE | September 2013 | Part 3 | Question: 51

Consider the following two function declarations:

int *f()

int (*f)()

Which of the following is true?

A. Both are identical
B. The first is a correct declaration and the second is wrong
C. Both are different ways of declaring pointer to a function
D. The first declaration is a function returning a pointer to an integer and the second is a pointer to function returning integer

ugcnetcse-sep2013-paper3 programming-in-c pointer-declaration

Answer key☟

10.19 Pointers (6)

10.19.1 Pointers: UGC NET CSE | December 2019 | Part 2 | Question: 72

Which of the following are legal statements in C programming language?

i.
```
int *P=&44;
```
ii.
```
int *P=&r;
```
iii.
```
int P=&a;
```
iv.
```
int P=a;
```

Choose the correct option:

A. (i) and (ii) B. (ii) and (iii) C. (ii) and (iv) D. (i) and (iv)

ugcnetcse-dec2019-paper2 programming-in-c pointers

Answer key☟

10.19.2 Pointers: UGC NET CSE | June 2008 | Part 2 | Question: 12

Consider the following declaration in C :

```
char a[];
char * p;
```

Which of the following statement is not a valid statement?

A. $\mathrm{p} = \mathrm{a};$
B. $\mathrm{p} = \mathrm{a} + 2;$
C. $\mathrm{a} = \mathrm{p};$
D. $\mathrm{p} = \&\mathrm{a}[2]$

ugcnetcse-june2008-paper2 programming-in-c array pointers

Answer key☟

10.19.3 Pointers: UGC NET CSE | June 2023 | Part 2: 34

What is x in the following program?

```
# include < stdioh >
int main ( )
{typedef (*(* arrfptr[3])())[10];
arrfptr x ;
return 0 ;
}
```

A. x is a pointer
B. x is a array of three pointer
C. x is an array of three function pointer
D. Error in x declaration

ugcnetcse-june2023-paper2 programming-in-c array pointers

10.19.4 Pointers: UGC NET CSE | November 2017 | Part 2 | Question: 11

$\mathrm{prtdata}$ is a pointer to a data type. The expression $^{*}\mathrm{prtdata}++$ is evaluated as (in C++)

A. $^{*}(\mathrm{prtdata}{+}{+})$
B. $(^{*}\mathrm{prtdata})++$
C. $^{*}(\mathrm{prtdata})++$
D. Depends on compiler

ugcnetcse-nov2017-paper2 programming-in-c pointers

Answer key☟

10.19.5 Pointers: UGC NET CSE | October 2022 | Part 1 | Question: 48

Pointers cannot be used to

A. find the address of a variable in memory
B. reference value directly
C. simulate call by reference
D. manipulate dynamic data structure

ugcnetcse-oct2022-paper1 programming-in-c pointers data-structures

Answer key☟

10.19.6 Pointers: UGC NET CSE | October 2022 | Part 1 | Question: 71

Which statement is false?

A. All function calls in C pass arguments using call by value.
B. Call by reference enables a called function to modify a variable in calling function.
C. Call by value is always more efficient than call by reference.
D. Programmers use pointers and indirection operation to simulate call by reference.

ugcnetcse-oct2022-paper1 programming-in-c pointers

10.20 Programming In C (17)

10.20.1 Programming In C: UGC NET CSE | August 2016 | Part 2 | Question: 11

Given $i = 0, j = 1, k = -1, x = 0.5, y = 0.0$

What is the output of given 'C' expression?

x * 3 & & 3 || j | k

A. -1 B. 0 C. 1 D. 2

ugcnetcse-aug2016-paper2 programming-in-c

Answer key

10.20.2 Programming In C: UGC NET CSE | December 2006 | Part 2 | Question: 12

Enumeration variables can be used in :

A. search statement like an integer variable
B. break statement
C. preprocessor commands
D. function statement

ugcnetcse-dec2006-paper2 programming-in-c

10.20.3 Programming In C: UGC NET CSE | December 2010 | Part 2 | Question: 11

How many of the following declarations are correct ?

int $z = 7.0$;

double void = 0.000;

short array $[2] = 0, 1, 2$;

char c = “\n”;

A. None
B. One is correct
C. Two are correct
D. All four are correct

ugcnetcse-dec2010-paper2 programming-in-c

Answer key

10.20.4 Programming In C: UGC NET CSE | December 2010 | Part 2 | Question: 13

Which one of the following will set the value of y to 5 if x has the value 3, but not otherwise ?

A. If $(x = 3)y = 5$
B. If $x == 3(y = 5)$
C. If $(x == 3); y = 5$
D. If $(x == 3)y = 5$

ugcnetcse-dec2010-paper2 programming-in-c

Answer key

10.20.5 Programming In C: UGC NET CSE | December 2015 | Part 2 | Question: 11

Consider the following program:

```
#include<stdio.h>
main()
{
    int i, inp;
    float x, term=1, sum=0;
    scanf("%d %f", &inp, &x);
    for(i=1;i<=inp;i++)
    {
        term=term*x/i;
        sum=sum+term;
    }
    printf("Result=%f\n", sum);
}
```

The program computes the sum of which of the following series?

A. $x + x^2/2 + x^3/3 + x^4/4 + \ldots$
B. $x + x^2/2! + x^3/3! + x^4/4! + \ldots$
C. $1 + x^2/2 + x^3/3 + x^4/4 + \ldots$
D. $1 + x^2/2! + x^3/3! + x^4/4! + \ldots$

ugcnetcse-dec2015-paper2 programming-in-c

Answer key

10.20.6 Programming In C: UGC NET CSE | December 2015 | Part 3 | Question: 43

A horn clause is

A. A clause in which no variables occur in the expression
B. A clause that has at least one negative literal
C. A disjunction of a number of literals
D. A clause that has atmost one positive literal

programming-in-c ugcnetcse-dec2015-paper3

Answer key

10.20.7 Programming In C: UGC NET CSE | June 2006 | Part 2 | Question: 12

A static variable is one :

A. Which cannot be initialized
B. Which is initialized once at the commencement of execution and cannot be changed at runtime
C. Which retains its value throughout the life of the program
D. Which is the same as an automatic variable but is placed at the head of a program

ugcnetcse-june2006-paper2 programming-in-c

10.20.8 Programming In C: UGC NET CSE | June 2006 | Part 2 | Question: 14

$\#$ define max $(x, y) x=(x>y) ? x: y$ is a macro definition, which can find the maximum of two numbers x and y if:

A. x and y are both integers only
B. x and y are both declared as float only
C. x and y are both declared as double only
D. x and y are both integers, float or double

ugcnetcse-june2006-paper2 programming-in-c

10.20.9 Programming In C: UGC NET CSE | June 2007 | Part 2 | Question: 11

The following loop in $'C'$:

```
int i=0;
while (i++<0)i--;
```

A. will terminate
B. will go into an infinite loop
C. will give compilation error
D. will never be executed

ugcnetcse-june2007-paper2 programming-in-c

Answer key

10.20.10 Programming In C: UGC NET CSE | June 2013 | Part 2 | Question: 6

When the following code is executed what will be the value of x and y?

int x=1, y=0;

y=x++;

A. 2, 1
B. 2, 2
C. 1, 1
D. 1, 2

ugcnetcse-june2013-paper2 programming-in-c

Answer key

10.20.11 Programming In C: UGC NET CSE | June 2013 | Part 3 | Question: 51

Trace the error:

```
void main()
{
int *b, &a;
*b=20;
printf("%d, %d", a, *b)
}
```

A. No error
B. Logical error
C. Syntax error
D. Semantic error

ugcnetcse-june2013-paper3 programming-in-c

Answer key

10.20.12 Programming In C: UGC NET CSE | November 2017 | Part 2 | Question: 12

The associativity of which of the following operators is Left to Right, in C++?

A. Unary Operator
B. Logical not
C. Array element access
D. addressof

ugcnetcse-nov2017-paper2 programming-in-c

Answer key

10.20.13 Programming In C: UGC NET CSE | October 2020 | Part 2 | Question: 9

Consider the following pseudo-code fragment, where a and b are integer variables that have been initialized:
/* Pre-conditions : $(a > 1 \wedge a < b)$ */
/* Assume that overflow never occurs */
int $x = 0$; int $p = 1$;
while $(p < b)\{$
$p = p * a$;
$x = x + 1$;
$\}$
When the while loop terminates, what will be the value of x in terms of a and b?

A. a^b
B. b^a
C. $\lfloor \log_a^b \rfloor$ /* $\lfloor\ \rfloor$ means floor */
D. $\lfloor \log_a^b \rfloor$ /* $\lceil\ \rceil$ means ceil */

ugcnetcse-oct2020-paper2 programming-in-c

Answer key

10.20.14 Programming In C: UGC NET CSE | September 2013 | Part 2 | Question: 33

What is the size of the following union? Assume that the size of int=2, size of float =4, size of char=1

```
union tag {
int a;
float b;
char c;
};
```

A. 2
B. 4
C. 1
D. 7

ugcnetsep2013ii programming-in-c

Answer key

10.20.15 Programming In C: UGC NET CSE | September 2013 | Part 2 | Question: 34

What is the output of the following program segment?

```
sum(n)
{
if (n<1) return n;
else return (n+sum(n-1));
}
main()
{
printf("%d", sum(5));
}
```

A. 10
B. 16
C. 15
D. 14

ugcnetsep2013ii programming-in-c

Answer key

10.20.16 Programming In C: UGC NET CSE | September 2013 | Part 2 | Question: 36

Consider the following program segment:

```
d=0;
for(i=1; i<31, ++i)
for (j=1; j < 31; ++j)
for (k=1; k < 31; ++k)
if((i+j+k%3)==0))
d=d+1;
printf("%d", d);
```

The output will be

A. 9000 B. 3000 C. 90 D. 2700

ugcnetsep2013ii programming-in-c

Answer key

10.20.17 Programming In C: UGC NET CSE | September 2013 | Part 3 | Question: 53

What is the output of the following program?

```
#include<stdio.h>
main()
{
int a, b =0;
static int c[10]={1, 2, 3, 4, 5, 6, 7, 8, 9, 0};
for (a=0; a<10; ++a)
int ((c[a]%2)==0) b+=c[a];
printf("%d", b);
}
```

A. 15 B. 25 C. 45 D. 20

ugcnetcse-sep2013-paper3 programming-in-c

Answer key

10.21 Recursion (1)

10.21.1 Recursion: UGC NET CSE | December 2018 | Part 2 | Question: 51

Consider the $C/C++$ function $f()$ given below:

```
void f(char w[])
{
  int x=strlen(w); //length of a string
  char c;
  for (int i=0; i<x; i++)
  {
    c=w[i];
    w[i]=w[x-i-1];
    w[x-i-1] =c;
  }
}
```

Which of the following is the purpose of $f()$?

A. It outputs the contents of the array in reverse order
B. It outputs the contents of the array in the original order
C. It outputs the contents of the array with the characters shifted over by one position
D. It outputs the contents of the array with the characters rearranged so they are no longer recognized as the words in the original phrase

ugcnetcse-dec2018-paper2 programming-in-c data-structures recursion

Answer key

10.22 Storage Classes In C (1)

10.22.1 Storage Classes In C: UGC NET CSE | January 2017 | Part 2 | Question: 13

Which of the following storage classes have global visibility in $C/C++$?

A. Auto
B. Extern
C. Static
D. Register

ugcnetjan2017ii programming-in-c storage-classes-in-c

Answer key

10.23 Three Dimensional Array (1)

10.23.1 Three Dimensional Array: UGC NET CSE | December 2015 | Part 2 | Question: 16

A three dimensional array in 'C' is declared as int A[x][y][z]. Here, the address of an item at the location A[p][q][r] can be computed as follows: (where w is the word length of an integer)

A. &A[0][0][0]+w(y*z*q+z*p+r)
B. &A[0][0][0]+w(y*z*p+z*q+r)
C. &A[0][0][0]+w(x*y*p+z*q+r)
D. &A[0][0][0]+w(x*y*q+z*p+r)

ugcnetcse-dec2015-paper2 programming-in-c three-dimensional-array

Answer key

Answer Keys

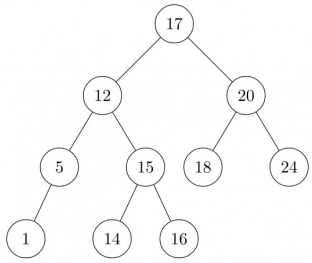
10.1.1	TBA	10.1.2	A	10.1.3	C	10.1.4	TBA	10.1.5	TBA
10.2.1	TBA	10.3.1	TBA	10.4.1	TBA	10.5.1	B	10.6.1	B;C;D
10.7.1	A	10.8.1	TBA	10.9.1	TBA	10.10.1	TBA	10.11.1	TBA
10.12.1	TBA	10.13.1	TBA	10.13.2	D	10.14.1	D	10.14.2	TBA
10.14.3	D	10.15.1	TBA	10.15.2	TBA	10.15.3	TBA	10.15.4	TBA
10.15.5	TBA	10.16.1	TBA	10.17.1	A	10.18.1	D	10.19.1	TBA
10.19.2	TBA	10.19.3	TBA	10.19.4	A	10.19.5	TBA	10.19.6	TBA
10.20.1	TBA	10.20.2	TBA	10.20.3	TBA	10.20.4	TBA	10.20.5	B
10.20.6	B	10.20.7	TBA	10.20.8	TBA	10.20.9	TBA	10.20.10	A
10.20.11	C	10.20.12	C	10.20.13	X	10.20.14	B	10.20.15	C
10.20.16	C	10.20.17	D	10.21.1	B	10.22.1	B	10.23.1	B

11 Programming and DS: Data Structures (378)

11.1 AVL Tree (9)

11.1.1 AVL Tree: GATE CSE 1988 | Question: 7ii

Mark the balance factor of each node on the tree given in the below figure and state whether it is height-balanced.

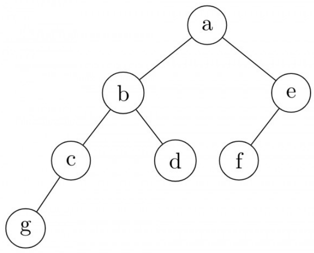


gate1988 data-structures normal descriptive avl-tree binary-tree

Answer key

11.1.2 AVL Tree: GATE CSE 1996 | Question: 1.14

In the balanced binary tree in the below figure, how many nodes will become unbalanced when a node is inserted as a child of the node "g"?



A. 1 B. 3 C. 7 D. 8

gate1996 data-structures binary-tree avl-tree normal

Answer key

11.1.3 AVL Tree: GATE CSE 1998 | Question: 21

A. Derive a recurrence relation for the size of the smallest AVL tree with height h.
B. What is the size of the smallest AVL tree with height 8?

gate1998 data-structures avl-tree descriptive numerical-answers

Answer key

11.1.4 AVL Tree: GATE CSE 2009 | Question: 37,ISRO-DEC2017-55

What is the maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0.

A. 2 B. 3 C. 4 D. 5

gatecse-2009 data-structures binary-search-tree normal isrodec2017 avl-tree

Answer key

11.1.5 AVL Tree: GATE CSE 2020 | Question: 6

What is the worst case time complexity of inserting n^2 elements into an AVL-tree with n elements initially?

A. $\Theta(n^4)$
B. $\Theta(n^2)$
C. $\Theta(n^2 \log n)$
D. $\Theta(n^3)$

gatecse-2020 binary-tree avl-tree one-mark

Answer key☟

11.1.6 AVL Tree: GATE IT 2008 | Question: 12

Which of the following is TRUE?

A. The cost of searching an AVL tree is $\Theta(\log n)$ but that of a binary search tree is $O(n)$
B. The cost of searching an AVL tree is $\Theta(\log n)$ but that of a complete binary tree is $\Theta(n \log n)$
C. The cost of searching a binary search tree is $O(\log n)$ but that of an AVL tree is $\Theta(n)$
D. The cost of searching an AVL tree is $\Theta(n \log n)$ but that of a binary search tree is $O(n)$

gateit-2008 data-structures binary-search-tree easy avl-tree

Answer key☟

11.1.7 AVL Tree: UGC NET CSE | December 2012 | Part 2 | Question: 2

The worst case time complexity of AVL is tree is better in comparison to binary search tree for

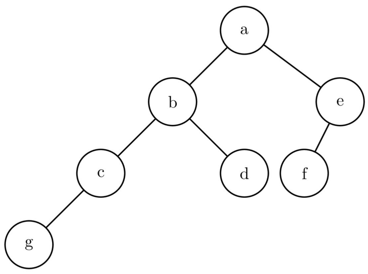
A. Search and Insert Operations
B. Search and Delete Operations
C. Insert and Delete Operations
D. Search, Insert and Delete Operations

data-structures binary-tree ugcnetcse-dec2012-paper2 avl-tree

Answer key☟

11.1.8 AVL Tree: UGC NET CSE | June 2005 | Part 2 | Question: 23

In the balanced binary tree given below, how many nodes will become unbalanced when a node is inserted as a child of the node "g" ?



A. 1
B. 3
C. 7
D. 8

ugcnetcse-june2005-paper2 data-structures avl-tree

Answer key☟

11.1.9 AVL Tree: UGC NET CSE | June 2023 | Part 2: 82

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: The AVL trees are more balanced as compared to Red Black trees, but they may cause more rotations during insertion and deletion

Reason R: A Red Black tree with n nodes has height that is greater than $2\log_2(n+1)$ and the AVL tree with n nodes has height less than $\log_\Phi(\sqrt{5}(n+2))-2$ (where Φ is golden ratio)

In the light of the above statements, choose the correct answer from the options given below.

A. Both A and R are correct and R is the correct explanation of A
B. Both A and R are correct and R is NOT the correct explanation of A
C. A is true but R is false
D. A is false but R is true

ugcnetcse-june2023-paper2 binary-tree avl-tree time-complexity data-structures

11.2 Array (15)

11.2.1 Array: GATE CSE 1993 | Question: 12

The following Pascal program segments finds the largest number in a two-dimensional integer array $A[0 \ldots n-1, 0 \ldots n-1]$ using a single loop. Fill up the boxes to complete the program and write against $\boxed{\text{A}}, \boxed{\text{B}}, \boxed{\text{C}}$ and $\boxed{\text{D}}$ in your answer book Assume that max is a variable to store the largest value and i, j are the indices to the array.

```
begin
   max:=|A|, i:=0, j:=0;
   while |B| do
   begin
      if A[i, j]>max then max:=A[i, j];
      if |C| then j:=j+1;
      else begin
         j:=0;
         i:=|D|
      end
   end
end
```

gate1993 data-structures array normal descriptive

Answer key

11.2.2 Array: GATE CSE 1994 | Question: 1.11

In a compact single dimensional array representation for lower triangular matrices (i.e all the elements above the diagonal are zero) of size $n \times n$, non-zero elements, (i.e elements of lower triangle) of each row are stored one after another, starting from the first row, the index of the $(i, j)^{th}$ element of the lower triangular matrix in this new representation is:

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

gate1994 data-structures array normal

Answer key

11.2.3 Array: GATE CSE 1994 | Question: 25

An array A contains n integers in non-decreasing order, $A[1] \leq A[2] \leq \cdots \leq A[n]$. Describe, using Pascal like pseudo code, a linear time algorithm to find i, j, such that $A[i] + A[j] = a$ given integer M, if such i, j exist.

gate1994 data-structures array normal descriptive

Answer key

11.2.4 Array: GATE CSE 1997 | Question: 17

An array A contains $n \geq 1$ positive integers in the locations $A[1], A[2], \ldots A[n]$. The following program fragment prints the length of a shortest sequence of consecutive elements of A, $A[i], A[i+1], \ldots, A[j]$ such that the sum of their values is $\geq M$, a given positive number. It prints '$n+1$' if no such sequence exists. Complete the program by filling in the boxes. In each case use the simplest possible expression. Write only the line number and the contents of the box.

```
begin
i:=1;j:=1;
sum := □
min:=n; finish:=false;
```

```
while not finish do
   if □ then
      if j=n then finish:=true
      else
      begin
         j:=j+1;
         sum:= □
      end
   else
   begin
      if(j-i) < min then min:=j-i;
      sum:=sum –A[i];
      i:=i+1;
   end
   writeln (min +1);
end.
```

gate1997 data-structures array normal descriptive

Answer key

11.2.5 Array: GATE CSE 1998 | Question: 2.14

Let A be a two dimensional array declared as follows:

```
A: array [1 .... 10] [1 ..... 15] of integer;
```

Assuming that each integer takes one memory location, the array is stored in row-major order and the first element of the array is stored at location 100, what is the address of the element $A[i][j]$?

A. $15i + j + 84$ B. $15j + i + 84$ C. $10i + j + 89$ D. $10j + i + 89$

gate1998 data-structures array easy

Answer key

11.2.6 Array: GATE CSE 2000 | Question: 1.2

An $n \times n$ array v is defined as follows:

$v\,[i,j] = i - j$ for all $i, j, i \leq n, 1 \leq j \leq n$

The sum of the elements of the array v is

A. 0 B. $n - 1$ C. $n^2 - 3n + 2$ D. $n^2 \frac{(n+1)}{2}$

gatecse-2000 data-structures array easy

Answer key

11.2.7 Array: GATE CSE 2000 | Question: 15

Suppose you are given arrays $p[1......N]$ and $q[1......N]$ both uninitialized, that is, each location may contain an arbitrary value), and a variable count, initialized to 0. Consider the following procedures set and is_set:

```
set(i) {
   count = count + 1;
   q[count] = i;
   p[i] = count;
}
is_set(i) {
   if (p[i] ≤ 0 or p[i] > count)
      return false;
   if (q[p[i]] ≠ i)
      return false;
   return true;
}
```

A. Suppose we make the following sequence of calls:
   $set(7); set(3); set(9);$
   After these sequence of calls, what is the value of count, and what do $q[1], q[2], q[3], p[7], p[3]$ and $p[9]$ contain?
B. Complete the following statement "The first count elements of __________contain values i such that set

(_________________) has been called".

C. Show that if $set(i)$ has not been called for some i, then regardless of what $p[i]$ contains, $is\_set(i)$ will return false.

gatecse-2000 data-structures array easy descriptive

Answer key

11.2.8 Array: GATE CSE 2005 | Question: 5

A program P reads in 500 integers in the range $[0, 100]$ representing the scores of 500 students. It then prints the frequency of each score above 50. What would be the best way for P to store the frequencies?

A. An array of 50 numbers
B. An array of 100 numbers
C. An array of 500 numbers
D. A dynamically allocated array of 550 numbers

gatecse-2005 data-structures array easy

Answer key

11.2.9 Array: GATE CSE 2013 | Question: 50

The procedure given below is required to find and replace certain characters inside an input character string supplied in array A. The characters to be replaced are supplied in array $oldc$, while their respective replacement characters are supplied in array $newc$. Array A has a fixed length of five characters, while arrays $oldc$ and $newc$ contain three characters each. However, the procedure is flawed.

```
void find_and_replace (char *A, char *oldc, char *newc) {
   for (int i=0; i<5; i++)
      for (int j=0; j<3; j++)
         if (A[i] == oldc[j])
            A[i] = newc[j];
}
```

The procedure is tested with the following four test cases.

1. $oldc = “abc”, newc = “dab”$
2. $oldc = “cde”, newc = “bcd”$
3. $oldc = “bca”, newc = “cda”$
4. $oldc = “abc”, newc = “bac”$

The tester now tests the program on all input strings of length five consisting of characters ‘a’, ‘b’, ‘c’, ‘d’ and ‘e’ with duplicates allowed. If the tester carries out this testing with the four test cases given above, how many test cases will be able to capture the flaw?

A. Only one
B. Only two
C. Only three
D. All four

gatecse-2013 data-structures array normal

Answer key

11.2.10 Array: GATE CSE 2013 | Question: 51

The procedure given below is required to find and replace certain characters inside an input character string supplied in array A. The characters to be replaced are supplied in array $oldc$, while their respective replacement characters are supplied in array $newc$. Array A has a fixed length of five characters, while arrays $oldc$ and $newc$ contain three characters each. However, the procedure is flawed.

```
void find_and_replace (char *A, char *oldc, char *newc) {
   for (int i=0; i<5; i++)
      for (int j=0; j<3; j++)
         if (A[i] == oldc[j])
            A[i] = newc[j];
}
```

The procedure is tested with the following four test cases.

1. $oldc =$ "abc", $newc =$ "dab"
2. $oldc =$ "cde", $newc =$ "bcd"
3. $oldc =$ "bca", $newc =$ "cda"
4. $oldc =$ "abc", $newc =$ "bac"

If array A is made to hold the string "$abcde$", which of the above four test cases will be successful in exposing the flaw in this procedure?

A. None
B. 2 only
C. 3 and 4 only
D. 4 only

gatecse-2013 data-structures array normal

Answer key

11.2.11 Array: GATE CSE 2014 Set 3 | Question: 42

Consider the C function given below. Assume that the array $listA$ contains $n(> 0)$ elements, sorted in ascending order.

```
int ProcessArray(int *listA, int x, int n)
{
      int i, j, k;
      i = 0;     j = n-1;
       do {
            k = (i+j)/2;
            if (x <= listA[k]) j = k-1;
            if (listA[k] <= x) i = k+1;
          }
      while (i <= j);
      if (listA[k] == x) return(k);
      else   return -1;
}
```

Which one of the following statements about the function $ProcessArray$ is **CORRECT**?

A. It will run into an infinite loop when x is not in $listA$.
B. It is an implementation of binary search.
C. It will always find the maximum element in $listA$.
D. It will return -1 even when x is present in $listA$.

gatecse-2014-set3 data-structures array easy

Answer key

11.2.12 Array: GATE CSE 2015 Set 2 | Question: 31

A Young tableau is a $2D$ array of integers increasing from left to right and from top to bottom. Any unfilled entries are marked with ∞, and hence there cannot be any entry to the right of, or below a ∞. The following Young tableau consists of unique entries.

1	2	5	14
3	4	6	23
10	12	18	25
31	∞	∞	∞

When an element is removed from a Young tableau, other elements should be moved into its place so that the resulting table is still a Young tableau (unfilled entries may be filled with a ∞). The minimum number of entries (other than 1) to be shifted, to remove 1 from the given Young tableau is _____.

gatecse-2015-set2 databases array normal numerical-answers

Answer key

11.2.13 Array: GATE CSE 2021 Set 1 | Question: 2

Let P be an array containing n integers. Let t be the lowest upper bound on the number of comparisons of the array elements, required to find the minimum and maximum values in an arbitrary array of n elements. Which one of the following choices is correct?

A. $t > 2n - 2$
B. $t > 3\lceil \frac{n}{2} \rceil$ and $t \leq 2n - 2$
C. $t > n$ and $t \leq 3\lceil \frac{n}{2} \rceil$
D. $t > \lceil \log_2(n) \rceil$ and $t \leq n$

gatecse-2021-set1 data-structures array one-mark

Answer key☟

11.2.14 Array: UGC NET CSE | June 2013 | Part 2 | Question: 7

How many values can be held by an array A(-1, m; 1, m)?

A. m
B. m^2
C. m(m+1)
D. m(m+2)

ugcnetcse-june2013-paper2 array

Answer key☟

11.2.15 Array: UGC NET CSE | June 2023 | Part 2: 26

A three dimensional array in $\mathrm{C}++$ is declared as int $\mathrm{A}[\mathrm{a}][\mathrm{b}]$ [c]. Consider that array elements are stored in row major order and indexing begin from 0. Here the address of an item at the location $\mathrm{A}[\mathrm{r}][\mathrm{s}][\mathrm{t}]$ computed in terms of word length w of an integer is

A. & A [0] [0] [0] $+\mathrm{w}\left(\mathrm{b}^* \mathrm{c}^* \mathrm{~s}+\mathrm{c}^* \mathrm{r}+\mathrm{t}\right)$
B. & A [0] [0] [0] $+w\left(b * c^* r^*+c^* s+t\right)$
C. & A [0] [0] [0]+w $\left(\mathrm{a}^* \mathrm{~b}^* \mathrm{r}^*+\mathrm{c} * \mathrm{~s}+\mathrm{t}\right)$
D. & A [0] [0] [0] $+w\left(a^* b^* s+c^* r+t\right)$

ugcnetcse-june2023-paper2 array memory-management

Answer key☟

11.3 B Tree (5)

11.3.1 B Tree: UGC NET CSE | December 2012 | Part 2 | Question: 34

The maximum number of keys stored in a B-tree of order m and depth d is

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

ugcnetcse-dec2012-paper2 b-tree databases

Answer key☟

11.3.2 B Tree: UGC NET CSE | December 2019 | Part 2 | Question: 38

In a B-Tree, each node represents a disk block. Suppose one block holds 8192 bytes. Each key uses 32 bytes. In a B-tree of order M there are $M-1$ keys. Since each branch is on another disk block, we assume a branch is of 4 bytes. The total memory requirement for a non-leaf node is

A. $32M - 32$
B. $36M{-}32$
C. $36M{-}36$
D. $32M{-}36$

ugcnetcse-dec2019-paper2 b-tree data-structures memory-management

Answer key☟

11.3.3 B Tree: UGC NET CSE | June 2009 | Part 2 | Question: 24

In a B tree of order m with p nodes the average number of splits is at most :

A. 1/(⌈m/2⌉–1)
B. ⌈m/2⌉–1
C. 1/(m/2)
D. None

ugcnetcse-june2009-paper2 b-tree data-structures

Answer key☟

11.3.4 B Tree: UGC NET CSE | June 2013 | Part 2 | Question: 27

For a B-tree of height h and degree t, the total CPU time used to insert a node is

A. O(h log t) B. O(t log h) C. $O(t^2h)$ D. O(th)

ugcnetcse-june2013-paper2 b-tree time-complexity data-structures

Answer key☟

11.3.5 B Tree: UGC NET CSE | October 2022 | Part 1 | Question: 18

Consider a **B**-tree of height h. minimum degree $t \geq 2$ that contains any n-key, where $n \geq 1$. Which of the following is correct?

A. $h \geq \log_t \frac{n+1}{2}$

B. $h \leq \log_t \frac{n+1}{2}$

C. $h \geq \log_t \frac{n-1}{2}$

D. $h \leq \log_t \frac{n-1}{2}$

ugcnetcse-oct2022-paper1 b-tree data-structures

11.4 Binary Heap (40)

11.4.1 Binary Heap: GATE CSE 1990 | Question: 2-viii

Match the pairs in the following questions:

(a)	A heap construction	(p)	$\Omega(n \log_{10} n)$
(b)	Constructing Hashtable with linear probing	(q)	$O(n)$
(c)	AVL tree construction	(r)	$O(n^2)$
(d)	Digital trie construction	(s)	$O(n \log_2 n)$

gate1990 match-the-following data-structures binary-heap

Answer key☟

11.4.2 Binary Heap: GATE CSE 1996 | Question: 2.11

The minimum number of interchanges needed to convert the array into a max-heap is

$$89, 19, 40, 17, 12, 10, 2, 5, 7, 11, 6, 9, 70$$

A. 0 B. 1 C. 2 D. 3

gate1996 data-structures binary-heap easy

Answer key☟

11.4.3 Binary Heap: GATE CSE 1999 | Question: 12

A. In binary tree, a full node is defined to be a node with 2 children. Use induction on the height of the binary tree to prove that the number of full nodes plus one is equal to the number of leaves.

B. Draw the min-heap that results from insertion of the following elements in order into an initially empty min-heap: $7, 6, 5, 4, 3, 2, 1$. Show the result after the deletion of the root of this heap.

gate1999 data-structures binary-heap normal descriptive

Answer key☟

11.4.4 Binary Heap: GATE CSE 2001 | Question: 1.15

Consider any array representation of an n element binary heap where the elements are stored from index 1 to index n of the array. For the element stored at index i of the array $(i \leq n)$, the index of the parent is

A. $i-1$ B. $\lfloor \frac{i}{2} \rfloor$ C. $\lceil \frac{i}{2} \rceil$ D. $\frac{(i+1)}{2}$

gatecse-2001 data-structures binary-heap easy

Answer key

11.4.5 Binary Heap: GATE CSE 2003 | Question: 23

In a min-heap with n elements with the smallest element at the root, the 7^{th} smallest element can be found in time

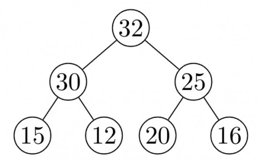
A. $\Theta(n \log n)$
B. $\Theta(n)$
C. $\Theta(\log n)$
D. $\Theta(1)$

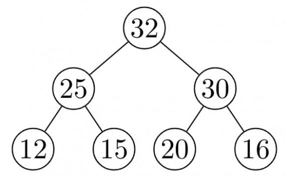
gatecse-2003 data-structures binary-heap

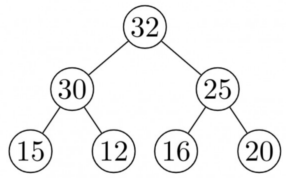
Answer key

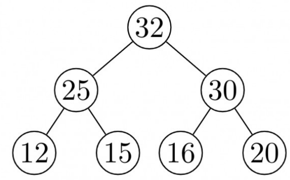
11.4.6 Binary Heap: GATE CSE 2004 | Question: 37

The elements $32, 15, 20, 30, 12, 25, 16,$ are inserted one by one in the given order into a maxHeap. The resultant maxHeap is

A. 

B. 

C. 

D. 

gatecse-2004 data-structures binary-heap easy

Answer key

11.4.7 Binary Heap: GATE CSE 2005 | Question: 34

A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: $10, 8, 5, 3, 2$. Two new elements 1 and 7 are inserted into the heap in that order. The level-order traversal of the heap after the insertion of the elements is:

A. $10, 8, 7, 5, 3, 2, 1$
B. $10, 8, 7, 2, 3, 1, 5$
C. $10, 8, 7, 1, 2, 3, 5$
D. $10, 8, 7, 3, 2, 1, 5$

gatecse-2005 data-structures binary-heap normal

Answer key

11.4.8 Binary Heap: GATE CSE 2006 | Question: 10

In a binary max heap containing n numbers, the smallest element can be found in time

A. $O(n)$
B. $O(\log n)$
C. $O(\log \log n)$
D. $O(1)$

gatecse-2006 data-structures binary-heap easy

Answer key

11.4.9 Binary Heap: GATE CSE 2006 | Question: 76

Statement for Linked Answer Questions 76 & 77:

A 3-ary max heap is like a binary max heap, but instead of 2 children, nodes have 3 children. A 3-ary heap can be represented by an array as follows: The root is stored in the first location, $a[0]$, nodes in the next level, from left to right, is stored from $a[1]$ to $a[3]$. The nodes from the second level of the tree from left to right are stored from $a[4]$ location onward. An item x can be inserted into a 3-ary heap containing n items by placing x in the location $a[n]$

and pushing it up the tree to satisfy the heap property.

76. Which one of the following is a valid sequence of elements in an array representing 3-ary max heap?

A. $1, 3, 5, 6, 8, 9$
B. $9, 6, 3, 1, 8, 5$
C. $9, 3, 6, 8, 5, 1$
D. $9, 5, 6, 8, 3, 1$

gatecse-2006 data-structures binary-heap normal

Answer key

11.4.10 Binary Heap: GATE CSE 2006 | Question: 77

Statement for Linked Answer Questions 76 & 77:

A 3-ary max heap is like a binary max heap, but instead of 2 children, nodes have 3 children. A 3-ary heap can be represented by an array as follows: The root is stored in the first location, $a[0]$, nodes in the next level, from left to right, is stored from $a[1]$ to $a[3]$. The nodes from the second level of the tree from left to right are stored from $a[4]$ location onward. An item x can be inserted into a 3-ary heap containing n items by placing x in the location $a[n]$ and pushing it up the tree to satisfy the heap property.

76. Which one of the following is a valid sequence of elements in an array representing $3-$ary max heap?

A. $1, 3, 5, 6, 8, 9$
B. $9, 6, 3, 1, 8, 5$
C. $9, 3, 6, 8, 5, 1$
D. $9, 5, 6, 8, 3, 1$

77. Suppose the elements $7, 2, 10$ and 4 are inserted, in that order, into the valid 3-ary max heap found in the previous question, Q.76. Which one of the following is the sequence of items in the array representing the resultant heap?

A. $10, 7, 9, 8, 3, 1, 5, 2, 6, 4$
B. $10, 9, 8, 7, 6, 5, 4, 3, 2, 1$
C. $10, 9, 4, 5, 7, 6, 8, 2, 1, 3$
D. $10, 8, 6, 9, 7, 2, 3, 4, 1, 5$

gatecse-2006 data-structures binary-heap normal

Answer key

11.4.11 Binary Heap: GATE CSE 2007 | Question: 47

Consider the process of inserting an element into a Max Heap, where the Max Heap is represented by an array. Suppose we perform a binary search on the path from the new leaf to the root to find the position for the newly inserted element, the number of comparisons performed is:

A. $\Theta(\log_2 n)$
B. $\Theta(\log_2 \log_2 n)$
C. $\Theta(n)$
D. $\Theta(n \log_2 n)$

gatecse-2007 data-structures binary-heap normal

Answer key

11.4.12 Binary Heap: GATE CSE 2009 | Question: 59

Consider a binary max-heap implemented using an array.
Which one of the following array represents a binary max-heap?

A. $\{25, 12, 16, 13, 10, 8, 14\}$
B. $\{25, 14, 13, 16, 10, 8, 12\}$
C. $\{25, 14, 16, 13, 10, 8, 12\}$
D. $\{25, 14, 12, 13, 10, 8, 16\}$

gatecse-2009 data-structures binary-heap easy

Answer key

11.4.13 Binary Heap: GATE CSE 2009 | Question: 60

Consider a binary max-heap implemented using an array.
What is the content of the array after two delete operations on $\{25, 14, 16, 13, 10, 8, 12\}$

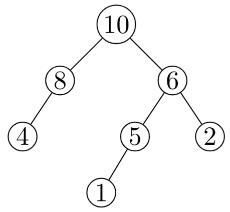
A. $\{14, 13, 12, 10, 8\}$
B. $\{14, 12, 13, 8, 10\}$
C. $\{14, 13, 8, 12, 10\}$
D. $\{14, 13, 12, 8, 10\}$

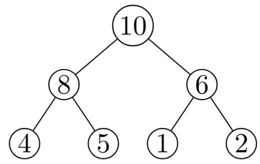
gatecse-2009 data-structures binary-heap normal

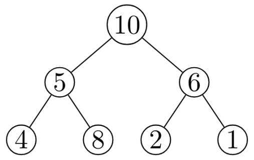
Answer key

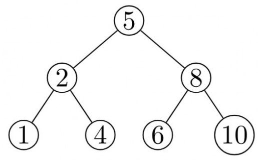
11.4.14 Binary Heap: GATE CSE 2011 | Question: 23

A max-heap is a heap where the value of each parent is greater than or equal to the value of its children. Which of the following is a max-heap?

A. 

B. 

C. 

D. 

gatecse-2011 data-structures binary-heap easy

Answer key

11.4.15 Binary Heap: GATE CSE 2014 Set 2 | Question: 12

A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: $10, 8, 5, 3, 2$. Two new elements 1 and 7 are inserted into the heap in that order. The level-order traversal of the heap after the insertion of the elements is:

A. $10,8,7,3,2,1,5$
B. $10,8,7,2,3,1,5$
C. $10,8,7,1,2,3,5$
D. $10,8,7,5,3,2,1$

gatecse-2014-set2 data-structures binary-heap normal

Answer key

11.4.16 Binary Heap: GATE CSE 2015 Set 1 | Question: 32

Consider a max heap, represented by the array: $40, 30, 20, 10, 15, 16, 17, 8, 4$.

Array index	1	2	3	4	5	6	7	8	9
Value	40	30	20	10	15	16	17	8	4

Now consider that a value 35 is inserted into this heap. After insertion, the new heap is

A. $40,30,20,10,15,16,17,8,4,35$
B. $40,35,20,10,30,16,17,8,4,15$
C. $40,30,20,10,35,16,17,8,4,15$
D. $40,35,20,10,15,16,17,8,4,30$

gatecse-2015-set1 data-structures binary-heap easy

Answer key

11.4.17 Binary Heap: GATE CSE 2015 Set 2 | Question: 17

Consider a complete binary tree where the left and right subtrees of the root are max-heaps. The lower bound for the number of operations to convert the tree to a heap is

A. $\Omega(\log n)$
B. $\Omega(n)$
C. $\Omega(n \log n)$
D. $\Omega(n^2)$

gatecse-2015-set2 data-structures binary-heap normal

Answer key

11.4.18 Binary Heap: GATE CSE 2015 Set 3 | Question: 19

Consider the following array of elements.

$\langle 89, 19, 50, 17, 12, 15, 2, 5, 7, 11, 6, 9, 100 \rangle$

The minimum number of interchanges needed to convert it into a max-heap is

A. 4 B. 5 C. 2 D. 3

gatecse-2015-set3 data-structures binary-heap easy

Answer key

11.4.19 Binary Heap: GATE CSE 2016 Set 1 | Question: 37

An operator delete(i) for a binary heap data structure is to be designed to delete the item in the i-th node. Assume that the heap is implemented in an array and i refers to the i-th index of the array. If the heap tree has depth d (number of edges on the path from the root to the farthest leaf), then what is the time complexity to re-fix the heap efficiently after the removal of the element?

A. $O(1)$
B. $O(d)$ but not $O(1)$
C. $O(2^d)$ but not $O(d)$
D. $O(d\,2^d)$ but not $O(2^d)$

gatecse-2016-set1 data-structures binary-heap normal

Answer key

11.4.20 Binary Heap: GATE CSE 2016 Set 2 | Question: 34

A complete binary min-heap is made by including each integer in $[1, 1023]$ exactly once. The depth of a node in the heap is the length of the path from the root of the heap to that node. Thus, the root is at depth 0. The maximum depth at which integer 9 can appear is _________.

gatecse-2016-set2 data-structures binary-heap normal numerical-answers

Answer key

11.4.21 Binary Heap: GATE CSE 2018 | Question: 46

The number of possible min-heaps containing each value from $\{1, 2, 3, 4, 5, 6, 7\}$ exactly once is _______

gatecse-2018 binary-heap numerical-answers combinatory two-marks

Answer key

11.4.22 Binary Heap: GATE CSE 2019 | Question: 40

Consider the following statements:

I. The smallest element in a max-heap is always at a leaf node
II. The second largest element in a max-heap is always a child of a root node
III. A max-heap can be constructed from a binary search tree in $\Theta(n)$ time
IV. A binary search tree can be constructed from a max-heap in $\Theta(n)$ time

Which of the above statements are TRUE?

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

gatecse-2019 data-structures binary-heap two-marks

Answer key

11.4.23 Binary Heap: GATE CSE 2020 | Question: 47

Consider the array representation of a binary min-heap containing 1023 elements. The minimum number of comparisons required to find the maximum in the heap is ___________.

gatecse-2020 numerical-answers binary-heap two-marks

Answer key

11.4.24 Binary Heap: GATE CSE 2021 Set 2 | Question: 2

Let H be a binary min-heap consisting of n elements implemented as an array. What is the worst case time complexity of an optimal algorithm to find the maximum element in H?

A. $\Theta(1)$
B. $\Theta(\log n)$
C. $\Theta(n)$
D. $\Theta(n \log n)$

gatecse-2021-set2 data-structures binary-heap time-complexity one-mark

Answer key

11.4.25 Binary Heap: GATE CSE 2023 | Question: 2

Which one of the following sequences when stored in an array at locations $A[1], \ldots, A[10]$ forms a max-heap?

A. $23, 17, 10, 6, 13, 14, 1, 5, 7, 12$
B. $23, 17, 14, 7, 13, 10, 1, 5, 6, 12$
C. $23, 17, 14, 6, 13, 10, 1, 5, 7, 15$
D. $23, 14, 17, 1, 10, 13, 16, 12, 7, 5$

gatecse-2023 data-structures binary-heap one-mark

Answer key

11.4.26 Binary Heap: GATE CSE 2024 | Set 1 | Question: 33

Consider a binary min-heap containing 105 distinct elements. Let k be the index (in the underlying array) of the maximum element stored in the heap. The number of possible values of k is

A. 53
B. 52
C. 27
D. 1

gatecse2024-set1 data-structures binary-heap two-marks

Answer key

11.4.27 Binary Heap: GATE IT 2004 | Question: 53

An array of integers of size n can be converted into a heap by adjusting the heaps rooted at each internal node of the complete binary tree starting at the node $\lfloor (n-1)/2 \rfloor$, and doing this adjustment up to the root node (root node is at index 0) in the order $\lfloor (n-1)/2 \rfloor$, $\lfloor (n-3)/2 \rfloor$, ..., 0. The time required to construct a heap in this manner is

A. $O(\log n)$
B. $O(n)$
C. $O(n \log \log n)$
D. $O(n \log n)$

gateit-2004 data-structures binary-heap normal

Answer key

11.4.28 Binary Heap: GATE IT 2006 | Question: 44

Which of the following sequences of array elements forms a heap?

A. $\{23, 17, 14, 6, 13, 10, 1, 12, 7, 5\}$
B. $\{23, 17, 14, 6, 13, 10, 1, 5, 7, 12\}$
C. $\{23, 17, 14, 7, 13, 10, 1, 5, 6, 12\}$
D. $\{23, 17, 14, 7, 13, 10, 1, 12, 5, 7\}$

gateit-2006 data-structures binary-heap easy

Answer key

11.4.29 Binary Heap: GATE IT 2006 | Question: 72

An array X of n distinct integers is interpreted as a complete binary tree. The index of the first element of the array is 0. If only the root node does not satisfy the heap property, the algorithm to convert the complete binary tree into a heap has the best asymptotic time complexity of

A. $O(n)$
B. $O(\log n)$
C. $O(n \log n)$
D. $O(n \log \log n)$

gateit-2006 data-structures binary-heap easy

Answer key

11.4.30 Binary Heap: UGC NET CSE | December 2008 | Part 2 | Question: 33

In a heap, every element is ____________ of all the elements in the subtree.

A. maximum
B. minimum
C. sum
D. product

ugcnetcse-dec2008-paper2 data-structures binary-heap

Answer key

11.4.31 Binary Heap: UGC NET CSE | December 2018 | Part 2 | Question: 22

The elements $42, 25, 30, 40, 22, 35, 26$ are inserted one by one in the given order into a max-heap. The resultant max-heap is sorted in an array implementation as

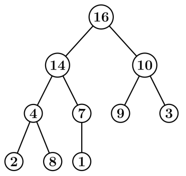
A. $< 42, 40, 35, 25, 22, 30, 26 >$
B. $< 42, 35, 40, 22, 25, 30, 26 >$
C. $< 42, 40, 35, 25, 22, 26, 30 >$
D. $< 42, 35, 40, 22, 25, 26, 30 >$

ugcnetcse-dec2018-paper2 data-structures binary-heap

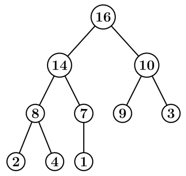
Answer key

11.4.32 Binary Heap: UGC NET CSE | January 2017 | Part 2 | Question: 23

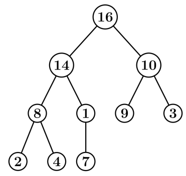
Which of the following is a valid heap?



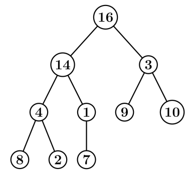
a.



b.



c.



d.

A. a
B. b
C. c
D. d

ugcnetjan2017ii data-structures binary-heap

Answer key

11.4.33 Binary Heap: UGC NET CSE | July 2018 | Part 2 | Question: 22

Consider the array A=<4, 1, 3, 2, 16, 9, 10, 14, 8, 7>. After building heap from the array A, the depth of the heap and the right child of max-heap are _______ and ______ respectively (Root is at level 0).

A. 3, 14
B. 3, 10
C. 4, 14
D. 4, 10

ugcnetcse-july2018-paper2 data-structures binary-heap

Answer key

11.4.34 Binary Heap: UGC NET CSE | June 2013 | Part 2 | Question: 28

The time complexity to build a heap with a list of n numbers is

A. O(log n)
B. O(n)
C. O(n logn)
D. O(n^2)

heap-sort ugcnetcse-june2013-paper2 data-structures binary-heap time-complexity

Answer key

11.4.35 Binary Heap: UGC NET CSE | June 2013 | Part 3 | Question: 13

In any n-element heap, the number of nodes of height h is,

A. less than equal to $\left[\frac{n}{2^h}\right]$
B. greater than $\left[\frac{n}{2^h}\right]$
C. greater than $\left[\frac{n}{2^h+1}\right]$
D. less than equal to $\left[\frac{n}{2^h+1}\right]$

ugcnetcse-june2013-paper3 data-structures binary-heap

Answer key

11.4.36 Binary Heap: UGC NET CSE | Junet 2015 | Part 3 | Question: 36

The number of nodes in height h in any n-element heap is

A. h
B. z^h

C. ceil $\left(\frac{n}{z^h}\right)$

D. ceil $\left(\frac{n}{z^{h+1}}\right)$

ugcnetcse-june2015-paper3 data-structures binary-heap

Answer key

11.4.37 Binary Heap: UGC NET CSE | November 2017 | Part 2 | Question: 21

Consider an array representation of an n element binary heap where the elements are stored from index 1 to index n of the array. For the element stored at index i of the array $(i \leq n)$, the index of the parent is

A. $\text{floor}((i+1)/2)$

B. $\text{ceiling}((i+1)/2)$

C. $\text{floor}(i/2)$

D. $\text{ceiling}(i/2)$

ugcnetcse-nov2017-paper2 binary-heap array data-structures

Answer key

11.4.38 Binary Heap: UGC NET CSE | November 2017 | Part 3 | Question: 20

Heap allocation is required for languages that

A. Use dynamic scope rules

B. Support dynamic data structures

C. Support recursion

D. Support recursion and dynamic data structures

ugcnetcse-nov2017-paper3 data-structures binary-heap

Answer key

11.4.39 Binary Heap: UGC NET CSE | October 2020 | Part 2 | Question: 24

In a binary max heap containing n numbers, the smallest element can be found in _______

A. $O(n)$

B. $O(\log_2 n)$

C. $O(1)$

D. $O(\log_2 \log_2 n)$

ugcnetcse-oct2020-paper2 data-structures binary-heap

Answer key

11.4.40 Binary Heap: UGC NET CSE | October 2022 | Part 1 | Question: 9

The number of nodes of height h in any n-element heap is atmost:

A. $n/2^{n+1}$

B. $\frac{n}{2^{h-1}}$

C. $\frac{n}{2^h}$

D. $\frac{n-1}{2^{h-1}}$

ugcnetcse-oct2022-paper1 data-structures binary-heap

11.5 Binary Search Tree (44)

11.5.1 Binary Search Tree: GATE CSE 1996 | Question: 2.14

A binary search tree is generated by inserting in order the following integers:

$$50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24$$

The number of nodes in the left subtree and right subtree of the root respectively is

A. $(4, 7)$

B. $(7, 4)$

C. $(8, 3)$

D. $(3, 8)$

gate1996 data-structures binary-search-tree easy

Answer key

11.5.2 Binary Search Tree: GATE CSE 1996 | Question: 4

A binary search tree is used to locate the number 43. Which of the following probe sequences are possible and which are not? Explain.

(a)	61	52	14	17	40	43
(b)	2	3	50	40	60	43
(c)	10	65	31	48	37	43
(d)	81	61	52	14	41	43
(e)	17	77	27	66	18	43

gate1996 data-structures binary-search-tree normal descriptive

Answer key

11.5.3 Binary Search Tree: GATE CSE 1997 | Question: 4.5

A binary search tree contains the value $1, 2, 3, 4, 5, 6, 7, 8$. The tree is traversed in pre-order and the values are printed out. Which of the following sequences is a valid output?

A. $5\ 3\ 1\ 2\ 4\ 7\ 8\ 6$
B. $5\ 3\ 1\ 2\ 6\ 4\ 8\ 7$
C. $5\ 3\ 2\ 4\ 1\ 6\ 7\ 8$
D. $5\ 3\ 1\ 2\ 4\ 7\ 6\ 8$

gate1997 data-structures binary-search-tree normal

Answer key

11.5.4 Binary Search Tree: GATE CSE 2001 | Question: 14

A. Insert the following keys one by one into a binary search tree in the order specified.

$$15, 32, 20, 9, 3, 25, 12, 1$$

Show the final binary search tree after the insertions.

B. Draw the binary search tree after deleting 15 from it.
C. Complete the statements $S1$, $S2$ and $S3$ in the following function so that the function computes the depth of a binary tree rooted at t.

```
typedef struct tnode{
   int key;
   struct tnode *left, *right;
} *Tree;

int depth (Tree t)
{
   int x, y;
   if (t == NULL) return 0;
   x = depth (t -> left);
S1:     ___________;

S2:     if (x > y) return __________;

S3:     else return _______;

}
```

gatecse-2001 data-structures binary-search-tree normal descriptive

Answer key

11.5.5 Binary Search Tree: GATE CSE 2003 | Question: 19, ISRO2009-24

Suppose the numbers $7, 5, 1, 8, 3, 6, 0, 9, 4, 2$ are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree?

A. $7\ 5\ 1\ 0\ 3\ 2\ 4\ 6\ 8\ 9$
B. $0\ 2\ 4\ 3\ 1\ 6\ 5\ 9\ 8\ 7$
C. $0\ 1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9$
D. $9\ 8\ 6\ 4\ 2\ 3\ 0\ 1\ 5\ 7$

gatecse-2003 binary-search-tree easy isro2009

Answer key

11.5.6 Binary Search Tree: GATE CSE 2003 | Question: 6

Let $T(n)$ be the number of different binary search trees on n distinct elements.
Then $T(n) = \sum_{k=1}^{n} T(k-1)T(x)$, where x is

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

gatecse-2003 normal binary-search-tree

Answer key☟

11.5.7 Binary Search Tree: GATE CSE 2003 | Question: 63, ISRO2009-25

A data structure is required for storing a set of integers such that each of the following operations can be done in $O(\log n)$ time, where n is the number of elements in the set.

I. Deletion of the smallest element
II. Insertion of an element if it is not already present in the set

Which of the following data structures can be used for this purpose?

A. A heap can be used but not a balanced binary search tree
B. A balanced binary search tree can be used but not a heap
C. Both balanced binary search tree and heap can be used
D. Neither balanced search tree nor heap can be used

gatecse-2003 data-structures easy isro2009 binary-search-tree

Answer key☟

11.5.8 Binary Search Tree: GATE CSE 2004 | Question: 4, ISRO2009-26

The following numbers are inserted into an empty binary search tree in the given order: $10, 1, 3, 5, 15, 12, 16$. What is the height of the binary search tree (the height is the maximum distance of a leaf node from the root)?

A. 2 B. 3 C. 4 D. 6

gatecse-2004 data-structures binary-search-tree easy isro2009

Answer key☟

11.5.9 Binary Search Tree: GATE CSE 2004 | Question: 85

A program takes as input a balanced binary search tree with n leaf nodes and computes the value of a function $g(x)$ for each node x. If the cost of computing $g(x)$ is:

$$\min\left(\begin{array}{c}\text{number of leaf-nodes}\\ \text{in left-subtree of } x\end{array}, \begin{array}{c}\text{number of leaf-nodes}\\ \text{in right-subtree of } x\end{array}\right)$$

Then the worst-case time complexity of the program is?

A. $\Theta(n)$ B. $\Theta(n \log n)$
C. $\Theta(n^2)$ D. $\Theta(n^2 \log n)$

gatecse-2004 binary-search-tree normal data-structures

Answer key☟

11.5.10 Binary Search Tree: GATE CSE 2005 | Question: 33

Postorder traversal of a given binary search tree, T produces the following sequence of keys
$10, 9, 23, 22, 27, 25, 15, 50, 95, 60, 40, 29$
Which one of the following sequences of keys can be the result of an in-order traversal of the tree T?

A. $9, 10, 15, 22, 23, 25, 27, 29, 40, 50, 60, 95$

B. $9, 10, 15, 22, 40, 50, 60, 95, 23, 25, 27, 29$
C. $29, 15, 9, 10, 25, 22, 23, 27, 40, 60, 50, 95$
D. $95, 50, 60, 40, 27, 23, 22, 25, 10, 9, 15, 29$

gatecse-2005 data-structures binary-search-tree easy

Answer key

11.5.11 Binary Search Tree: GATE CSE 2005 | Question: 35

How many distinct binary search trees can be created out of 4 distinct keys?

A. 5 B. 14 C. 24 D. 42

gatecse-2005 data-structures binary-search-tree counting normal

Answer key

11.5.12 Binary Search Tree: GATE CSE 2008 | Question: 46

You are given the postorder traversal, P, of a binary search tree on the n elements $1, 2, \dots, n$. You have to determine the unique binary search tree that has P as its postorder traversal. What is the time complexity of the most efficient algorithm for doing this?

A. $\Theta(\log n)$
B. $\Theta(n)$
C. $\Theta(n \log n)$
D. None of the above, as the tree cannot be uniquely determined

gatecse-2008 data-structures binary-search-tree normal

Answer key

11.5.13 Binary Search Tree: GATE CSE 2012 | Question: 5

The worst case running time to search for an element in a balanced binary search tree with $n2^n$ elements is

A. $\Theta(n \log n)$
B. $\Theta(n2^n)$
C. $\Theta(n)$
D. $\Theta(\log n)$

gatecse-2012 data-structures normal binary-search-tree

Answer key

11.5.14 Binary Search Tree: GATE CSE 2013 | Question: 43

The preorder traversal sequence of a binary search tree is $30, 20, 10, 15, 25, 23, 39, 35, 42$. Which one of the following is the postorder traversal sequence of the same tree?

A. $10, 20, 15, 23, 25, 35, 42, 39, 30$
B. $15, 10, 25, 23, 20, 42, 35, 39, 30$
C. $15, 20, 10, 23, 25, 42, 35, 39, 30$
D. $15, 10, 23, 25, 20, 35, 42, 39, 30$

gatecse-2013 data-structures binary-search-tree normal

Answer key

11.5.15 Binary Search Tree: GATE CSE 2013 | Question: 7

Which one of the following is the tightest upper bound that represents the time complexity of inserting an object into a binary search tree of n nodes?

A. $O(1)$ B. $O(\log n)$ C. $O(n)$ D. $O(n \log n)$

gatecse-2013 data-structures easy binary-search-tree

Answer key

11.5.16 Binary Search Tree: GATE CSE 2014 Set 3 | Question: 39

Suppose we have a balanced binary search tree T holding n numbers. We are given two numbers L and H and wish to sum up all the numbers in T that lie between L and H. Suppose there are m such numbers in T. If the tightest upper bound on the time to compute the sum is $O(n^a \log^b n + m^c \log^d n)$, the value of $a + 10b + 100c + 1000d$ is ______.

gatecse-2014-set3 data-structures binary-search-tree numerical-answers normal

Answer key

11.5.17 Binary Search Tree: GATE CSE 2015 Set 1 | Question: 10

Which of the following is/are correct in order traversal sequence(s) of binary search tree(s)?

I. $3, 5, 7, 8, 15, 19, 25$
II. $5, 8, 9, 12, 10, 15, 25$
III. $2, 7, 10, 8, 14, 16, 20$
IV. $4, 6, 7, 9, 18, 20, 25$

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

gatecse-2015-set1 data-structures binary-search-tree easy

Answer key

11.5.18 Binary Search Tree: GATE CSE 2015 Set 1 | Question: 23

What are the worst-case complexities of insertion and deletion of a key in a binary search tree?

A. $\Theta(\log n)$ for both insertion and deletion
B. $\Theta(n)$ for both insertion and deletion
C. $\Theta(n)$ for insertion and $\Theta(\log n)$ for deletion
D. $\Theta(\log n)$ for insertion and $\Theta(n)$ for deletion

gatecse-2015-set1 data-structures binary-search-tree easy

Answer key

11.5.19 Binary Search Tree: GATE CSE 2015 Set 3 | Question: 13

While inserting the elements $71, 65, 84, 69, 67, 83$ in an empty binary search tree (BST) in the sequence shown, the element in the lowest level is

A. 65 B. 67 C. 69 D. 83

gatecse-2015-set3 data-structures binary-search-tree easy

Answer key

11.5.20 Binary Search Tree: GATE CSE 2016 Set 2 | Question: 40

The number of ways in which the numbers $1, 2, 3, 4, 5, 6, 7$ can be inserted in an empty binary search tree, such that the resulting tree has height 6, is _________.

Note: The height of a tree with a single node is 0.

gatecse-2016-set2 data-structures binary-search-tree normal numerical-answers

Answer key

11.5.21 Binary Search Tree: GATE CSE 2017 Set 1 | Question: 6

Let T be a binary search tree with 15 nodes. The minimum and maximum possible heights of T are:

Note: The height of a tree with a single node is 0.

A. 4 and 15 respectively. B. 3 and 14 respectively.
C. 4 and 14 respectively. D. 3 and 15 respectively.

gatecse-2017-set1 data-structures binary-search-tree easy

Answer key

11.5.22 Binary Search Tree: GATE CSE 2017 Set 2 | Question: 36

The pre-order traversal of a binary search tree is given by $12, 8, 6, 2, 7, 9, 10, 16, 15, 19, 17, 20$. Then the post-order traversal of this tree is

A. $2, 6, 7, 8, 9, 10, 12, 15, 16, 17, 19, 20$
B. $2, 7, 6, 10, 9, 8, 15, 17, 20, 19, 16, 12$
C. $7, 2, 6, 8, 9, 10, 20, 17, 19, 15, 16, 12$
D. $7, 6, 2, 10, 9, 8, 15, 16, 17, 20, 19, 12$

gatecse-2017-set2 data-structures binary-search-tree

Answer key

11.5.23 Binary Search Tree: GATE CSE 2020 | Question: 41

In a balanced binary search tree with n elements, what is the worst case time complexity of reporting all elements in range $[a, b]$? Assume that the number of reported elements is k.

A. $\Theta(\log n)$
B. $\Theta(\log n + k)$
C. $\Theta(k \log n)$
D. $\Theta(n \log k)$

gatecse-2020 data-structures binary-search-tree two-marks

Answer key

11.5.24 Binary Search Tree: GATE CSE 2020 | Question: 5

The preorder traversal of a binary search tree is $15, 10, 12, 11, 20, 18, 16, 19$. Which one of the following is the postorder traversal of the tree?

A. $10,11,12,15,16,18,19,20$
B. $11,12,10,16,19,18,20,15$
C. $20,19,18,16,15,12,11,10$
D. $19,16,18,20,11,12,10,15$

gatecse-2020 binary-search-tree one-mark

Answer key

11.5.25 Binary Search Tree: GATE CSE 2021 Set 1 | Question: 10

A binary search tree T contains n distinct elements. What is the time complexity of picking an element in T that is smaller than the maximum element in T?

A. $\Theta(n \log n)$
B. $\Theta(n)$
C. $\Theta(\log n)$
D. $\Theta(1)$

gatecse-2021-set1 data-structures binary-search-tree time-complexity one-mark

Answer key

11.5.26 Binary Search Tree: GATE CSE 2022 | Question: 18

Suppose a binary search tree with 1000 distinct elements is also a complete binary tree. The tree is stored using the array representation of binary heap trees. Assuming that the array indices start with $0,$ the 3^{rd} largest element of the tree is stored at index _______________ .

gatecse-2022 numerical-answers data-structures binary-search-tree one-mark

Answer key

11.5.27 Binary Search Tree: GATE CSE 2024 | Set 2 | Question: 29

You are given a set V of distinct integers. A binary search tree T is created by inserting all elements of V one by one, starting with an empty tree. The tree T follows the convention that, at each node, all values stored in the left subtree of the node are smaller than the value stored at the node. You are not aware of the sequence in which these values were inserted into T, and you do not have access to T.

Which one of the following statements is TRUE?

A. Inorder traversal of T can be determined from V
B. Root node of T can be determined from V
C. Preorder traversal of T can be determined from V
D. Postorder traversal of T can be determined from V

gatecse2024-set2 binary-search-tree two-marks

Answer key

11.5.28 Binary Search Tree: GATE CSE 2025 | Set 1 | Question: 16

Which of the following statement(s) is/are TRUE for any binary search tree (BST) having n distinct integers?

A. The maximum length of a path from the root node to any other node is $(n-1)$.
B. An inorder traversal will always produce a sorted sequence of elements.
C. Finding an element takes $O(\log_2 n)$ time in the worst case.
D. Every BST is also a Min-Heap.

gatecse2025-set1 data-structures binary-search-tree multiple-selects one-mark

Answer key

11.5.29 Binary Search Tree: GATE CSE 2025 | Set 2 | Question: 25

Suppose the values $10, -4, 15, 30, 20, 5, 60, 19$ are inserted in that order into an initially empty binary search tree. Let T be the resulting binary search tree. The number of edges in the path from the node containing 19 to the root node of T is _________. (Answer in integer)

gatecse2025-set2 data-structures binary-search-tree numerical-answers easy one-mark

Answer key

11.5.30 Binary Search Tree: GATE IT 2005 | Question: 12

The numbers $1, 2, \dots . n$ are inserted in a binary search tree in some order. In the resulting tree, the right subtree of the root contains p nodes. The first number to be inserted in the tree must be

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

gateit-2005 data-structures normal binary-search-tree

Answer key

11.5.31 Binary Search Tree: GATE IT 2005 | Question: 55

A binary search tree contains the numbers $1, 2, 3, 4, 5, 6, 7, 8.$ When the tree is traversed in pre-order and the values in each node printed out, the sequence of values obtained is $5, 3, 1, 2, 4, 6, 8, 7.$ If the tree is traversed in post-order, the sequence obtained would be

A. $8,7,6,5,4,3,2,1$
B. $1,2,3,4,8,7,6,5$
C. $2,1,4,3,6,7,8,5$
D. $2,1,4,3,7,8,6,5$

gateit-2005 data-structures binary-search-tree normal

Answer key

11.5.32 Binary Search Tree: GATE IT 2006 | Question: 45

Suppose that we have numbers between 1 and 100 in a binary search tree and want to search for the number 55. Which of the following sequences CANNOT be the sequence of nodes examined?

A. $\{10,75,64,43,60,57,55\}$
B. $\{90,12,68,34,62,45,55\}$
C. $\{9,85,47,68,43,57,55\}$
D. $\{79,14,72,56,16,53,55\}$

gateit-2006 data-structures binary-search-tree normal

Answer key

11.5.33 Binary Search Tree: GATE IT 2007 | Question: 29

When searching for the key value 60 in a binary search tree, nodes containing the key values $10, 20, 40, 50, 70, 80, 90$ are traversed, not necessarily in the order given. How many different orders are possible in which these key values can occur on the search path from the root to the node containing the value 60?

A. 35 B. 64 C. 128 D. 5040

gateit-2007 data-structures binary-search-tree normal

Answer key

11.5.34 Binary Search Tree: GATE IT 2008 | Question: 71

A Binary Search Tree (BST) stores values in the range 37 to 573. Consider the following sequence of keys.

I. $81, 537, 102, 439, 285, 376, 305$
II. $52, 97, 121, 195, 242, 381, 472$
III. $142, 248, 520, 386, 345, 270, 307$
IV. $550, 149, 507, 395, 463, 402, 270$

Suppose the BST has been unsuccessfully searched for key 273. Which all of the above sequences list nodes in the order in which we could have encountered them in the search?

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

gateit-2008 data-structures binary-search-tree normal

Answer key

11.5.35 Binary Search Tree: GATE IT 2008 | Question: 72

A Binary Search Tree (BST) stores values in the range 37 to 573. Consider the following sequence of keys.

I. $81, 537, 102, 439, 285, 376, 305$
II. $52, 97, 121, 195, 242, 381, 472$
III. $142, 248, 520, 386, 345, 270, 307$
IV. $550, 149, 507, 395, 463, 402, 270$

Which of the following statements is TRUE?

A. I, II and IV are inorder sequences of three different BSTs
B. I is a preorder sequence of some BST with 439 as the root
C. II is an inorder sequence of some BST where 121 is the root and 52 is a leaf
D. IV is a postorder sequence of some BST with 149 as the root

gateit-2008 data-structures binary-search-tree easy

Answer key

11.5.36 Binary Search Tree: GATE IT 2008 | Question: 73

How many distinct BSTs can be constructed with 3 distinct keys?

A. 4 B. 5 C. 6 D. 9

gateit-2008 data-structures binary-search-tree normal

Answer key

11.5.37 Binary Search Tree: UGC NET CSE | August 2016 | Part 2 | Question: 23

The runtime for traversing all the nodes of a binary search tree with n nodes and printing them in an order is

A. $O(\lg n)$ B. $O(n \lg n)$ C. $O(n)$ D. $O(n^2)$

ugcnetcse-aug2016-paper2 data-structures binary-search-tree

Answer key

11.5.38 Binary Search Tree: UGC NET CSE | December 2005 | Part 2 | Question: 25

Which traversal techniques lists the nodes of a binary search tree in ascending order?

A. post – order
B. in – order
C. pre – order
D. linear – order

ugcnetcse-dec2005-paper2 data-structures binary-search-tree

Answer key

11.5.39 Binary Search Tree: UGC NET CSE | December 2018 | Part 2 | Question: 25

A binary search tree is constructed by inserting the following numbers in order :
$60, 25, 72, 15, 30, 68, 101, 13, 18, 47, 70, 34$
The number of nodes in the left subtree is

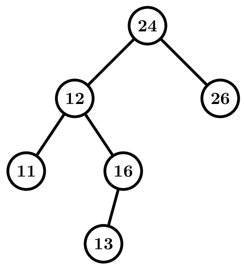
A. 5
B. 6
C. 7
D. 3

ugcnetcse-dec2018-paper2 data-structures binary-search-tree

Answer key

11.5.40 Binary Search Tree: UGC NET CSE | July 2016 | Part 2 | Question: 21

Consider the following binary search tree:



If we remove the root node which of the node from the left subtree will be the new root?

A. 11
B. 12
C. 13
D. 16

data-structures binary-tree binary-search-tree ugcnetcse-july2016-paper2

Answer key

11.5.41 Binary Search Tree: UGC NET CSE | July 2016 | Part 3 | Question: 35

Suppose that we have numbers between 1 and 1,000 in a binary search tree and want to search for the number 364. Which of the following sequences could not be the sequence of nodes examined?

A. 925, 221, 912, 245, 899, 259, 363, 364
B. 3, 400, 388, 220, 267, 383, 382, 279, 364
C. 926, 203, 912, 241, 913, 246, 364
D. 3, 253, 402, 399, 331, 345, 398, 364

ugcnetcse-july2016-paper3 data-structures binary-search-tree

Answer key

11.5.42 Binary Search Tree: UGC NET CSE | July 2018 | Part 2 | Question: 26

A binary search tree in which every non-leaf node has non-empty left and right subtrees is called a strictly binary tree. Such a tree with 19 leaves:

A. cannot have more than 37 nodes
B. has exactly 37 nodes
C. has exactly 35 nodes
D. cannot have more than 35 nodes

ugcnetcse-july2018-paper2 data-structures binary-search-tree

Answer key

11.5.43 Binary Search Tree: UGC NET CSE | October 2022 | Part 1 | Question: 63

How many rotations are required during the construction of an AVL tree if the following elements are to be added in the given sequence?

$35, 50, 40, 25, 30, 60, 78, 20, 28$

A. 2 left rotations, 2 right rotations
B. 2 left rotations, 3 right rotations
C. 3 left rotations, 2 right rotations
D. 3 left rotations, 1 right rotation

ugcnetcse-oct2022-paper1 binary-search-tree data-structures sorting

Answer key☟

11.5.44 Binary Search Tree: UGC NET CSE | September 2013 | Part 3 | Question: 41

Given a binary search trees for a set of $n = 5$ keys with the following probabilities :

i	0	1	2	3	4	5
p_i	-	0.15	0.10	0.05	0.10	0.20
q_i	0.05	0.10	0.05	0.05	0.05	0.10

The expected optimal cost of the search is

A. 2.65
B. 2.70
C. 2.75
D. 2.80

ugcnetcse-sep2013-paper3 data-structures binary-search-tree

Answer key☟

11.6 Binary Tree (65)

11.6.1 Binary Tree: GATE CSE 1987 | Question: 2c

State whether the following statements are TRUE or FALSE:

It is possible to construct a binary tree uniquely whose pre-order and post-order traversals are given?

gate1987 binary-tree data-structures normal true-false

Answer key☟

11.6.2 Binary Tree: GATE CSE 1987 | Question: 2g

State whether the following statements are TRUE or FALSE:

If the number of leaves in a tree is not a power of $2,$ then the tree is not a binary tree.

gate1987 data-structures binary-tree true-false

Answer key☟

11.6.3 Binary Tree: GATE CSE 1987 | Question: 7b

Construct a binary tree whose preorder traversal is

- $K\ L\ N\ M\ P\ R\ Q\ S\ T$

and inorder traversal is

- $N\ L\ K\ P\ R\ M\ S\ Q\ T$

gate1987 data-structures binary-tree descriptive

Answer key☟

11.6.4 Binary Tree: GATE CSE 1988 | Question: 7i

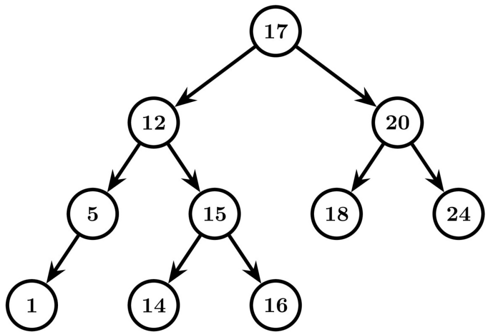
Define the height of a binary tree or subtree and also define a height-balanced (AVL) tree.

gate1988 normal descriptive data-structures binary-tree

Answer key

11.6.5 Binary Tree: GATE CSE 1988 | Question: 7iii

Consider the tree given in the below figure, insert 13 and show the new balance factors that would arise if the tree is not rebalanced. Finally, carry out the required rebalancing of the tree and show the new tree with the balance factors on each mode.



gate1988 normal descriptive data-structures binary-tree

Answer key

11.6.6 Binary Tree: GATE CSE 1989 | Question: 3-ixa

Which one of the following statements (s) is/are FALSE?

A. Overlaying is used to run a program, which is longer than the address space of the computer.
B. Optimal binary search tree construction can be performed efficiently by using dynamic programming.
C. Depth first search cannot be used to find connected components of a graph.
D. Given the prefix and postfix walls over a binary tree, the binary tree can be uniquely constructed.

normal gate1989 binary-tree multiple-selects

Answer key

11.6.7 Binary Tree: GATE CSE 1990 | Question: 3-iv

The total external path length, $\text{EPL},$ of a binary tree with n external nodes is, $\text{EPL} = \sum\limits_{w} I_w,$ where I_w is the path length of external node w),

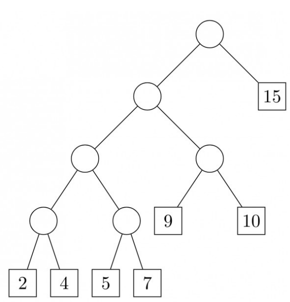
A. $\leq n^2$ always.
B. $\geq n \log_2 n$ always.
C. Equal to n^2 always.
D. $O(n)$ for some special trees.

gate1990 normal data-structures binary-tree multiple-selects

Answer key

11.6.8 Binary Tree: GATE CSE 1991 | Question: 01,viii

The weighted external path length of the binary tree in figure is ______

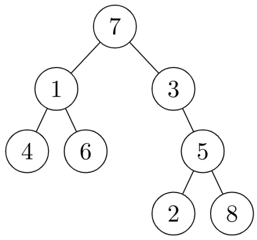


gate1991 binary-tree data-structures normal numerical-answers

Answer key

11.6.9 Binary Tree: GATE CSE 1991 | Question: 1,ix

If the binary tree in figure is traversed in inorder, then the order in which the nodes will be visited is ______

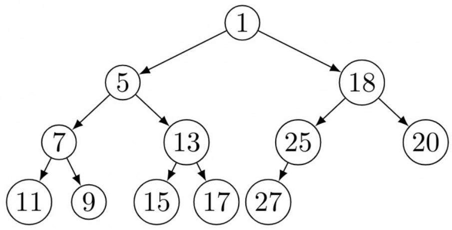


gate1991 binary-tree easy data-structures descriptive

Answer key☟

11.6.10 Binary Tree: GATE CSE 1991 | Question: 14,a

Consider the binary tree in the figure below:



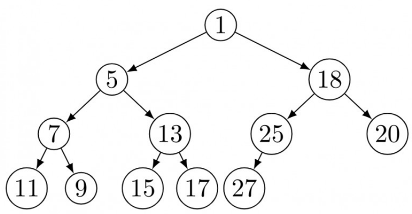
What structure is represented by the binary tree?

gate1991 data-structures binary-tree time-complexity easy descriptive

Answer key☟

11.6.11 Binary Tree: GATE CSE 1991 | Question: 14,b

Consider the binary tree in the figure below:



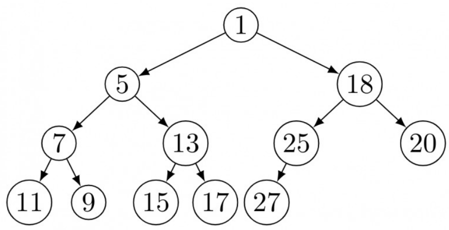
Give different steps for deleting the node with key 5 so that the structure is preserved.

gate1991 data-structures binary-tree normal descriptive

Answer key☟

11.6.12 Binary Tree: GATE CSE 1991 | Question: 14,c

Consider the binary tree in the figure below:



Outline a procedure in Pseudo-code to delete an arbitrary node from such a binary tree with n nodes that preserves the structures. What is the worst-case time complexity of your procedure?

gate1991 normal data-structures binary-tree time-complexity descriptive

Answer key

11.6.13 Binary Tree: GATE CSE 1993 | Question: 16

Prove by the principal of mathematical induction that for any binary tree, in which every non-leaf node has 2-descendants, the number of leaves in the tree is one more than the number of non-leaf nodes.

gate1993 data-structures binary-tree normal descriptive

Answer key

11.6.14 Binary Tree: GATE CSE 1994 | Question: 8

A rooted tree with 12 nodes has its nodes numbered 1 to 12 in pre-order. When the tree is traversed in post-order, the nodes are visited in the order $3, 5, 4, 2, 7, 8, 6, 10, 11, 12, 9, 1$.

Reconstruct the original tree from this information, that is, find the parent of each node, and show the tree diagrammatically.

gate1994 data-structures binary-tree normal descriptive

Answer key

11.6.15 Binary Tree: GATE CSE 1995 | Question: 1.17

A binary tree T has n leaf nodes. The number of nodes of degree 2 in T is

A. $\log_2 n$
B. $n-1$
C. n
D. 2^n

gate1995 data-structures binary-tree normal

Answer key

11.6.16 Binary Tree: GATE CSE 1995 | Question: 6

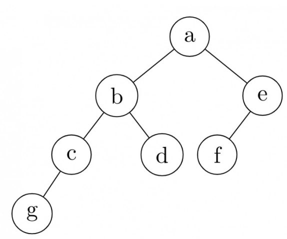
What is the number of binary trees with 3 nodes which when traversed in post-order give the sequence A, B, C? Draw all these binary trees.

gate1995 data-structures binary-tree normal descriptive

Answer key

11.6.17 Binary Tree: GATE CSE 1996 | Question: 1.15

Which of the following sequences denotes the post order traversal sequence of the below tree?



A. $f\,e\,g\,c\,d\,b\,a$
B. $g\,c\,b\,d\,a\,f\,e$
C. $g\,c\,d\,b\,f\,e\,a$
D. $f\,e\,d\,g\,c\,b\,a$

gate1996 data-structures binary-tree easy

Answer key

11.6.18 Binary Tree: GATE CSE 1997 | Question: 16

A size-balanced binary tree is a binary tree in which for every node the difference between the number of nodes in the left and right subtree is at most 1. The distance of a node from the root is the length of the path from the root to the node. The height of a binary tree is the maximum distance of a leaf node from the root.

A. Prove, by using induction on h, that a size-balance binary tree of height h contains at least 2^h nodes.
B. In a size-balanced binary tree of height $h \geqslant 1$, how many nodes are at distance $h-1$ from the root? Write only the answer without any explanations.

gate1997 data-structures binary-tree normal descriptive proof

Answer key☟

11.6.19 Binary Tree: GATE CSE 1998 | Question: 20

Draw the binary tree with node labels $\mathrm{a, b, c, d, e, f}$ and g for which the inorder and postorder traversals result in the following sequences:

Inorder: $\mathrm{a\ f\ b\ c\ d\ g\ e}$

Postorder: $\mathrm{a\ f\ c\ g\ e\ d\ b}$

gate1998 data-structures binary-tree descriptive

Answer key☟

11.6.20 Binary Tree: GATE CSE 2000 | Question: 1.14

Consider the following nested representation of binary trees: $(X\ Y\ Z)$ indicates Y and Z are the left and right subtrees, respectively, of node X. Note that Y and Z may be $NULL$, or further nested. Which of the following represents a valid binary tree?

A. $(1\ 2\ (4\ 5\ 6\ 7))$
B. $(1\ (2\ 3\ 4)\ 5\ 6)\ 7)$
C. $(1\ (2\ 3\ 4)\ (5\ 6\ 7))$
D. $(1\ (2\ 3\ NULL)\ (4\ 5))$

gatecse-2000 data-structures binary-tree easy

Answer key☟

11.6.21 Binary Tree: GATE CSE 2000 | Question: 2.16

Let LASTPOST, LASTIN and LASTPRE denote the last vertex visited `in a postorder, inorder and preorder traversal respectively, of a complete binary tree. Which of the following is always true?

A. LASTIN = LASTPOST
B. LASTIN = LASTPRE
C. LASTPRE = LASTPOST
D. None of the above

gatecse-2000 data-structures binary-tree normal

Answer key☟

11.6.22 Binary Tree: GATE CSE 2002 | Question: 2.12

A weight-balanced tree is a binary tree in which for each node, the number of nodes in the left sub tree is at least half and at most twice the number of nodes in the right sub tree. The maximum possible height (number of nodes on the path from the root to the furthest leaf) of such a tree on n nodes is best described by which of the following?

A. $\log_2 n$
B. $\log_{\frac{4}{3}} n$
C. $\log_3 n$
D. $\log_{\frac{3}{2}} n$

gatecse-2002 data-structures binary-tree normal

Answer key☟

11.6.23 Binary Tree: GATE CSE 2002 | Question: 6

Draw all binary trees having exactly three nodes labeled A, B and C on which preorder traversal gives the sequence C, B, A.

gatecse-2002 data-structures binary-tree easy descriptive

Answer key☟

11.6.24 Binary Tree: GATE CSE 2004 | Question: 35

Consider the label sequences obtained by the following pairs of traversals on a labeled binary tree. Which of these pairs identify a tree uniquely?

I. preorder and postorder
II. inorder and postorder
III. preorder and inorder
IV. level order and postorder

A. I only
B. II, III
C. III only
D. IV only

gatecse-2004 data-structures binary-tree normal

Answer key

11.6.25 Binary Tree: GATE CSE 2004 | Question: 43

Consider the following C program segment

```
struct CellNode{
  struct CellNode *leftChild
  int element;
  struct CellNode *rightChild;
  };

int Dosomething (struct CellNode *ptr)
{
  int value = 0;
  if(ptr != NULL)
  {
    if (ptr -> leftChild != NULL)
      value = 1 + DoSomething (ptr -> leftChild);
    if (ptr -> rightChild != NULL)
      value = max(value, 1 + Dosomething (ptr -> rightChild));
  }
  return(value);
}
```

The value returned by the function DoSomething when a pointer to the root of a non-empty tree is passed as argument is

A. The number of leaf nodes in the tree
B. The number of nodes in the tree
C. The number of internal nodes in the tree
D. The height of the tree

gatecse-2004 data-structures binary-tree normal

Answer key

11.6.26 Binary Tree: GATE CSE 2006 | Question: 13

A scheme for storing binary trees in an array X is as follows. Indexing of X starts at 1 instead of 0. the root is stored at $X[1]$. For a node stored at $X[i]$, the left child, if any, is stored in $X[2i]$ and the right child, if any, in $X[2i+1]$. To be able to store any binary tree on n vertices the minimum size of X should be

A. $\log_2 n$
B. n
C. $2n+1$
D. $2^n - 1$

gatecse-2006 data-structures binary-tree normal

Answer key

11.6.27 Binary Tree: GATE CSE 2007 | Question: 12

The height of a binary tree is the maximum number of edges in any root to leaf path. The maximum number of nodes in a binary tree of height h is:

A. $2^h - 1$
B. $2^{h-1} - 1$
C. $2^{h+1} - 1$
D. 2^{h+1}

gatecse-2007 data-structures binary-tree easy

Answer key

11.6.28 Binary Tree: GATE CSE 2007 | Question: 13

The maximum number of binary trees that can be formed with three unlabeled nodes is:

A. 1 B. 5 C. 4 D. 3

gatecse-2007 data-structures binary-tree normal

Answer key

11.6.29 Binary Tree: GATE CSE 2007 | Question: 39, UGCNET-June2015-II: 22

The inorder and preorder traversal of a binary tree are

d b e a f c g and a b d e c f g, respectively

The postorder traversal of the binary tree is:

A. d e b f g c a
B. e d b g f c a
C. e d b f g c a
D. d e f g b c a

gatecse-2007 data-structures binary-tree normal ugcnetcse-june2015-paper2

Answer key

11.6.30 Binary Tree: GATE CSE 2007 | Question: 46

Consider the following C program segment where CellNode represents a node in a binary tree:

```
struct CellNode {
   struct CellNode *leftChild;
   int element;
   struct CellNode *rightChild;
};

int Getvalue (struct CellNode *ptr) {
   int value = 0;
   if (ptr != NULL) {
      if ((ptr->leftChild == NULL) &&
         (ptr->rightChild == NULL))
         value = 1;
      else
         value = value + GetValue(ptr->leftChild)
                + GetValue(ptr->rightChild);
   }
   return(value);
}
```

The value returned by GetValue when a pointer to the root of a binary tree is passed as its argument is:

A. the number of nodes in the tree
B. the number of internal nodes in the tree
C. the number of leaf nodes in the tree
D. the height of the tree

gatecse-2007 data-structures binary-tree normal

Answer key

11.6.31 Binary Tree: GATE CSE 2010 | Question: 10

In a binary tree with n nodes, every node has an odd number of descendants. Every node is considered to be its own descendant. What is the number of nodes in the tree that have exactly one child?

A. 0 B. 1 C. $\frac{(n-1)}{2}$ D. $n-1$

gatecse-2010 data-structures binary-tree normal

Answer key

11.6.32 Binary Tree: GATE CSE 2011 | Question: 29

We are given a set of n distinct elements and an unlabeled binary tree with n nodes. In how many ways can we populate the tree with the given set so that it becomes a binary search tree?

A. 0 B. 1 C. $n!$ D. $\frac{1}{n+1} \cdot {}^{2n}C_n$

gatecse-2011 binary-tree normal

Answer key

11.6.33 Binary Tree: GATE CSE 2012 | Question: 47

The height of a tree is defined as the number of edges on the longest path in the tree. The function shown in the pseudo-code below is invoked as height (root) to compute the height of a binary tree rooted at the tree pointer root.

```
int height(treeptr n)
{ if(n == NULL) return -1;
  if(n -> left == NULL)
    if(n -> right == NULL) return 0;
    else return B1; // Box 1

  else{h1 = height(n -> left);
     if(n -> right == NULL) return (1+h1);
     else{h2 = height(n -> right);
          return B2; // Box 2
          }
     }
}
```

The appropriate expressions for the two boxes **B1** and **B2** are:

A. **B1**: $(1 + \text{height}(n \rightarrow \text{ right}))$; **B2**: $(1 + \max(h1, h2))$
B. **B1**: $(\text{height}(n \rightarrow \text{ right}))$; **B2**: $(1 + \max(h1, h2))$
C. **B1**: $\text{height}(n \rightarrow \text{ right})$; **B2**: $\max(h1, h2)$
D. **B1**: $(1 + \text{height}(n \rightarrow \text{ right}))$; **B2**: $\max(h1, h2)$

gatecse-2012 data-structures binary-tree normal

Answer key

11.6.34 Binary Tree: GATE CSE 2014 Set 1 | Question: 12

Consider a rooted n node binary tree represented using pointers. The best upper bound on the time required to determine the number of subtrees having exactly 4 nodes is $O(n^a \log^b n)$. Then the value of $a + 10b$ is ___________.

gatecse-2014-set1 data-structures binary-tree numerical-answers normal

Answer key

11.6.35 Binary Tree: GATE CSE 2015 Set 1 | Question: 25

The height of a tree is the length of the longest root-to-leaf path in it. The maximum and minimum number of nodes in a binary tree of height 5 are

A. 63 and 6, respectively
B. 64 and 5, respectively
C. 32 and 6, respectively
D. 31 and 5, respectively

gatecse-2015-set1 data-structures binary-tree easy

Answer key

11.6.36 Binary Tree: GATE CSE 2015 Set 2 | Question: 10

A binary tree T has 20 leaves. The number of nodes in T having two children is ______.

gatecse-2015-set2 data-structures binary-tree normal numerical-answers

Answer key

11.6.37 Binary Tree: GATE CSE 2015 Set 3 | Question: 25

Consider a binary tree T that has 200 leaf nodes. Then the number of nodes in T that have exactly two children are ______.

gatecse-2015-set3 data-structures binary-tree normal numerical-answers

Answer key

11.6.38 Binary Tree: GATE CSE 2016 Set 2 | Question: 36

Consider the following New-order strategy for traversing a binary tree:

- Visit the root;
- Visit the right subtree using New-order;
- Visit the left subtree using New-order;

The New-order traversal of the expression tree corresponding to the reverse polish expression

```
3 4 * 5 - 2 ^ 6 7 * 1 + -
```

is given by:

A. $+ - 1\,6\,7 * 2 \wedge 5\; - \; 3\,4 *$
B. $- + 1 * 6\,7 \wedge 2 - 5 * 3\,4$
C. $- + 1 * 7\,6 \wedge 2\; - \;5\; * \;4\,3$
D. $1\,7\,6 * + 2\,5\,4\,3\; * \; - \wedge -$

gatecse-2016-set2 data-structures binary-tree normal

Answer key

11.6.39 Binary Tree: GATE CSE 2018 | Question: 20

The postorder traversal of a binary tree is $8, 9, 6, 7, 4, 5, 2, 3, 1$. The inorder traversal of the same tree is $8, 6, 9, 4, 7, 2, 5, 1, 3$. The height of a tree is the length of the longest path from the root to any leaf. The height of the binary tree above is _____

gatecse-2018 data-structures binary-tree numerical-answers one-mark

Answer key

11.6.40 Binary Tree: GATE CSE 2019 | Question: 46

Let T be a full binary tree with 8 leaves. (A full binary tree has every level full.) Suppose two leaves a and b of T are chosen uniformly and independently at random. The expected value of the distance between a and b in T (ie., the number of edges in the unique path between a and b) is (rounded off to 2 decimal places) _________.

gatecse-2019 numerical-answers data-structures binary-tree two-marks

Answer key

11.6.41 Binary Tree: GATE CSE 2021 Set 2 | Question: 16

Consider a complete binary tree with 7 nodes. Let A denote the set of first 3 elements obtained by performing Breadth-First Search (BFS) starting from the root. Let B denote the set of first 3 elements obtained by performing Depth-First Search (DFS) starting from the root.

The value of $|A - B|$ is _____________

gatecse-2021-set2 numerical-answers data-structures binary-tree one-mark

Answer key

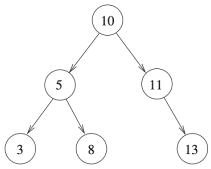
11.6.42 Binary Tree: GATE CSE 2023 | Question: 37

Consider the C function foo and the binary tree shown.

```
typedef struct node {
  int val;
  struct node *left, *right;
} node;

int foo(node *p) {
```

```
    int retval;
    if (p == NULL)
        return 0;
    else {
        retval = p->val + foo(p->left) + foo(p->right);
        printf("%d ", retval);
        return retval;
    }
}
```



When foo is called with a pointer to the root node of the given binary tree, what will it print?

A. $3\ 8\ 5\ 13\ 11\ 10$
B. $3\ 5\ 8\ 10\ 11\ 13$
C. $3\ 8\ 16\ 13\ 24\ 50$
D. $3\ 16\ 8\ 50\ 24\ 13$

gatecse-2023 data-structures binary-tree two-marks

Answer key

11.6.43 Binary Tree: GATE CSE 2025 | Set 2 | Question: 3

Consider a binary tree T in which every node has either zero or two children. Let $n > 0$ be the number of nodes in T.

Which ONE of the following is the number of nodes in T that have exactly two children?

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

gatecse2025-set2 data-structures binary-tree one-mark

Answer key

11.6.44 Binary Tree: GATE DS&AI 2024 | Question: 18

Consider the following tree traversals on a full binary tree:

i. Preorder
ii. Inorder
iii. Postorder

Which of the following traversal options is/are sufficient to uniquely reconstruct the full binary tree?

A. (i) and (ii)
B. (ii) and (iii)
C. (i) and (iii)
D. (ii) only

gate-ds-ai-2024 data-structures binary-tree multiple-selects one-mark

Answer key

11.6.45 Binary Tree: GATE DS&AI 2024 | Question: 42

Let H, I, L, and N represent height, number of internal nodes, number of leaf nodes, and the total number of nodes respectively in a rooted binary tree.

Which of the following statements is/are always TRUE?

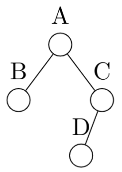
A. $L \leq I + 1$
B. $H + 1 \leq N \leq 2^{H+1} - 1$
C. $H \leq I \leq 2^H - 1$
D. $H \leq L \leq 2^{H-1}$

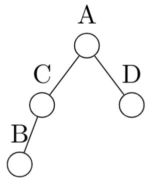
gate-ds-ai-2024 data-structures binary-tree multiple-selects two-marks

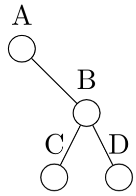
Answer key

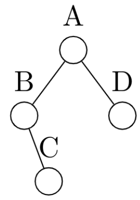
11.6.46 Binary Tree: GATE IT 2004 | Question: 54

Which one of the following binary trees has its inorder and preorder traversals as $BCAD$ and $ABCD$, respectively?

A. 

B. 

C. 

D. 

gateit-2004 binary-tree easy data-structures

Answer key☟

11.6.47 Binary Tree: GATE IT 2005 | Question: 50

In a binary tree, for every node the difference between the number of nodes in the left and right subtrees is at most 2. If the height of the tree is $h > 0$, then the minimum number of nodes in the tree is

A. 2^{h-1}
B. $2^{h-1}+1$
C. 2^h-1
D. 2^h

gateit-2005 data-structures binary-tree normal

Answer key☟

11.6.48 Binary Tree: GATE IT 2006 | Question: 71

An array X of n distinct integers is interpreted as a complete binary tree. The index of the first element of the array is 0. The index of the parent of element $X[i], i \neq 0$, is?

A. $\left\lfloor \frac{i}{2} \right\rfloor$
B. $\left\lceil \frac{i-1}{2} \right\rceil$
C. $\left\lceil \frac{i}{2} \right\rceil$
D. $\left\lceil \frac{i}{2} \right\rceil - 1$

gateit-2006 data-structures binary-tree normal

Answer key☟

11.6.49 Binary Tree: GATE IT 2006 | Question: 73

An array X of n distinct integers is interpreted as a complete binary tree. The index of the first element of the array is 0. If the root node is at level 0, the level of element $X[i]$, $i \neq 0$, is

A. $\lfloor \log_2 i \rfloor$
B. $\lceil \log_2 (i+1) \rceil$
C. $\lfloor \log_2 (i+1) \rfloor$
D. $\lceil \log_2 i \rceil$

gateit-2006 data-structures binary-tree normal

Answer key☟

11.6.50 Binary Tree: GATE IT 2006 | Question: 9

In a binary tree, the number of internal nodes of degree 1 is 5, and the number of internal nodes of degree 2 is 10. The number of leaf nodes in the binary tree is

A. 10
B. 11
C. 12
D. 15

gateit-2006 data-structures binary-tree normal

Answer key☟

11.6.51 Binary Tree: GATE IT 2008 | Question: 46

The following three are known to be the preorder, inorder and postorder sequences of a binary tree. But it is not known which is which.

I. $MBCAFHPYK$
II. $KAMCBYPFH$
III. $MABCKYFPH$

Pick the true statement from the following.

A. I and II are preorder and inorder sequences, respectively
B. I and III are preorder and postorder sequences, respectively
C. II is the inorder sequence, but nothing more can be said about the other two sequences
D. II and III are the preorder and inorder sequences, respectively

gateit-2008 data-structures normal binary-tree

Answer key☟

11.6.52 Binary Tree: GATE IT 2008 | Question: 76

A binary tree with $n > 1$ nodes has n_1, n_2 and n_3 nodes of degree one, two and three respectively. The degree of a node is defined as the number of its neighbours.

n_3 can be expressed as

A. $n_1 + n_2 - 1$
B. $n_1 - 2$
C. $[((n_1 + n_2)/2)]$
D. $n_2 - 1$

gateit-2008 data-structures binary-tree normal

Answer key☟

11.6.53 Binary Tree: GATE IT 2008 | Question: 77

A binary tree with $n > 1$ nodes has n_1, n_2 and n_3 nodes of degree one, two and three respectively. The degree of a node is defined as the number of its neighbours.

Starting with the above tree, while there remains a node v of degree two in the tree, add an edge between the two neighbours of v and then remove v from the tree. How many edges will remain at the end of the process?

A. $2 * n_1 - 3$
B. $n_2 + 2 * n_1 - 2$
C. $n_3 - n_2$
D. $n_2 + n_1 - 2$

gateit-2008 data-structures binary-tree normal

Answer key☟

11.6.54 Binary Tree: UGC NET CSE | December 2005 | Part 2 | Question: 21

In what tree, for every node the height of its left subtree and right subtree differ at least by one:

A. Binary search tree
B. AVL-tree
C. Threaded binary tree
D. Complete tree

ugcnetcse-dec2005-paper2 binary-tree data-structures

11.6.55 Binary Tree: UGC NET CSE | December 2007 | Part 2 | Question: 23

The height of a binary tree with n nodes, in the worst case is :

A. $O(logn)$
B. $O(n)$
C. $\Omega(n \log n)$
D. $\Omega(n^2)$

ugcnetcse-dec2007-paper2 data-structures binary-tree time-complexity

Answer key☟

11.6.56 Binary Tree: UGC NET CSE | December 2009 | Part 2 | Question: 21

If the number of leaves in a strictly binary tree is an odd number, then what can you say with full conviction about total number of nodes in the tree ?
(A) It is an odd number.
(B) It is an even number.
(C) It cannot be equal to the number of leaves.

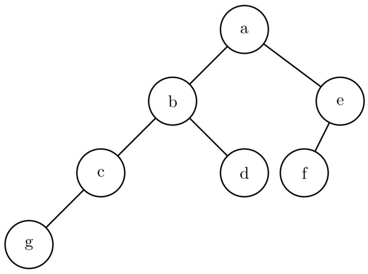
(D) It is always greater than twice the number of leaves.

ugcnetcse-dec2009-paper2 data-structures binary-tree

Answer key

11.6.57 Binary Tree: UGC NET CSE | June 2006 | Part 2 | Question: 21

In the balanced binary tree given below, how many nodes will become unbalanced when a node is inserted as a child of the node "g".



A. 1 B. 3 C. 7 D. 8

ugcnetcse-june2006-paper2 binary-tree data-structures

11.6.58 Binary Tree: UGC NET CSE | June 2007 | Part 2 | Question: 3

The maximum number of nodes in a binary tree of depth 10:

A. 1024 B. $2^{10}-1$ C. 1000 D. None of the above

ugcnetcse-june2007-paper2 binary-tree data-structures

11.6.59 Binary Tree: UGC NET CSE | June 2009 | Part 2 | Question: 27

In a full binary tree of height k, there are ______ internal nodes .

A. 2k-1
B. 2k-1
C. 2k
D. 2k+1

ugcnetcse-june2009-paper2 data-structures binary-tree

Answer key

11.6.60 Binary Tree: UGC NET CSE | June 2009 | Part 2 | Question: 28

A binary tree is said to have heap property if the elements along any path :

A. from leaf to root are non-increasing
B. from leaf to root are non-decreasing
C. from root to leaf are non-decreasing
D. from root to leaf are non-increasing

ugcnetcse-june2009-paper2 binary-tree data-structures

Answer key

11.6.61 Binary Tree: UGC NET CSE | June 2012 | Part 2 | Question: 27

The Inorder traversal of the tree will yield a sorted listing of elements of tree in

A. Binary tree
B. Binary search tree
C. Heaps
D. None of the above

data-structures binary-tree ugcnetcse-june2012-paper2

Answer key

11.6.62 Binary Tree: UGC NET CSE | June 2012 | Part 2 | Question: 8

A binary search tree is a binary tree in which

A. All items in the left subtree are less than root
B. All items in the right subtree are greater than or equal to root
C. Each subtree is itself a binary search tree
D. All of the above

ugcnetcse-june2012-paper2 data-structures binary-tree

Answer key

11.6.63 Binary Tree: UGC NET CSE | October 2020 | Part 2 | Question: 23

A complete n-ary tree is a tree in which each node has n children or no children. Let I be the number of internal nodes and L be the number of leaves in a complete n-ary tree. If $L = 41$, and $I = 10$, what is the value of n?

A. 3 B. 4 C. 5 D. 6

ugcnetcse-oct2020-paper2 data-structures binary-tree

Answer key

11.6.64 Binary Tree: UGC NET CSE | September 2013 | Part 2 | Question: 11

The min. number of nodes in a binary tree of depth d (root at level 0) is

A. $(2^d + 1)$ B. $(2^{(d+1)} - 1)$ C. d D. $d + 1$

binary-tree data-structures ugcnetsep2013ii

Answer key

11.6.65 Binary Tree: UGC NET CSE | September 2013 | Part 2 | Question: 21

Consider the In-order and Post-order traversals of a tree as given below:

In-order: j e n k o p b f a c l g m d h i

Post-order: j n o p k e f b c l m g h l d a

The Pre-order traversal of the tree shall be

A. a b f e j k n o p c d g l m h i
B. a b c d e f j k n o p g l m h i
C. a b e j k n o p f c d g l m h i
D. j e n o p k f b c l m g h l d a

ugcnetsep2013ii data-structures binary-tree

Answer key

11.7 Btree (1)

11.7.1 Btree: UGC NET CSE | June 2010 | Part 2 | Question: 25

In a B tree of order 5, the following keys are inserted as follows : $7, 8, 1, 4, 13, 20, 2, 6$ and 5 How many elements are present in the root of the tree ?

A. 1 B. 2 C. 3 D. 4

ugcnetcse-june2010-paper2 data-structures btree

Answer key

11.8 Cryptography (1)

11.8.1 Cryptography: UGC NET CSE | January 2017 | Part 2 | Question: 24

If h is chosen from a universal collection of hash functions and is used to hash n keys into a table of size m, where $n \leq m$, the expected number of collisions involving a particular key x is less than __________.

A. 1 B. $1/n$ C. $1/m$ D. n/m

ugcnetjan2017ii cryptography hashing data-structures

Answer key☟

11.9 Data Structures (13)

11.9.1 Data Structures: GATE CSE 1997 | Question: 6.2

Let G be the graph with 100 vertices numbered 1 to 100. Two vertices i and j are adjacent if $|i-j|=8$ or $|i-j|=12$. The number of connected components in G is

A. 8 B. 4 C. 12 D. 25

gate1997 data-structures normal graph-theory

Answer key☟

11.9.2 Data Structures: GATE CSE 2005 | Question: 2

An Abstract Data Type (ADT) is:

A. same as an abstract class
B. a data type that cannot be instantiated
C. a data type for which only the operations defined on it can be used, but none else
D. all of the above

gatecse-2005 data-structures normal abstract-data-type

Answer key☟

11.9.3 Data Structures: GATE CSE 2014 Set 1 | Question: 3

Let $G=(V,E)$ be a directed graph where V is the set of vertices and E the set of edges. Then which one of the following graphs has the same strongly connected components as G ?

A. G_1 = (V,E_1) where $E_1=\{(u,v) \mid (u,v) \notin E\}$
B. G_2 = (V,E_2) where $E_2=\{(u,v) \mid (v,u) \in E\}$
C. G_3 = (V,E_3) where $E_3=\{(u,v) |$ there is a path of length ≤ 2 from u to v in $E\}$
D. G_4 = (V_4,E) where V_4 is the set of vertices in G which are not isolated

gatecse-2014-set1 data-structures graph-theory ambiguous

Answer key☟

11.9.4 Data Structures: GATE CSE 2016 Set 1 | Question: 38

Consider the weighted undirected graph with 4 vertices, where the weight of edge $\{i,j\}$ is given by the entry W_{ij} in the matrix W.

$$W=\begin{bmatrix} 0 & 2 & 8 & 5 \\ 2 & 0 & 5 & 8 \\ 8 & 5 & 0 & x \\ 5 & 8 & x & 0 \end{bmatrix}$$

The largest possible integer value of x, for which at least one shortest path between some pair of vertices will contain the edge with weight x is ___________.

gatecse-2016-set1 data-structures graph-theory normal numerical-answers

Answer key☟

11.9.5 Data Structures: GATE DS&AI 2024 | Question: 6

Match the items in **Column** 1 with the items in **Column** 2 in the following table:

	Column 1		Column 2
(p)	First In First Out	(i)	Stacks
(q)	Lookup Operation	(ii)	Queues
(r)	Last In First Out	(iii)	Hash Tables

A. $(\mathrm{p})-(\mathrm{ii}),(\mathrm{q})-(\mathrm{iii}),(\mathrm{r})-(\mathrm{i})$
B. $(\mathrm{p})-(\mathrm{ii}),(\mathrm{q})-(\mathrm{i}),(\mathrm{r})-(\mathrm{iii})$
C. $(\mathrm{p})-(\mathrm{i}),(\mathrm{q})-(\mathrm{ii}),(\mathrm{r})-(\mathrm{iii})$
D. $(\mathrm{p})-(\mathrm{i}),(\mathrm{q})-(\mathrm{iii}),(\mathrm{r})-(\mathrm{ii})$

gate-ds-ai-2024 data-structures match-the-following one-mark

Answer key☟

11.9.6 Data Structures: UGC NET CSE | December 2011 | Part 2 | Question: 1

Which of the following data structure is Non-linear type ?

A. Strings B. Lists C. Stacks D. None of the above

ugcnetcse-dec2011-paper2 data-structures

Answer key☟

11.9.7 Data Structures: UGC NET CSE | July 2016 | Part 2 | Question: 2

The number of different spanning trees in complete graph, K_4 and bipartite graph, $K_{2,2}$ have _____ and ____ respectively.

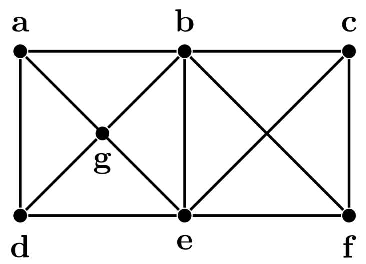
A. 14, 14 B. 16, 14 C. 16, 4 D. 14, 4

ugcnetcse-july2016-paper2 data-structures graph-theory

Answer key☟

11.9.8 Data Structures: UGC NET CSE | July 2016 | Part 2 | Question: 5

A clique in a simple undirected graph is a complete subgraph that is not contained in any larger complete subgraph. How many cliques are there in a graph shown below?



A. 2 B. 4 C. 5 D. 6

ugcnetcse-july2016-paper2 data-structures graph-theory

Answer key☟

11.9.9 Data Structures: UGC NET CSE | June 2012 | Part 2 | Question: 49

Which of the following data structure is linear type?

A. Strings B. Lists C. Queues D. All of the above data-structures ugcnetcse-june2012-paper2 easy

Answer key☟

11.9.10 Data Structures: UGC NET CSE | June 2013 | Part 2 | Question: 30

Consider the following statements for priority queue:

S1: It is a data structure in which the intrinsic ordering of the elements does determine the result of its basic operations.

S2: The elements of a priority queue may be complex structures that are ordered on one or several fields

A. Both S1 and S2 are incorrect
B. S1 is correct and S2 is incorrect
C. S1 is incorrect and S2 is correct
D. Both S1 and S2 are correct

data-structures ugcnetcse-june2013-paper2

Answer key☟

11.9.11 Data Structures: UGC NET CSE | June 2013 | Part 3 | Question: 49

Suppose you want to delete the name that occurs before 'Vivek' in an alphabetical listing. Which one of the following data structures shall be most efficient for this operation?

A. Circular linked list
B. Doubly linked list
C. Linked list
D. Dequeue

ugcnetcse-june2013-paper3 data-structures

Answer key☟

11.9.12 Data Structures: UGC NET CSE | October 2020 | Part 2 | Question: 63

Which of the following statements are true?

i. Minimax search is breadth-first; it processes all the nodes at a level before moving to a node in next level.
ii. The effectiveness of the alpha-beta pruning is highly dependent on the order in which the states are examined
iii. The alpha-beta search algorithms computes the same optimal moves as minimax algorithm
iv. Optimal play in games of imperfect information does not require reasoning about the current and future belief states of each player

Choose the correct answer from the options given below:

A. (i) and (iii) only
B. (i) and (iv) only
C. (ii) and (iii) only
D. (iii) and (iv) only

ugcnetcse-oct2020-paper2 data-structures breadth-first-search

Answer key☟

11.9.13 Data Structures: UGC NET CSE | September 2013 | Part 3 | Question: 15

Which of the following is the minimum cost for an assignment problem given below?

			A	B	C	D
		I	5	3	2	8
Jobs	Workers	II	7	9	2	6
		III	6	4	5	7
		IV	5	7	7	8

A. 13
B. 16
C. 17
D. 18

ugcnetcse-sep2013-paper3 data-structures

Answer key☟

11.10 Expression Evaluation (4)

11.10.1 Expression Evaluation: UGC NET CSE | December 2006 | Part 2 | Question: 24

The equivalent postfix expression for $d/(e+f)+b*c$:

1. $defbc/++*$
2. $def+/bc+*$
3. $def+/bc*+$
4. None of these

ugcnetcse-dec2006-paper2 expression-evaluation stack

Answer key☟

11.10.2 Expression Evaluation: UGC NET CSE | June 2005 | Part 2 | Question: 24

If the postfix form of a string is $ABC+-D^*$, the actual string is :

A. $(A-(B+C))^*D$
B. $((A-B)+C)^*D$
C. $((A+B)-C)^*D$
D. $(A+(B-C))^*D$

ugcnetcse-june2005-paper2 expression-evaluation stack infix-prefix

Answer key☟

11.10.3 Expression Evaluation: UGC NET CSE | June 2006 | Part 2 | Question: 24

If the post fix form of a string is $ABC+-D^*$, The actual string is:

A. $(A-(B+C))^*D$
B. $((A-B)+C)^*D$
C. $((A+B)-C)^*D$
D. $(A+(B-C)^*D)$

ugcnetcse-june2006-paper2 expression-evaluation stack data-structures

Answer key☟

11.10.4 Expression Evaluation: UGC NET CSE | June 2013 | Part 2 | Question: 29

The value of postfix expression: 834+-382/+*2$3+ is

A. 17
B. 131
C. 64
D. 52

ugcnetcse-june2013-paper2 expression-evaluation stack data-structures

Answer key☟

11.11 Graph Algorithms (1)

11.11.1 Graph Algorithms: UGC NET CSE | July 2018 | Part 2 | Question: 24

Which of the following algorithms solves the single-source shortest paths?

A. Prim's algorithm
B. Floys-Warshall algorithm
C. Johnson's algorithm
D. Dijkstra's algorithm

ugcnetcse-july2018-paper2 data-structures graph-algorithms

Answer key☟

11.12 Graph Connectivity (1)

11.12.1 Graph Connectivity: UGC NET CSE | September 2013 | Part 2 | Question: 20

Consider the following statements:

I. A graph in which there is a unique path between every pair of vertices is a tree.
II. A connected graph with e=v-1 is a tree
III. A connected graph with e=v-1 that has no circuit is a tree

Which one of the above statements is/are true?

A. I and III
B. II and III
C. I and II
D. All of the above

graph-connectivity ugcnetsep2013ii

Answer key

11.13 Hashing (33)

11.13.1 Hashing: GATE CSE 1996 | Question: 1.13

An advantage of chained hash table (external hashing) over the open addressing scheme is

A. Worst case complexity of search operations is less
B. Space used is less
C. Deletion is easier
D. None of the above

gate1996 data-structures hashing normal

Answer key

11.13.2 Hashing: GATE CSE 1996 | Question: 15

Insert the characters of the string $K\ R\ P\ C\ S\ N\ Y\ T\ J\ M$ into a hash table of size 10.
Use the hash function

$$h(x) = (ord(x) – ord(\text{"}a\text{"}) + 1) \mod 10$$

and linear probing to resolve collisions.

A. Which insertions cause collisions?
B. Display the final hash table.

gate1996 data-structures hashing normal descriptive

Answer key

11.13.3 Hashing: GATE CSE 1997 | Question: 12

Consider a hash table with n buckets, where external (overflow) chaining is used to resolve collisions. The hash function is such that the probability that a key value is hashed to a particular bucket is $\frac{1}{n}$. The hash table is initially empty and K distinct values are inserted in the table.

A. What is the probability that bucket number 1 is empty after the K^{th} insertion?
B. What is the probability that no collision has occurred in any of the K insertions?
C. What is the probability that the first collision occurs at the K^{th} insertion?

gate1997 data-structures hashing probability normal descriptive

Answer key

11.13.4 Hashing: GATE CSE 2004 | Question: 7

Given the following input $(4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199)$ and the hash function x mod 10, which of the following statements are true?

I. $9679, 1989, 4199$ hash to the same value
II. $1471, 6171$ hash to the same value
III. All elements hash to the same value
IV. Each element hashes to a different value

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

gatecse-2004 data-structures hashing easy

Answer key

11.13.5 Hashing: GATE CSE 2007 | Question: 40

Consider a hash table of size seven, with starting index zero, and a hash function $(3x+4) \mod 7$. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence $1, 3, 8, 10$ is inserted into the table using closed hashing? Note that – denotes an empty location in the table.

A. $8, -, -, -, -, -, 10$
B. $1, 8, 10, -, -, -, 3$
C. $1, -, -, -, -, -, 3$
D. $1, 10, 8, -, -, -, 3$

gatecse-2007 data-structures hashing easy

Answer key

11.13.6 Hashing: GATE CSE 2009 | Question: 36

The keys $12, 18, 13, 2, 3, 23, 5$ and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function $h(k) = k \mod 10$ and linear probing. What is the resultant hash table?

A.

0	
1	
2	2
3	23
4	
5	15
6	
7	
8	18
9	

B.

0	
1	
2	12
3	13
4	
5	5
6	
7	
8	18
9	

C.

0	
1	
2	12
3	13
4	2
5	3
6	23
7	5
8	18
9	15

D.

0	
1	
2	2, 12
3	13, 3, 23
4	
5	5, 15
6	
7	
8	18
9	

gatecse-2009 data-structures hashing normal

Answer key

11.13.7 Hashing: GATE CSE 2010 | Question: 52

A hash table of length 10 uses open addressing with hash function $h(k) = k \mod 10$, and linear probing. After inserting 6 values into an empty hash table, the table is shown as below

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

Which one of the following choices gives a possible order in which the key values could have been inserted in the table?

A. $46, 42, 34, 52, 23, 33$
B. $34, 42, 23, 52, 33, 46$
C. $46, 34, 42, 23, 52, 33$
D. $42, 46, 33, 23, 34, 52$

gatecse-2010 data-structures hashing normal

Answer key

11.13.8 Hashing: GATE CSE 2010 | Question: 53

A hash table of length 10 uses open addressing with hash function $h(k) = k \mod 10$, and linear probing. After inserting 6 values into an empty hash table, the table is shown as below

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

How many different insertion sequences of the key values using the same hash function and linear probing will result in the hash table shown above?

A. 10 B. 20 C. 30 D. 40

data-structures hashing normal gatecse-2010

Answer key☟

11.13.9 Hashing: GATE CSE 2014 Set 1 | Question: 40

Consider a hash table with 9 slots. The hash function is $h(k) = k \mod 9$. The collisions are resolved by chaining. The following 9 keys are inserted in the order: $5, 28, 19, 15, 20, 33, 12, 17, 10$. The maximum, minimum, and average chain lengths in the hash table, respectively, are

A. $3, 0,$ and 1 B. $3, 3,$ and 3 C. $4, 0,$ and 1 D. $3, 0,$ and 2

gatecse-2014-set1 data-structures hashing normal

Answer key☟

11.13.10 Hashing: GATE CSE 2014 Set 3 | Question: 40

Consider a hash table with 100 slots. Collisions are resolved using chaining. Assuming simple uniform hashing, what is the probability that the first 3 slots are unfilled after the first 3 insertions?

A. $(97 \times 97 \times 97)/100^3$
B. $(99 \times 98 \times 97)/100^3$
C. $(97 \times 96 \times 95)/100^3$
D. $(97 \times 96 \times 95/(3! \times 100^3)$

gatecse-2014-set3 data-structures hashing probability normal

Answer key☟

11.13.11 Hashing: GATE CSE 2015 Set 2 | Question: 33

Which one of the following hash functions on integers will distribute keys most uniformly over 10 buckets numbered 0 to 9 for i ranging from 0 to 2020?

A. $h(i) = i^2 \text{mod } 10$
B. $h(i) = i^3 \text{mod } 10$
C. $h(i) = (11 * i^2) \text{mod } 10$
D. $h(i) = (12 * i^2) \text{mod } 10$

gatecse-2015-set2 data-structures hashing normal

Answer key☟

11.13.12 Hashing: GATE CSE 2015 Set 3 | Question: 17

Given that hash table T with 25 slots that stores 2000 elements, the load factor a for T is _________.

gatecse-2015-set3 data-structures hashing easy numerical-answers

Answer key☟

11.13.13 Hashing: GATE DS&AI 2024 | Question: 11

Consider performing uniform hashing on an open address hash table with load factor $\alpha = \frac{n}{m} < 1$, where n elements are stored in the table with m slots. The expected number of probes in an unsuccessful search is at most $\frac{1}{1-\alpha}$.

Inserting an element in this hash table requires at most probes,________ on average.

A. $\ln\left(\frac{1}{1-\alpha}\right)$ B. $\frac{1}{1-\alpha}$ C. $1+\frac{\alpha}{2}$ D. $\frac{1}{1+\alpha}$

gate-ds-ai-2024 data-structures hashing uniform-hashing one-mark

Answer key☟

11.13.14 Hashing: GATE IT 2006 | Question: 20

Which of the following statement(s) is TRUE?

I. A hash function takes a message of arbitrary length and generates a fixed length code.
II. A hash function takes a message of fixed length and generates a code of variable length.
III. A hash function may give the same hash value for distinct messages.

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

gateit-2006 data-structures hashing normal

Answer key☟

11.13.15 Hashing: GATE IT 2007 | Question: 28

Consider a hash function that distributes keys uniformly. The hash table size is 20. After hashing of how many keys will the probability that any new key hashed collides with an existing one exceed 0.5.

A. 5 B. 6 C. 7 D. 10

gateit-2007 data-structures hashing probability normal

Answer key☟

11.13.16 Hashing: GATE IT 2008 | Question: 48

Consider a hash table of size 11 that uses open addressing with linear probing. Let $h(k) = k \mod 11$ be the hash function used. A sequence of records with keys

$43\ 36\ 92\ 87\ 11\ 4\ 71\ 13\ 14$

is inserted into an initially empty hash table, the bins of which are indexed from zero to ten. What is the index of the bin into which the last record is inserted?

A. 3 B. 4 C. 6 D. 7

gateit-2008 data-structures hashing normal

Answer key☟

11.13.17 Hashing: UGC NET CSE | August 2016 | Part 3 | Question: 32

Consider a hash table of size $m = 10000$, and the hash function $h(K) = floor(m(KA \mod 1))$ for $A = (\sqrt{5}-1)/2$. The key 123456 is mapped to location ______.

A. 46 B. 41 C. 43 D. 48

ugcnetcse-aug2016-paper3 data-structures hashing

Answer key☟

11.13.18 Hashing: UGC NET CSE | December 2004 | Part 2 | Question: 22

Suppose we are implementing quadratic probing with a Hash function, Hash $(y) = X$ mode 100. If an element with key 4594 is inserted and the first three locations attempted are already occupied, then the next cell that will be tried is :

A. 2 B. 3 C. 9 D. 97

ugcnetcse-dec2004-paper2 hashing data-structures

Answer key☟

11.13.19 Hashing: UGC NET CSE | December 2004 | Part 2 | Question: 32

Which of the following is not collision resolution technique?

A. Hash addressing B. Chaining C. Both (A) and (B) D. Indexing

ugcnetcse-dec2004-paper2 hashing data-structures

Answer key☟

11.13.20 Hashing: UGC NET CSE | December 2005 | Part 2 | Question: 34

Which of the following is not collision Resolution Technique :

A. Hash addressing B. Chainning C. Indexing D. None of these

ugcnetcse-dec2005-paper2 data-structures hashing

Answer key☟

11.13.21 Hashing: UGC NET CSE | December 2009 | Part 2 | Question: 25

A hash function f defined as f(key) = key mod 7, with linear probing used to resolve collisions. Insert the keys 37, 38, 72, 48, 98 and 11 into the table indexed from 0 to 6.

What will be the location of 11 ?

(A) 3

(B) 4

(C) 5

(D) 6

ugcnetcse-dec2009-paper2 data-structures hashing

Answer key☟

11.13.22 Hashing: UGC NET CSE | December 2011 | Part 2 | Question: 6

A hash table has space for 75 records, then the probability of collision before the table is 6% full.

A. $.25$ B. $.20$ C. $.35$ D. $.30$

ugcnetcse-dec2011-paper2 data-structures hashing

Answer key☟

11.13.23 Hashing: UGC NET CSE | December 2012 | Part 2 | Question: 26

A hash function f defined as $f(key) = key \mod 13$, with linear probing is used to insert keys 55, 58, 68, 91, 27, 145. What will be the location of 79?

A. 1 B. 2 C. 3 D. 4

ugcnetcse-dec2012-paper2 data-structures hashing

Answer key☟

11.13.24 Hashing: UGC NET CSE | December 2015 | Part 2 | Question: 35

The hash function used in double hashing is of the form:

A. $h(k,i) = (h_1(k) + h_2(k) + i) \, mod \, m$
B. $h(k,i) = (h_1(k) + h_2(k) - i) \, mod \, m$
C. $h(k,i) = (h_1(k) + i \, h_2(k)) \, mod \, m$
D. $h(k,i) = (h_1(k) - i \, h_2(k)) \, mod \, m$

ugcnetcse-dec2015-paper2 data-structures hashing

Answer key

11.13.25 Hashing: UGC NET CSE | July 2018 | Part 2 | Question: 23

A hash function h defined h(key)=key mod 7, with linear probing, is used to insert the keys 44, 45, 79, 55, 91, 18, 63 into a table indexed from 0 to 6. What will be the location of key 18?

A. 3
B. 4
C. 5
D. 6

ugcnetcse-july2018-paper2 data-structures hashing

Answer key

11.13.26 Hashing: UGC NET CSE | July 2018 | Part 2 | Question: 70

Consider a hash table of sze seven, with starting index zero, and a hash function (7x+3) mod 4. Assuming that the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 3, 8, 10 is inserted into the table using closed hashing? Here "____" denotes an empty location in the table.

A. 3, 10, 1, 8, ___ , _____ , _____
B. 1, 3, 8, 10, ___, ___, ___
C. 1, ___, 3, ___, 8, ___, 10
D. 3, 10, ___, _____, 8, ___, ___

ugcnetcse-july2018-paper2 data-structures hashing

Answer key

11.13.27 Hashing: UGC NET CSE | June 2010 | Part 2 | Question: 24

A chained hash table has an array size of 100. What is the maximum number of entries that can be placed in the table ?

A. 100
B. 200
C. 10000
D. There is no upper limit

ugcnetcse-june2010-paper2 data-structures hashing

Answer key

11.13.28 Hashing: UGC NET CSE | June 2011 | Part 2 | Question: 24

Consider a hash table of size $m = 10000$ and the hash function $h(k) = \lfloor m(KA \bmod 1)' \rfloor$ for $A = \frac{(\sqrt{5}-1}{2}$. The location to the key $k = 123456$ is

A. 46
B. 47
C. 41
D. 43

ugcnetcse-june2011-paper2 data-structures hashing

Answer key

11.13.29 Hashing: UGC NET CSE | June 2014 | Part 2 | Question: 38

Searching for an element in the hash table requires $O(1)$ time for the _________time, whereas for direct addressing it holds for the _______ time.

A. worst-case, average
B. worst-case, worst-case
C. average, worst-case
D. best, average

ugcnetcse-june2014-paper2 hashing data-structures

Answer key

11.13.30 Hashing: UGC NET CSE | June 2014 | Part 3 | Question: 64

If h is chosen from a universal collection of hash functions and is used to hash n keys into a table of size m, where $n \leq m$, the expected number of collisions involving a particular key K is

A. Less than 1
B. Less than lgn
C. Greater than 1
D. Greater than lgn

ugcnetjune2014iii data-structures hashing

Answer key

11.13.31 Hashing: UGC NET CSE | June 2023 | Part 2: 9

Consider a hash table of size seven with starting index zero and a hash function $(6x+3) \bmod 4$. Assuming the hash table is initially empty. Which of the following is the content of the table when the sequence $1,3,8,10,5$, is inserted into the table using closed hashing? Here '' denotes an empty location in the table.

A. $1,3,8,10,5,\_,\_$
B. $3,8,1,\_,10,5$
C. $\_,3,8,1,\_,10,5$
D. $\_1,3,8,10,5,\_$

ugcnetcse-june2023-paper2 data-structures hashing

Answer key

11.13.32 Hashing: UGC NET CSE | Junet 2015 | Part 3 | Question: 34

Consider a hash table of size m=100 and the hash function h(k)=floor (m(kA mod 1)) for $A=\frac{(\sqrt{5}-1)}{2}=0.618033$. Compute the location to which the key k=123456 is placed in hash table

A. 77
B. 82
C. 88
D. 89

ugcnetcse-june2015-paper3 data-structures hashing

Answer key

11.13.33 Hashing: UGC NET CSE | October 2022 | Part 1 | Question: 12

Consider the hash table of size 11 that uses open addressing with linear probing. Let $h(k)=k \bmod 11$ be the hash function. A sequence of records with keys $43,36,92,87.11.47.11,13,14$ is inserted into an initially empty hash table, the bins of which are indexed from 0 to 10. What is the index of the bin into which the last record is inserted?

A. 8
B. 7
C. 10
D. 4

ugcnetcse-oct2022-paper1 hashing data-structures

Answer key

11.14 Infix Prefix (7)

11.14.1 Infix Prefix: GATE CSE 1989 | Question: 4-ii

Compute the postfix equivalent of the following infix arithmetic expression

$$a+b*c+d*e\uparrow f$$

where $\uparrow$ represents exponentiation. Assume normal operator precedences.

gate1989 descriptive data-structures stack infix-prefix

Answer key

11.14.2 Infix Prefix: GATE CSE 1997 | Question: 1.7

Which of the following is essential for converting an infix expression to the postfix form efficiently?

A. An operator stack
B. An operand stack
C. An operand stack and an operator stack
D. A parse tree

gate1997 normal infix-prefix stack data-structures

Answer key

11.14.3 Infix Prefix: GATE CSE 1998 | Question: 19b

Compute the post fix equivalent of the following expression $3^{*}\log(x+1)-\frac{a}{2}$

gate1998 stack infix-prefix descriptive

Answer key

11.14.4 Infix Prefix: GATE CSE 2004 | Question: 38, ISRO2009-27

Assume that the operators $+, -, \times$ are left associative and $\hat{}$ is right associative. The order of precedence (from highest to lowest) is $\hat{}, \times, +, -$. The postfix expression corresponding to the infix expression $a+b\times c-d\ \hat{}\ e\ \hat{}\ f$ is

A. $abc\times+def\ \hat{}\ \ \hat{}-$
B. $abc\times+de\ \hat{}\ f\ \hat{}\ -$
C. $ab+c\times d-e\ \hat{}\ f\ \hat{}$
D. $-+a\times bc\ \hat{}\ \ \hat{}\ def$

gatecse-2004 stack isro2009 infix-prefix

Answer key

11.14.5 Infix Prefix: GATE CSE 2007 | Question: 38, ISRO2016-27

The following postfix expression with single digit operands is evaluated using a stack:

$$8\,2\,3\ \hat{}\ /\ 2\,3*+5\,1*-$$

Note that $\hat{}$ is the exponentiation operator. The top two elements of the stack after the first $*$ is evaluated are

A. $6,1$
B. $5,7$
C. $3,2$
D. $1,5$

gatecse-2007 data-structures stack normal infix-prefix isro2016

Answer key

11.14.6 Infix Prefix: UGC NET CSE | August 2016 | Part 2 | Question: 25

Given the following prefix expression :

* $+3+3\uparrow 3+333$

What is the value of the prefix expression ?

A. 2178
B. 2199
C. 2205
D. 2232

ugcnetcse-aug2016-paper2 data-structures infix-prefix

Answer key

11.14.7 Infix Prefix: UGC NET CSE | June 2012 | Part 2 | Question: 1

The postfix expression AB + CD -* can be evaluated using a

A. stack
B. tree
C. queue
D. linked list

ugcnetcse-june2012-paper2 data-structures stack infix-prefix

Answer key

11.15 Insertion (1)

11.15.1 Insertion: UGC NET CSE | June 2023 | Part 2: 60

A B-tree used as an index for a large database table has four levels including the root node. If a new key is inserted in this index, then maximum number of nodes that could be newly created in the process is

A. 5
B. 4
C. 3
D. 2

ugcnetcse-june2023-paper2 b-tree insertion

11.16 Linear Probing (1)

11.16.1 Linear Probing: UGC NET CSE | December 2005 | Part 2 | Question: 22

A hash function f defined as $f(\text{key}) = \text{key} \bmod 7$, with linear probing it is used to insert the key $37, 38, 72, 48, 98, 11, 56$ into a table index from 0 to 6. What will be the locations of 11:

A. 3
B. 4
C. 5
D. 6

ugcnetcse-dec2005-paper2 data-structures hashing linear-probing

Answer key☟

11.17 Linked List (30)

11.17.1 Linked List: GATE CSE 1987 | Question: 1-xv

In a circular linked list organization, insertion of a record involves modification of

A. One pointer.
B. Two pointers.
C. Multiple pointers.
D. No pointer.

gate1987 data-structures linked-list

Answer key☟

11.17.2 Linked List: GATE CSE 1987 | Question: 6a

A list of n elements is commonly written as a sequence of n elements enclosed in a pair of square brackets. For example. $[10, 20, 30]$ is a list of three elements and $[]$ is a nil list. Five functions are defined below:

- $car(l)$ returns the first element of its argument list l;
- $cdr(l)$ returns the list obtained by removing the first element of the argument list l;
- $glue(a, l)$ returns a list m such that $car(m) = a$ and $cdr(m) = l$.
- $f(x, y) \equiv$ if $x = []$ then y
  else $glue(car(x), f(cdr(x), y))$;
- $g(x) \equiv$ if $x = []$ then $[]$
  else $f(g(cdr(x)), glue(car(x), []))$

What do the following compute?

a. $f([32, 16, 8], [9, 11, 12])$
b. $g([5, 1, 8, 9])$

gate1987 data-structures linked-list descriptive

Answer key☟

11.17.3 Linked List: GATE CSE 1989 | Question: 4-xi

Express the following list in terms of a linked list structure suitable for internal representation.

$(((ab)c)d((e)))$

gate1989 descriptive data-structures linked-list unsolved

Answer key☟

11.17.4 Linked List: GATE CSE 1993 | Question: 13

Consider a singly linked list having n nodes. The data items $d_1, d_2, \dots d_n$ are stored in these n nodes. Let X be a pointer to the j^{th} node $(1 \leq j \leq n)$ in which d_j is stored. A new data item d stored in node with address Y is to be inserted. Give an algorithm to insert d into the list to obtain a list having items $d_1, d_2, \dots, d_j, d, \dots, d_n$ in order without using the header.

gate1993 data-structures linked-list normal descriptive

Answer key☟

11.17.5 Linked List: GATE CSE 1994 | Question: 1.17, UGCNET-Sep2013-II: 32

Linked lists are not suitable data structures for which one of the following problems?

A. Insertion sort
B. Binary search
C. Radix sort
D. Polynomial manipulation

gate1994 data-structures linked-list normal ugcnetsep2013ii

Answer key

11.17.6 Linked List: GATE CSE 1995 | Question: 2.22

Which of the following statements is true?

I. As the number of entries in a hash table increases, the number of collisions increases.
II. Recursive programs are efficient
III. The worst case complexity for Quicksort is $O(n^2)$
IV. Binary search using a linear linked list is efficient

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

gate1995 data-structures linked-list hashing

Answer key

11.17.7 Linked List: GATE CSE 1997 | Question: 1.4

The concatenation of two lists is to be performed on $O(1)$ time. Which of the following implementations of a list should be used?

A. Singly linked list
B. Doubly linked list
C. Circular doubly linked list
D. Array implementation of list

gate1997 data-structures linked-list easy

Answer key

11.17.8 Linked List: GATE CSE 1997 | Question: 18

Consider the following piece of 'C' code fragment that removes duplicates from an ordered list of integers.

```
Node *remove-duplicates (Node* head, int *j)
{
  Node *t1, *t2; *j=0;
  t1 = head;
  if (t1! = NULL)
    t2 = t1 ->next;
  else return head;
  *j = 1;
  if(t2 == NULL) return head;
  while (t2 != NULL)
  {
    if (t1.val != t2.val) ----------------> (S1)
    {
      (*j)++;
      t1 -> next = t2;
      t1 = t2; -----> (S2)
    }
      t2 = t2 ->next;
  }
  t1 -> next = NULL;
  return head;
}
```

Assume the list contains n elements $(n \geq 2)$ in the following questions.

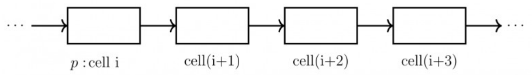
a. How many times is the comparison in statement $S1$ made?
b. What is the minimum and the maximum number of times statements marked $S2$ get executed?
c. What is the significance of the value in the integer pointed to by j when the function completes?

gate1997 data-structures linked-list normal descriptive

Answer key

11.17.9 Linked List: GATE CSE 1998 | Question: 19a

Let p be a pointer as shown in the figure in a single linked list.



What do the following assignment statements achieve?

```
q:= p -> next
p -> next:= q -> next
q -> next:=(q -> next) -> next
(p -> next) -> next:= q
```

gate1998 data-structures linked-list normal descriptive

Answer key

11.17.10 Linked List: GATE CSE 1999 | Question: 11b

Write a constant time algorithm to insert a node with data D just before the node with address p of a singly linked list.

gate1999 data-structures linked-list descriptive

Answer key

11.17.11 Linked List: GATE CSE 2002 | Question: 1.5

In the worst case, the number of comparisons needed to search a single linked list of length n for a given element is

A. $\log n$
B. $\frac{n}{2}$
C. $\log_2 n - 1$
D. n

gatecse-2002 easy data-structures linked-list

Answer key

11.17.12 Linked List: GATE CSE 2003 | Question: 90

Consider the function f defined below.

```
struct item {
      int data;
      struct item * next;
};
int f(struct item *p) {
   return ((p == NULL) || (p->next == NULL)||
      ((p->data <= p ->next -> data) &&
      f(p->next)));
}
```

For a given linked list p, the function f returns 1 if and only if

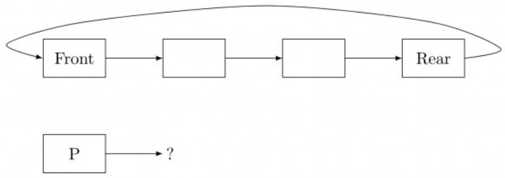
A. the list is empty or has exactly one element
B. the elements in the list are sorted in non-decreasing order of data value
C. the elements in the list are sorted in non-increasing order of data value
D. not all elements in the list have the same data value

gatecse-2003 data-structures linked-list normal

Answer key

11.17.13 Linked List: GATE CSE 2004 | Question: 36

A circularly linked list is used to represent a Queue. A single variable p is used to access the Queue. To which node should p point such that both the operations enQueue and deQueue can be performed in constant time?



A. rear node
B. front node
C. not possible with a single pointer
D. node next to front

gatecse-2004 data-structures linked-list normal

Answer key

11.17.14 Linked List: GATE CSE 2004 | Question: 40

Suppose each set is represented as a linked list with elements in arbitrary order. Which of the operations among $\text{union, intersection, membership, cardinality}$ will be the slowest?

A. union only
B. $\text{intersection, membership}$
C. $\text{membership, cardinality}$
D. $\text{union, intersection}$

gatecse-2004 data-structures linked-list normal

Answer key

11.17.15 Linked List: GATE CSE 2008 | Question: 62

The following C function takes a single-linked list of integers as a parameter and rearranges the elements of the list. The function is called with the list containing the integers $1, 2, 3, 4, 5, 6, 7$ in the given order. What will be the contents of the list after function completes execution?

```
struct node {
   int value;
   struct node *next;
};

void rearrange(struct node *list) {
   struct node *p, *q;
   int temp;
   if (!list || !list -> next) return;
   p = list; q = list -> next;
   while(q) {
      temp = p -> value; p->value =  q -> value;
      q->value = temp; p = q ->next;
      q = p? p ->next : 0;
   }
}
```

A. $1,2,3,4,5,6,7$
B. $2,1,4,3,6,5,7$
C. $1,3,2,5,4,7,6$
D. $2,3,4,5,6,7,1$

gatecse-2008 data-structures linked-list normal

Answer key

11.17.16 Linked List: GATE CSE 2010 | Question: 36

The following C function takes a singly-linked list as input argument. It modifies the list by moving the last element to the front of the list and returns the modified list. Some part of the code is left blank.

```
typedef struct node
{
   int value;
   struct node *next;
} Node;
Node *move_to-front(Node *head)
{
   Node *p, *q;
   if ((head == NULL) || (head -> next == NULL))
      return head;
   q = NULL;
   p = head;
```

```
    while (p->next != NULL)
    {
        q=p;
        p=p->next;
    }
    ______________

    return head;

}
```

Choose the correct alternative to replace the blank line.

A. q=NULL; $\mathrm{p} \rightarrow \mathrm{next} = \mathrm{head}; \mathrm{head} = \mathrm{p};$
B. $\mathrm{q} \rightarrow \mathrm{next} = \mathrm{NULL}; \mathrm{head} = \mathrm{p}; \mathrm{p} \rightarrow \mathrm{next} = \mathrm{head};$
C. $\mathrm{head} = \mathrm{p}; \mathrm{p} \rightarrow \mathrm{next} = \mathrm{q}; \mathrm{q} \rightarrow \mathrm{next} = \mathrm{NULL};$
D. $\mathrm{q} \rightarrow \mathrm{next} = \mathrm{NULL}; \mathrm{p} \rightarrow \mathrm{next} = \mathrm{head}; \mathrm{head} = \mathrm{p};$

gatecse-2010 data-structures linked-list normal

Answer key☟

11.17.17 Linked List: GATE CSE 2016 Set 2 | Question: 15

N items are stored in a sorted doubly linked list. For a *delete* operation, a pointer is provided to the record to be deleted. For a *decrease-key* operation, a pointer is provided to the record on which the operation is to be performed.

An algorithm performs the following operations on the list in this order: $\Theta(N)$ *delete*, $O(\log N)$ *insert*, $O(\log N)$ *find*, and $\Theta(N)$ *decrease-key*. What is the time complexity of all these operations put together?

A. $O(\log^2 N)$ B. $O(N)$ C. $O(N^2)$ D. $\Theta(N^2 \log N)$

gatecse-2016-set2 data-structures linked-list time-complexity normal algorithms

Answer key☟

11.17.18 Linked List: GATE CSE 2017 Set 1 | Question: 08

Consider the C code fragment given below.

```
typedef struct node {
    int data;
    node* next;
} node;

void join(node* m, node* n) {
    node* p = n;
    while(p->next != NULL) {
        p = p->next;
    }
    p->next = m;
}
```

Assuming that m and n point to valid NULL-terminated linked lists, invocation of join will

A. append list m to the end of list n for all inputs.
B. either cause a null pointer dereference or append list m to the end of list n.
C. cause a null pointer dereference for all inputs.
D. append list n to the end of list m for all inputs.

gatecse-2017-set1 data-structures linked-list normal

Answer key☟

11.17.19 Linked List: GATE CSE 2020 | Question: 16

What is the worst case time complexity of inserting n elements into an empty linked list, if the linked list needs to be maintained in sorted order?

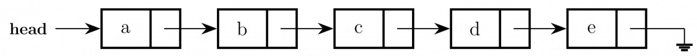
A. $\Theta(n)$ B. $\Theta(n \log n)$ C. $\Theta(n)^2$ D. $\Theta(1)$

gatecse-2020 linked-list one-mark

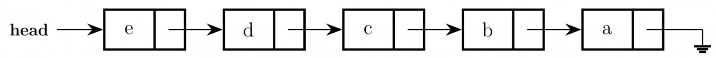
Answer key

11.17.20 Linked List: GATE CSE 2022 | Question: 5

Consider the problem of reversing a singly linked list. To take an example, given the linked list below,



the reversed linked list should look like



Which one of the following statements is TRUE about the time complexity of algorithms that solve the above problem in $O(1)$ space?

A. The best algorithm for the problem takes $\theta(n)$ time in the worst case.
B. The best algorithm for the problem takes $\theta(n \log n)$ time in the worst case.
C. The best algorithm for the problem takes $\theta(n^2)$ time in the worst case.
D. It is not possible to reverse a singly linked list in $O(1)$ space.

gatecse-2022 data-structures linked-list one-mark

Answer key

11.17.21 Linked List: GATE CSE 2023 | Question: 3

Let SLLdel be a function that deletes a node in a singly-linked list given a pointer to the node and a pointer to the head of the list. Similarly, let DLLdel be another function that deletes a node in a doubly-linked list given a pointer to the node and a pointer to the head of the list.
Let n denote the number of nodes in each of the linked lists. Which one of the following choices is TRUE about the worst-case time complexity of SLLdel and DLLdel?

A. SLLdel is $O(1)$ and DLLdel is $O(n)$
B. Both SLLdel and DLLdel are $O(\log(n))$
C. Both SLLdel and DLLdel are $O(1)$
D. SLLdel is $O(n)$ and DLLdel is $O(1)$

gatecse-2023 data-structures linked-list one-mark

Answer key

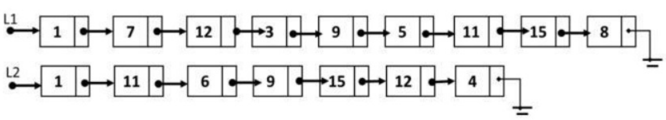
11.17.22 Linked List: GATE CSE 2025 | Set 1 | Question: 52

Let LIST be a datatype for an implementation of linked list defined as follows:

```
typedef struct list {
int data;
struct list *next;
} LIST;
```

Suppose a program has created two linked lists, $L1$ and $L2$, whose contents are given in the figure below (code for creating $L1$ and $L2$ is not provided here). $L1$ contains 9 nodes, and $L2$ contains 7 nodes.

Consider the following C program segment that modifies the list $L1$. The number of nodes that will be there in $L1$ after the execution of the code segment is __________. (Answer in integer)




```
int find (int query, LIST *list) {
while (list != NULL) {
if(list->data == query) return 1 ;
list = list->next;
}
```

```
return 0 ;
}
int main (){
... ... ...
ptr1=L1; ptr2=L2;
while (ptrl->next != NULL){
query = ptr1->next->data;
if (find (query, L2))
ptr1->next = ptr1->next->next;
else ptr1 = ptr1->next;
}
... .... ...
return 0;
}
```

gatecse2025-set1   data-structures   linked-list   numerical-answers   two-marks

Answer key

11.17.23 Linked List: GATE IT 2004 | Question: 13

Let P be a singly linked list. Let Q be the pointer to an intermediate node x in the list. What is the worst-case time complexity of the best-known algorithm to delete the node x from the list ?

A. $O(n)$
B. $O(\log^2 n)$
C. $O(\log n)$
D. $O(1)$

gateit-2004   data-structures   linked-list   normal   ambiguous

Answer key

11.17.24 Linked List: GATE IT 2005 | Question: 54

The following C function takes a singly-linked list of integers as a parameter and rearranges the elements of the list. The list is represented as pointer to a structure. The function is called with the list containing the integers $1, 2, 3, 4, 5, 6, 7$ in the given order. What will be the contents of the list after the function completes execution?

```
struct node {int value; struct node *next;);
void rearrange (struct node *list) {
   struct node *p, *q;
   int temp;
   if (!list || !list -> next) return;
   p = list; q = list -> next;
   while (q) {
      temp = p -> value;
      p -> value = q -> value;
      q -> value = temp;
      p = q -> next;
      q = p ? p -> next : 0;
    }
}
```

A. $1, 2, 3, 4, 5, 6, 7$
B. $2, 1, 4, 3, 6, 5, 7$
C. $1, 3, 2, 5, 4, 7, 6$
D. $2, 3, 4, 5, 6, 7, 1$

gateit-2005   data-structures   linked-list   normal

Answer key

11.17.25 Linked List: UGC NET CSE | August 2016 | Part 2 | Question: 21

Consider an implementation of unsorted single linked list. Suppose it has its representation with a head and a tail pointer (i.e. pointers to the first and last nodes of the linked list). Given the representation, which of the following operation can not be implemented in $O(1)$ time ?

A. Insertion at the front of the linked list.
B. Insertion at the end of the linked list.
C. Deletion of the front node of the linked list.
D. Deletion of the last node of the linked list.

ugcnetcse-aug2016-paper2   data-structures   linked-list

Answer key

11.17.26 Linked List: UGC NET CSE | December 2004 | Part 2 | Question: 24

What operation is supported in constant time by the doubly linked list, but not by the singly linked list ?

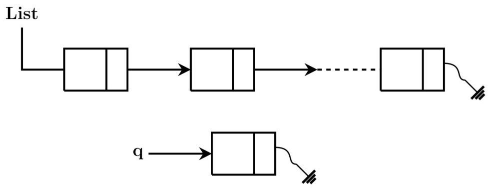
A. Advance B. Backup C. First D. Retrieve

ugcnetcse-dec2004-paper2 data-structures linked-list

Answer key

11.17.27 Linked List: UGC NET CSE | December 2007 | Part 2 | Question: 12

Consider the following linked list :



Which of the following piece of code will insert the node pointed to by q at the end of the list ?

A.
$\text{for (p=list; p !=NULL; p=p} \to \text{next);}$
$p = q;$

B.
$\text{for (p=list; p !=NULL; p=p} \to \text{next);}$
$\text{p} \to \text{next=q;}$

C.
$\text{for (p=list; p} \to \text{next !=NULL; p=p} \to \text{next);}$
$p = q;$

D.
$\text{for (p=list; p} \to \text{next !=NULL; p=p} \to \text{next);}$
$p \to next = q;$

ugcnetcse-dec2007-paper2 data-structures linked-list

Answer key

11.17.28 Linked List: UGC NET CSE | December 2009 | Part 2 | Question: 24

With regard to linked list, which of the following statement is false ?

(A) An algorithm to search for an element in a singly linked list requires 0(n) operations in the worst case.
(B) An algorithm for deleting the first element in a singly linked list requires 0(n) operations in the worst case.
(C) An algorithm for finding the maximum value in a circular linked list requires 0(n) operations.
(D) An algorithm for deleting the middle node of a circular linked list requires 0(n) operations.

ugcnetcse-dec2009-paper2 data-structures linked-list time-complexity

Answer key

11.17.29 Linked List: UGC NET CSE | December 2018 | Part 2 | Question: 29

Consider a singly linked list. What is the worst case time complexity of the best-known algorithm to delete the node a, pointer to this node is q, from the list?

A. $O(n \lg n)$ B. $O(n)$ C. $O(\lg n)$ D. $O(1)$

ugcnetcse-dec2018-paper2 data-structures linked-list time-complexity

Answer key

11.17.30 Linked List: UGC NET CSE | June 2023 | Part 2: 35

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: It is possible to create doubly linked list using only one pointer with every node.

Reason R: By storing the XOR of the addresses of the previous and next nodes.

In the light of the above statements, choose the most appropriate answer from the options given below.

A. Both A and R are true and R is the correct explanation of A
B. Both A and R are true but R is NOT the correct explanation of A
C. A is true but R is false
D. A is false but R is true

ugcnetcse-june2023-paper2 linked-list data-structures

Answer key

11.18 Max Heap (1)

11.18.1 Max Heap: UGC NET CSE | July 2016 | Part 3 | Question: 33

Which one of the following array represents a binary max-heap?

A. [26, 13, 17, 14, 11, 9, 15]
B. [26, 15, 14, 17, 11, 9, 13]
C. [26, 15, 17, 14, 11, 9, 13]
D. [26, 15, 13, 14, 11, 9, 17]

ugcnetcse-july2016-paper3 data-structures max-heap

Answer key

11.19 Minimum Spanning Tree (2)

11.19.1 Minimum Spanning Tree: UGC NET CSE | August 2016 | Part 3 | Question: 33

Consider a weighted complete graph G on the vertex set $\{\nu_1, \nu_2, \ldots . \nu_n\}$ such that the weight of the edge (ν_i, ν_j) is $4|i - j|$. The weight of minimum cost spanning tree of G is :

A. $4n^2$
B. n
C. $4n - 4$
D. $2n - 2$

ugcnetcse-aug2016-paper3 data-structures minimum-spanning-tree

Answer key

11.19.2 Minimum Spanning Tree: UGC NET CSE | December 2008 | Part 2 | Question: 3

The total number of spanning trees that can be drawn using five labeled vertices is:

1. 125
2. 64
3. 36
4. 16

ugcnetcse-dec2008-paper2 data-structures minimum-spanning-tree

Answer key

11.20 Number of Swap (1)

11.20.1 Number of Swap: GATE CSE 2025 | Set 1 | Question: 23

The pseudocode of a function $\mathrm{fun}\,()$ is given below:

```
fun(int A[0,....,n-1]) {
for i=0 to n-2
for j=0 to n-i-2
```

```
if (A[j]>A[j+1])
then swap A[j] and A[j+1]
}
```

Let $A[0, \ldots, 29]$ be an array storing 30 distinct integers in descending order. The number of swap operations that will be performed, if the function $\text{fun}\ ()$ is called with $A[0, \ldots, 29]$ as argument, is ________. (Answer in integer)

gatecse2025-set1 data-structures array number-of-swap numerical-answers one-mark

Answer key

11.21 Priority Queue (4)

11.21.1 Priority Queue: GATE CSE 1997 | Question: 4.7

A priority queue Q is used to implement a stack that stores characters. PUSH (C) is implemented as INSERT (Q, C, K) where K is an appropriate integer key chosen by the implementation. POP is implemented as DELETEMIN(Q). For a sequence of operations, the keys chosen are in

A. non-increasing order
B. non-decreasing order
C. strictly increasing order
D. strictly decreasing order

gate1997 data-structures stack normal priority-queue

Answer key

11.21.2 Priority Queue: GATE CSE 2023 | Question: 36

Let A be a priority queue for maintaining a set of elements. Suppose A is implemented using a max-heap data structure. The operation $\text{EXTRACT-MAX}(A)$ extracts and deletes the maximum element from A. The operation $\text{INSERT}(A, key)$ inserts a new element key in A. The properties of a max-heap are preserved at the end of each of these operations.

When A contains n elements, which one of the following statements about the worst case running time of these two operations is TRUE?

A. Both $\text{EXTRACT-MAX}(A)$ and $\text{INSERT}(A, key)$ run in $O(1)$.
B. Both $\text{EXTRACT-MAX}(A)$ and $\text{INSERT}(A, key)$ run in $O(\log(n))$.
C. $\text{EXTRACT-MAX}(A)$ runs in $O(1)$ whereas $\text{INSERT}(A, key)$ runs in $O(n)$.
D. $\text{EXTRACT-MAX}(A)$ runs in $O(1)$ whereas $\text{INSERT}(A, key)$ runs in $O(\log(n))$.

gatecse-2023 data-structures priority-queue time-complexity binary-heap two-marks

Answer key

11.21.3 Priority Queue: UGC NET CSE | August 2016 | Part 3 | Question: 34

A priority queue is implemented as a max-heap. Initially, it has five elements. The levelorder traversal of the heap is as follows :

20, 18, 15, 13, 12

Two new elements ‘10’ and ‘17’ are inserted in the heap in that order. The level-order traversal of the heap after the insertion of the element is :

A. 20, 18, 17, 15, 13, 12, 10
B. 20, 18, 17, 12, 13, 10, 15
C. 20, 18, 17, 10, 12, 13, 15
D. 20, 18, 17, 13, 12, 10, 15

ugcnetcse-aug2016-paper3 data-structures priority-queue

Answer key

11.21.4 Priority Queue: UGC NET CSE | June 2010 | Part 2 | Question: 22

What is the most appropriate data structure to implement a priority queue ?

A. Heap
B. Circular array
C. Linked list
D. Binary tree

ugcnetcse-june2010-paper2 data-structures priority-queue

Answer key

11.22 Queue (23)

11.22.1 Queue: GATE CSE 1992 | Question: 09

Suggest a data structure for representing a subset S of integers from 1 to n. Following operations on the set S are to be performed in constant time (independent of cardinality of S).

$$\begin{array}{lll} \text{i.} & \text{MEMBER } (X): & \text{Check whether } X \text{ is in the set } S \text{ or not} \\ \text{ii.} & \text{FIND-ONE } (S): & \text{If } S \text{ is not empty, return one element of the set } S \\ & & \quad \text{(any arbitrary element will do)} \\ \text{iii.} & \text{ADD } (X): & \text{Add integer } X \text{ to set } S \\ \text{ii.} & \text{DELETE } (X): & \text{Delete integer } X \text{ from } S \end{array}$$

Give pictorial examples of your data structure. Give routines for these operations in an English like language. You may assume that the data structure has been suitable initialized. Clearly state your assumptions regarding initialization.

gate1992 data-structures normal descriptive queue

Answer key

11.22.2 Queue: GATE CSE 1994 | Question: 26

A queue Q containing n items and an empty stack S are given. It is required to transfer all the items from the queue to the stack, so that the item at the front of queue is on the TOP of the stack, and the order of all other items are preserved. Show how this can be done in $O(n)$ time using only a constant amount of additional storage. Note that the only operations which can be performed on the queue and stack are Delete, Insert, Push and Pop. Do not assume any implementation of the queue or stack.

gate1994 data-structures queue stack normal descriptive

Answer key

11.22.3 Queue: GATE CSE 1996 | Question: 1.12

Consider the following statements:

i. First-in-first out types of computations are efficiently supported by STACKS.
ii. Implementing LISTS on linked lists is more efficient than implementing LISTS on an array for almost all the basic LIST operations.
iii. Implementing QUEUES on a circular array is more efficient than implementing QUEUES on a linear array with two indices.
iv. Last-in-first-out type of computations are efficiently supported by QUEUES.

A. (ii) and (iii) are true
B. (i) and (ii) are true
C. (iii) and (iv) are true
D. (ii) and (iv) are true

gate1996 data-structures easy queue stack linked-list

Answer key

11.22.4 Queue: GATE CSE 2001 | Question: 2.16

What is the minimum number of stacks of size n required to implement a queue of size n?

A. One
B. Two
C. Three
D. Four

gatecse-2001 data-structures easy stack queue

Answer key

11.22.5 Queue: GATE CSE 2006 | Question: 49

An implementation of a queue Q, using two stacks $S1$ and $S2$, is given below:

```
void insert (Q, x) {
   push (S1, x);
}
void delete (Q) {
   if (stack-empty(S2)) then
      if (stack-empty(S1)) then {
         print("Q is empty");
         return;
      }
      else while (!(stack-empty(S1))){
         x=pop(S1);
         push(S2,x);
      }
   x=pop(S2);
}
```

Let n *insert* and $m(\leq n)$ *delete* operations be performed in an arbitrary order on an empty queue Q. Let x and y be the number of *push* and *pop* operations performed respectively in the process. Which one of the following is true for all m and n?

A. $n+m \leq x < 2n$ and $2m \leq y \leq n+m$
B. $n+m \leq x < 2n$ and $2m \leq y \leq 2n$
C. $2m \leq x < 2n$ and $2m \leq y \leq n+m$
D. $2m \leq x < 2n$ and $2m \leq y \leq 2n$

gatecse-2006 data-structures queue stack normal

Answer key

11.22.6 Queue: GATE CSE 2012 | Question: 35

Suppose a circular queue of capacity $(n-1)$ elements is implemented with an array of n elements. Assume that the insertion and deletion operations are carried out using REAR and FRONT as array index variables, respectively. Initially, REAR $=$ FRONT $=0$. The conditions to detect queue full and queue empty are:

A. $\text{full}: (\text{REAR}+1) \mod n == \text{FRONT}$
$\text{empty}: \text{REAR} == \text{FRONT}$
B. $\text{full}: (\text{REAR}+1) \mod n == \text{FRONT}$
$\text{empty}: (\text{FRONT}+1) \mod n == \text{REAR}$
C. $\text{full}: \text{REAR} == \text{FRONT}$
$\text{empty}: (\text{REAR}+1) \mod n == \text{FRONT}$
D. $\text{full}: (\text{FRONT}+1) \mod n == \text{REAR}$
$\text{empty}: \text{REAR} == \text{FRONT}$

gatecse-2012 data-structures queue normal

Answer key

11.22.7 Queue: GATE CSE 2013 | Question: 44

Consider the following operation along with Enqueue and Dequeue operations on queues, where k is a global parameter.

```
MultiDequeue(Q){
   m = k
   while (Q is not empty) and (m > 0) {
      Dequeue(Q)
      m = m - 1
   }
}
```

What is the worst case time complexity of a sequence of n queue operations on an initially empty queue?

A. $\Theta(n)$ B. $\Theta(n+k)$ C. $\Theta(nk)$ D. $\Theta(n^2)$

gatecse-2013 data-structures algorithms normal queue

Answer key

11.22.8 Queue: GATE CSE 2016 Set 1 | Question: 10

A queue is implemented using an array such that ENQUEUE and DEQUEUE operations are performed efficiently. Which one of the following statements is **CORRECT** (n refers to the number of items in the queue) ?

A. Both operations can be performed in $O(1)$ time.
B. At most one operation can be performed in $O(1)$ time but the worst case time for the operation will be $\Omega(n)$.
C. The worst case time complexity for both operations will be $\Omega(n)$.
D. Worst case time complexity for both operations will be $\Omega(\log n)$

gatecse-2016-set1 data-structures queue normal

Answer key☟

11.22.9 Queue: GATE CSE 2016 Set 1 | Question: 41

Let Q denote a queue containing sixteen numbers and S be an empty stack. $Head(Q)$ returns the element at the head of the queue Q without removing it from Q. Similarly $Top(S)$ returns the element at the top of S without removing it from S. Consider the algorithm given below.

```
while Q is not Empty do
  if S is Empty OR Top(S) ≤ Head (Q) then
     x:= Dequeue (Q);
     Push (S, x);
  else
     x:= Pop(S);
     Enqueue (Q, x);
  end
end
```

The maximum possible number of iterations of the **while** loop in the algorithm is _______.

gatecse-2016-set1 data-structures queue difficult numerical-answers

Answer key☟

11.22.10 Queue: GATE CSE 2017 Set 2 | Question: 13

A circular queue has been implemented using a singly linked list where each node consists of a value and a single pointer pointing to the next node. We maintain exactly two external pointers FRONT and REAR pointing to the front node and the rear node of the queue, respectively. Which of the following statements is/are CORRECT for such a circular queue, so that insertion and deletion operations can be performed in $O(1)$ time?

I. Next pointer of front node points to the rear node.
II. Next pointer of rear node points to the front node.

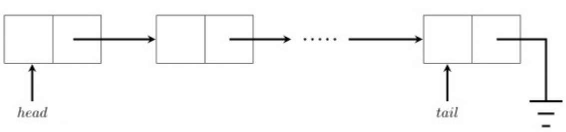
A. (I) only.
B. (II) only.
C. Both (I) and (II).
D. Neither (I) nor (II).

gatecse-2017-set2 data-structures queue

Answer key☟

11.22.11 Queue: GATE CSE 2018 | Question: 3

A queue is implemented using a non-circular singly linked list. The queue has a head pointer and a tail pointer, as shown in the figure. Let n denote the number of nodes in the queue. Let 'enqueue' be implemented by inserting a new node at the head, and 'dequeue' be implemented by deletion of a node from the tail.



Which one of the following is the time complexity of the most time-efficient implementation of 'enqueue' and 'dequeue, respectively, for this data structure?

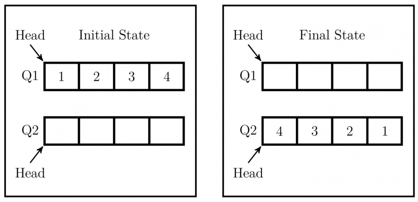
A. $\Theta(1), \Theta(1)$
B. $\Theta(1), \Theta(n)$
C. $\Theta(n), \Theta(1)$
D. $\Theta(n), \Theta(n)$

gatecse-2018 algorithms data-structures queue normal linked-list one-mark

Answer key☟

11.22.12 Queue: GATE CSE 2022 | Question: 52

Consider the queues Q_1 containing four elements and Q_2 containing none (shown as the **Initial State** in the figure). The only operations allowed on these two queues are **Enqueue (Q, element)** and **Dequeue (Q).** The minimum number of **Enqueue** operations on Q_1 required to place the elements of Q_1 in Q_2 in reverse order (shown as the **Final State** in the figure) without using any additional storage is________________.



gatecse-2022 numerical-answers data-structures queue two-marks

Answer key☟

11.22.13 Queue: GATE DS&AI 2024 | Question: 22

The fundamental operations in a double-ended queue D are:

insertFirst (e) - Insert a new element e at the beginning of D.

insertLast (e) - Insert a new element e at the end of D.

removeFirst () - Remove and return the first element of D.

removeLast () - Remove and return the last element of D.

In an empty double-ended queue, the following operations are performed:

insertFirst (10)
insertLast (32)
a ← removeFirst ()
insertLast (28)
insertLast (17)
a ← removeFirst ()
a ← removeLast ()

The value of $\mathbf{a}$ is _________.

gate-ds-ai-2024 numerical-answers data-structures queue one-mark

Answer key☟

11.22.14 Queue: GATE IT 2007 | Question: 30

Suppose you are given an implementation of a queue of integers. The operations that can be performed on the queue are:

i. isEmpty (Q) — returns true if the queue is empty, false otherwise.
ii. delete (Q) — deletes the element at the front of the queue and returns its value.
iii. insert (Q, i) — inserts the integer i at the rear of the queue.

Consider the following function:

```
void f (queue Q) {
```

```
int i ;
if (!isEmpty(Q)) {
  i = delete(Q);
  f(Q);
  insert(Q, i);
 }
}
```

What operation is performed by the above function f ?

A. Leaves the queue Q unchanged
B. Reverses the order of the elements in the queue Q
C. Deletes the element at the front of the queue Q and inserts it at the rear keeping the other elements in the same order
D. Empties the queue Q

gateit-2007 data-structures queue normal

Answer key

11.22.15 Queue: UGC NET CSE | August 2016 | Part 2 | Question: 24

Consider the following statements :

S_1 : A queue can be implemented using two stacks.

S_2 : A stack can be implemented using two queues.

Which of the following is correct ?

A. S_1 is correct and S_2 is not correct.
B. S_1 is not correct and S_2 is correct.
C. Both S_1 and S_2 are correct.
D. Both S_1 and S_2 are not correct.

ugcnetcse-aug2016-paper2 data-structures queue stack

Answer key

11.22.16 Queue: UGC NET CSE | December 2005 | Part 2 | Question: 24

The initial configuration of quaue is a, b, c, d. $'a'$ is at the front. To get the configuration d, c, b, a how many deletions and additions required:

A. 2 deletions, 3 additions
B. 3 deletions, 2 additions
C. 3 deletions, 4 additions
D. 3 deletions, 3 additions

ugcnetcse-dec2005-paper2 data-structures queue

Answer key

11.22.17 Queue: UGC NET CSE | December 2009 | Part 2 | Question: 23

At a hill station, the parking lot is one long drive way snaking up a hill side. Cars drive in and park right behind the car in front of them, one behind another. A car can't leave until all the cars in front of it have left. Is the parking lot more like

(A) An array

(B) A stack

(C) A queue

(D) A linked list

ugcnetcse-dec2009-paper2 data-structures queue

Answer key

11.22.18 Queue: UGC NET CSE | June 2006 | Part 2 | Question: 25

Application of data structure queue is :

A. Levelwise printing of tree
B. Implementation of priority queues
C. Function call implementation
D. Depth first search in a graph

ugcnetcse-june2006-paper2 data-structures queue

Answer key

11.22.19 Queue: UGC NET CSE | June 2007 | Part 2 | Question: 25

Application of data structure is queue is:

A. Level wise printing of tree.
B. Implementation of priority queues.
C. Function call implementation
D. Depth first search in a graph.

ugcnetcse-june2007-paper2 data-structures queue

Answer key

11.22.20 Queue: UGC NET CSE | June 2009 | Part 2 | Question: 26

Queue is a .... list .

A. $LIFO$
B. $LILO$
C. $FILO$
D. $FIFO$

ugcnetcse-june2009-paper2 data-structures queue easy

Answer key

11.22.21 Queue: UGC NET CSE | June 2011 | Part 2 | Question: 25

When the priority queue is represented by max heap, the insertion and deletion of an element can be performed in (queue containing n elements)

A. $\theta(n)$ and $\theta(1)$ respectively
B. $\theta(n)$ and $\theta(n)$ respectively
C. $\theta(1)$ and $\theta(1)$ respectively
D. None of the above

ugcnetcse-june2011-paper2 data-structures queue binary-heap

Answer key

11.22.22 Queue: UGC NET CSE | June 2023 | Part 2: 58

Suppose a circular queue of capacity $(\mathrm{n}-1)$ elements is implemented with an array of n elements. Assume that the insertion and deletion operations are carried out using REAR and FRONT as array index variable respectively. Initially,

$\mathrm{REAR}=\mathrm{FRONT}=0$. The conditions to detect queue empty and queue full are

1. EMPTY: REAR ==F R O N T
FULL : (REAR+1) $\bmod \mathrm{n}==$ FRONT

2. EMPTY: (FRONT +1) $\bmod \mathrm{n}==$ REAR
FULL: REAR+$1 \bmod \mathrm{n}==$FRONT

3. EMPTY REAR+$1)\ \mathrm{modn}$ ==FRONT
FULL: REAR $==$ FRONT

4. EMPTY: REAR== FRONT
FULL: (FRONT+1) $\bmod \mathrm{n}==$ REAR

ugcnetcse-june2023-paper2 data-structures queue

11.22.23 Queue: UGC NET CSE | September 2013 | Part 2 | Question: 12

The efficient data structure to insert/delete a number in a stored set of number is

A. Queue
B. Linked list
C. Doubly linked list
D. Binary tree

ugcnetsep2013ii data-structures queue linked-list

Answer key

11.23 Quick Sort (1)

11.23.1 Quick Sort: UGC NET CSE | September 2013 | Part 2 | Question: 10

Suppose that the splits at every level of Quicksort are in proportion $1 - \beta$ to β, where $0 < \beta \leq 0.5$ is a constant. The number of elements in an array is n. The maximum depth is approximately

A. 0.5 β lg n
B. 0.5 (1-β) lg n
C. -(lg n)/(lg β)
D. -(lg n)/lg (1-β)

ugcnetsep2013ii data-structures sorting algorithms quick-sort

Answer key☟

11.24 Radix Sort (2)

11.24.1 Radix Sort: UGC NET CSE | August 2016 | Part 3 | Question: 35

If there are n integers to sort, each integer has d digits, and each digit is in the set $\{1, 2, \ldots, k\}$, radix sort can sort the numbers in :

A. $O(k(n+d))$
B. $O(d(n+k))$
C. $O((n+k)lgd)$
D. $O((n+d)lgk)$

ugcnetcse-aug2016-paper3 data-structures radix-sort

Answer key☟

11.24.2 Radix Sort: UGC NET CSE | July 2018 | Part 2 | Question: 28

The maximum number of comparisons needed to sort 9 items using radix sort is (assume each item is 5 digit octal number):

A. 45
B. 72
C. 360
D. 450

ugcnetcse-july2018-paper2 data-structures radix-sort

Answer key☟

11.25 Recursion (3)

11.25.1 Recursion: UGC NET CSE | December 2006 | Part 2 | Question: 11

When a function is recursively called, all automatic variables :

A. are initialized during each execution of the function
B. are retained from the last execution
C. are maintained in a stack
D. are ignored

ugcnetcse-dec2006-paper2 recursion functions stack programming-in-c

Answer key☟

11.25.2 Recursion: UGC NET CSE | December 2007 | Part 2 | Question: 22

Which of the following data structure is used to implement recursion ?

A. Arrays
B. Stacks
C. Queues
D. Linked lists

ugcnetcse-dec2007-paper2 data-structures recursion

Answer key☟

11.25.3 Recursion: UGC NET CSE | January 2017 | Part 3 | Question: 24

A recursive function h, is defined as follows:

$$\begin{aligned} h(m) &= k, \text{if } m = 0 \\ &= 1, \text{if } m = 1 \\ &= 2h(m-1) + 4h(m-2), \text{if } m \geq 2 \end{aligned}$$

If the value of $h(4)$ is 88 then the value of k is:

A. 0
B. 1
C. 2
D. -1

ugcnetcse-jan2017-paper3 data-structures recursion

Answer key

11.26 Rooted Tree (1)

11.26.1 Rooted Tree: UGC NET CSE | December 2007 | Part 2 | Question: 21

Consider a rooted tree in which every node has at least three children. What is the minimum number of nodes at level i (i > 0) of the tree ? Assume that the root is at level 0:

A. 3^i
B. $3i$
C. 3
D. $3i+1$

ugcnetcse-dec2007-paper2 data-structures rooted-tree

Answer key

11.27 Stack (34)

11.27.1 Stack: GATE CSE 1991 | Question: 03,vii

The following sequence of operations is performed on a stack:

$PUSH(10), PUSH(20), POP, PUSH(10), PUSH(20), POP, POP, POP, PUSH(20), POP$

The sequence of values popped out is

A. $20, 10, 20, 10, 20$
B. $20, 20, 10, 10, 20$
C. $10, 20, 20, 10, 20$
D. $20, 20, 10, 20, 10$

gate1991 data-structures stack easy

Answer key

11.27.2 Stack: GATE CSE 1994 | Question: 1.14

Which of the following permutations can be obtained in the output (in the same order) using a stack assuming that the input is the sequence $1, 2, 3, 4, 5$ in that order?

A. $3, 4, 5, 1, 2$
B. $3, 4, 5, 2, 1$
C. $1, 5, 2, 3, 4$
D. $5, 4, 3, 1, 2$

gate1994 data-structures stack normal

Answer key

11.27.3 Stack: GATE CSE 1995 | Question: 2.21

The postfix expression for the infix expression $A + B * (C + D)/F + D * E$ is:

A. $AB + CD + *F/D + E*$
B. $ABCD + *F/DE * ++$
C. $A * B + CD/F * DE ++$
D. $A + *BCD/F * DE ++$

gate1995 data-structures stack easy

Answer key

11.27.4 Stack: GATE CSE 2000 | Question: 13

Suppose a stack implementation supports, in addition to PUSH and POP, an operation REVERSE, which reverses the order of the elements on the stack.

A. To implement a queue using the above stack implementation, show how to implement ENQUEUE using a single operation and DEQUEUE using a sequence of 3 operations.
B. The following post fix expression, containing single digit operands and arithmetic operators $+$ and $*$, is evaluated using a stack.
   $5\ 2 * 3\ 4 + 5\ 2 * * +$
   Show the contents of the stack
   i. After evaluating $5\ 2 * 3\ 4 +$
   ii. After evaluating $5\ 2 * 3\ 4 + 5\ 2$
   iii. At the end of evaluation

gatecse-2000 data-structures stack normal descriptive

Answer key

11.27.5 Stack: GATE CSE 2003 | Question: 64

Let **S** be a stack of size $n \geq 1$. Starting with the empty stack, suppose we push the first n natural numbers in sequence, and then perform n pop operations. Assume that Push and Pop operations take X seconds each, and Y seconds elapse between the end of one such stack operation and the start of the next operation. For $m \geq 1$, define the stack-life of m as the time elapsed from the end of $Push(m)$ to the start of the pop operation that removes m from **S**. The average stack-life of an element of this stack is

A. $n(X+Y)$
B. $3Y+2X$
C. $n(X+Y)-X$
D. $Y+2X$

gatecse-2003 data-structures stack normal

Answer key

11.27.6 Stack: GATE CSE 2004 | Question: 3

A single array $A[1 \dots \text{MAXSIZE}]$ is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables $top1$ and $top2$ $(top1 < top2)$ point to the location of the topmost element in each of the stacks. If the space is to be used efficiently, the condition for "**stack full**" is

A. $(top1 = \text{MAXSIZE}/2)$ and $(top2 = \text{MAXSIZE}/2+1)$
B. $top1 + top2 = \text{MAXSIZE}$
C. $(top1 = \text{MAXSIZE}/2)$ or $(top2 = \text{MAXSIZE})$
D. $top1 = top2 - 1$

gatecse-2004 data-structures stack easy

Answer key

11.27.7 Stack: GATE CSE 2004 | Question: 5

The best data structure to check whether an arithmetic expression has balanced parentheses is a

A. queue
B. stack
C. tree
D. list

gatecse-2004 data-structures easy stack

Answer key

11.27.8 Stack: GATE CSE 2014 Set 2 | Question: 41

Suppose a stack implementation supports an instruction REVERSE, which reverses the order of elements on the stack, in addition to the PUSH and POP instructions. Which one of the following statements is TRUE (*with respect to this modified stack*)?

A. A queue cannot be implemented using this stack.
B. A queue can be implemented where ENQUEUE takes a single instruction and DEQUEUE takes a sequence of two instructions.
C. A queue can be implemented where ENQUEUE takes a sequence of three instructions and DEQUEUE takes a single instruction.
D. A queue can be implemented where both ENQUEUE and DEQUEUE take a single instruction each.

gatecse-2014-set2 data-structures stack easy

Answer key

11.27.9 Stack: GATE CSE 2015 Set 2 | Question: 38

Consider the C program below

```
#include <stdio.h>
int *A, stkTop;
int stkFunc (int opcode, int val)
{
   static int size=0, stkTop=0;
   switch (opcode) {
      case -1: size = val; break;
```

```
        case 0: if (stkTop < size ) A[stkTop++]=val; break;
        default: if (stkTop) return A[--stkTop];
    }
    return -1;
}
int main()
{
    int B[20]; A=B; stkTop = -1;
    stkFunc (-1, 10);
    stkFunc (0, 5);
    stkFunc (0, 10);
    printf ("%d\n", stkFunc(1, 0)+ stkFunc(1, 0));
}
```

The value printed by the above program is ________.

gatecse-2015-set2 data-structures stack easy numerical-answers

Answer key

11.27.10 Stack: GATE CSE 2015 Set 3 | Question: 12

The result evaluating the postfix expression $10\ 5 + 60\ 6 / * 8 -$ is

A. 284 B. 213 C. 142 D. 71

gatecse-2015-set3 data-structures stack easy

Answer key

11.27.11 Stack: GATE CSE 2021 Set 1 | Question: 21

Consider the following sequence of operations on an empty stack.

$$\textsf{push}(54); \textsf{push}(52); \textsf{pop}(); \textsf{push}(55); \textsf{push}(62); \textsf{s} = \textsf{pop}();$$

Consider the following sequence of operations on an empty queue.

$$\textsf{enqueue}(21); \textsf{enqueue}(24); \textsf{dequeue}(); \textsf{enqueue}(28); \textsf{enqueue}(32); \textsf{q} = \textsf{dequeue}();$$

The value of $\textsf{s}+\textsf{q}$ is ___________.

gatecse-2021-set1 data-structures stack easy numerical-answers one-mark

Answer key

11.27.12 Stack: GATE CSE 2023 | Question: 49

Consider a sequence a of elements $a_0 = 1, a_1 = 5, a_2 = 7, a_3 = 8, a_4 = 9,$ and $a_5 = 2$. The following operations are performed on a stack S and a queue Q, both of which are initially empty.

I. **push** the elements of a from a_0 to a_5 in that order into S.
II. **enqueue** the elements of a from a_0 to a_5 in that order into Q.
III. **pop** an element from S.
IV. **dequeue** an element from Q.
V. **pop** an element from S.
VI. **dequeue** an element from Q.
VII. **dequeue** an element from Q and push the same element into S.
VIII. Repeat operation VII three times.
IX. **pop** an element from S.
X. **pop** an element from S.

The top element of S after executing the above operations is ______________.

gatecse-2023 data-structures stack numerical-answers two-marks easy

Answer key

11.27.13 Stack: GATE CSE 2024 | Set 2 | Question: 38

Let $\mathrm{S1}$ and $\mathrm{S2}$ be two stacks. $\mathrm{S1}$ has capacity of 4 elements. $\mathrm{S2}$ has capacity of 2 elements. $\mathrm{S1}$ already has 4 elements: $100, 200, 300$, and 400, whereas $\mathrm{S2}$ is empty, as shown below.

400(Top)
300
200
100

Stack S1

Stack S2

Only the following three operations are available:

- PushToS2: Pop the top element from S1 and push it on S2.
- PushToS1: Pop the top element from S2 and push it on S1.
- GenerateOutput: Pop the top element from S1 and output it to the user.

Note that the pop operation is not allowed on an empty stack and the push operation is not allowed on a full stack.

Which of the following output sequences can be generated by using the above operations?

A. $100, 200, 400, 300$
B. $200, 300, 400, 100$
C. $400, 200, 100, 300$
D. $300, 200, 400, 100$

gatecse2024-set2 data-structures stack multiple-selects two-marks

Answer key

11.27.14 Stack: GATE CSE 2025 | Set 2 | Question: 35

Consider a stack data structure into which we can PUSH and POP records. Assume that each record pushed in the stack has a positive integer key and that all keys are distinct.

We wish to augment the stack data structure with an $O(1)$ time MIN operation that returns a pointer to the record with smallest key present in the stack

1. without deleting the corresponding record, and
2. without increasing the complexities of the standard stack operations.

Which one or more of the following approach(es) can achieve it?

A. Keep with every record in the stack, a pointer to the record with the smallest key below it.
B. Keep a pointer to the record with the smallest key in the stack.
C. Keep an auxiliary array in which the key values of the records in the stack are maintained in sorted order.
D. Keep a Min-Heap in which the key values of the records in the stack are maintained.

gatecse2025-set2 data-structures stack multiple-selects two-marks

Answer key

11.27.15 Stack: GATE DA 2025 | Question: 54

Consider the following pseudocode.

```
Create empty stack S
Set x=0, flag=0, sum=0
Push x onto S
while (S is not empty){
  if (flag equals 0){
    Set x = x+1
    Push x onto S}
  if (x equals 8):
    Set flag=1
  if (flag equals 1){
    x = Pop(S)
```

```
    if (x is odd):
      Pop (S)
    Set sum = sum + x}
}
Output sum
```

The value of sum output by a program executing the above pseudocode is __________ (Answer in integer)

gateda-2025 data-structures stack output numerical-answers two-marks

Answer key

11.27.16 Stack: GATE IT 2004 | Question: 52

A program attempts to generate as many permutations as possible of the string, '$abcd$' by pushing the characters a, b, c, d in the same order onto a stack, but it may pop off the top character at any time. Which one of the following strings CANNOT be generated using this program?

A. $abcd$ B. $dcba$ C. $cbad$ D. $cabd$

gateit-2004 data-structures normal stack

Answer key

11.27.17 Stack: GATE IT 2005 | Question: 13

A function f defined on stacks of integers satisfies the following properties. $f(\emptyset) = 0$ and $f(push(S, i)) = max(f(S), 0) + i$ for all stacks S and integers i.

If a stack S contains the integers $2, -3, 2, -1, 2$ in order from bottom to top, what is $f(S)$?

A. 6 B. 4 C. 3 D. 2

gateit-2005 data-structures stack normal

Answer key

11.27.18 Stack: GATE IT 2007 | Question: 32

Consider the following C program:

```
#include <stdio.h>
        #define EOF -1
        void push (int); /* push the argument on the stack */
        int pop  (void); /* pop the top of the stack */
        void flagError ();
        int main ()
       {         int c, m, n, r;
                  while ((c = getchar ()) != EOF)
                 { if  (isdigit (c) )
                            push (c);
                  else if ((c == '+') || (c == '*'))
                 {          m = pop ();
                             n = pop ();
                             r = (c == '+') ? n + m : n*m;
                             push (r);
                   }
                   else if (c != ' ')
                            flagError ();
          }
           printf("% c", pop ());
}
```

What is the output of the program for the following input?
$5\,2\,*\,3\,3\,2\,+*+$

A. 15 B. 25 C. 30 D. 150

gateit-2007 stack normal

Answer key

11.27.19 Stack: UGC NET CSE | December 2006 | Part 2 | Question: 23

What is the time required to insert an element in a stack with linked implementation ?

A. $O(\log_2 n)$ B. $O(n)$ C. $O(n \log_2 n)$ D. $O(1)$

ugcnetcse-dec2006-paper2 stack data-structures time-complexity

Answer key☟

11.27.20 Stack: UGC NET CSE | December 2006 | Part 2 | Question: 25

Which one of the following is a physical data structure ?

A. Array B. Linked lists C. Stacks D. Tables

ugcnetcse-dec2006-paper2 data-structures array linked-list stack

Answer key☟

11.27.21 Stack: UGC NET CSE | December 2012 | Part 2 | Question: 40

Given an empty stack, after performing push(1), push(2), pop, push(3), push(4), pop, pop, push(5), pop, what is the value of the top of the stack?

A. 4 B. 3 C. 2 D. 1

ugcnetcse-dec2012-paper2 data-structures stack

Answer key☟

11.27.22 Stack: UGC NET CSE | December 2012 | Part 3 | Question: 17

Which of the following permutations can be obtained in the output using a stack of size 3 elements assuming that input, sequence is 1, 2, 3, 4, 5?

A. 3, 2, 1, 5, 4
B. 5, 4, 3, 2, 1
C. 3, 4, 5, 2, 1
D. 3, 4, 5, 1, 2

ugcnetcse-dec2012-paper3 data-structures stack

Answer key☟

11.27.23 Stack: UGC NET CSE | December 2014 | Part 2 | Question: 08

How many **PUSH** and **POP** operations will be needed to evaluate the following expression by reverse polish notation in a stack machine $(A * B) + (C * D/E)$?

A. 4 **PUSH** and 3 **POP** instructions
B. 5 **PUSH** and 4 **POP** instructions
C. 6 **PUSH** and 2 **POP** instructions
D. 5 **PUSH** and 3 **POP** instructions

ugcnetcse-dec2014-paper2 data-structures stack

Answer key☟

11.27.24 Stack: UGC NET CSE | December 2014 | Part 2 | Question: 21

Convert the following infix expression into its equivalent post fix expression $(A + B\hat{\ }D)/(E - F) + G$

A. $ABD\hat{\ } + EF - /G+$
B. $ABD + \hat{\ }EF - /G+$
C. $ABD + \hat{\ }EF/ - G+$
D. $ABD\hat{\ } + EF/ - G+$

ugcnetcse-dec2014-paper2 data-structures stack

Answer key☟

11.27.25 Stack: UGC NET CSE | December 2018 | Part 2 | Question: 24

Consider the following postfix expression with single digit operands :

$6\,2\,3\,*\,/\,4\,2\,*\,+\,6\,8\,*\,-$

The top two elements of the stack after the second $*$ is evaluated, are :

A. $8,2$ B. $8,1$ C. $6,2$ D. $6,3$

ugcnetcse-dec2018-paper2 data-structures stack

Answer key

11.27.26 Stack: UGC NET CSE | January 2017 | Part 2 | Question: 22

The seven elements A, B, C, D, E, F and G are pushed onto a stack in reverse order, i.e., starting from G. The stack is popped five times and each element is inserted into a queue. Two elements are deleted from the queue and pushed back onto the stack. Now, one element is popped from the stack. The popped item is __________.

A. A
B. B
C. F
D. G

ugcnetjan2017ii data-structures stack

Answer key

11.27.27 Stack: UGC NET CSE | July 2016 | Part 2 | Question: 22

Consider the following operations performed on a stack of size 5:

Push (a); Pop(); Push(b); Push(c); Pop();

Push(d); Pop(); Pop(); Push(e)

Which of the following statements is correct?

A. Underflow occurs
B. Stack operations are performed smoothly
C. Overflow occurs
D. None of the above

ugcnetcse-july2016-paper2 data-structures stack easy

Answer key

11.27.28 Stack: UGC NET CSE | July 2016 | Part 2 | Question: 24

Which of the following is not an inherent application of stack?

A. Implementation of recursion
B. Evaluation of a postfix expression
C. Job scheduling
D. Reverse a string

ugcnetcse-july2016-paper2 data-structures stack

Answer key

11.27.29 Stack: UGC NET CSE | June 2005 | Part 2 | Question: 21

What is the time required to insert an element in a stack with linked implementation?

A. $O(\log_2 n)$
B. $O(n)$
C. $O(n \log_2 n)$
D. $O(1)$

ugcnetcse-june2005-paper2 data-structures linked-list stack

Answer key

11.27.30 Stack: UGC NET CSE | June 2008 | Part 2 | Question: 21

Which of the following data structures is most efficient in terms of both space and time to reverse a string of characters?

A. Linked list
B. Stack
C. Array
D. Tree

ugcnetcse-june2008-paper2 data-structures stack array

Answer key

11.27.31 Stack: UGC NET CSE | June 2010 | Part 2 | Question: 21

If we have six stack operationspushing and popping each of A, B and C-such that push (A) must occur before push (B) which must occur before push (C), then A, C, B is a possible order for the pop operations, since this could be our sequence : push (A), pop (A), push (B), push (C), pop (C), pop (B). Which one of the following orders could not be the order the pop operations are run, if we are to satisfy the requirements described above?

A. ABC B. CBA C. BAC D. CAB

ugcnetcse-june2010-paper2 data-structures stack

Answer key

11.27.32 Stack: UGC NET CSE | June 2012 | Part 3 | Question: 38

The following postfix expression is evaluated using a stack. 823^/23*+51*- . The top two elements of the stack after first * is evaluated

A. 6,1 B. 5, 7 C. 3,2 D. 1, 5

ugcnetcse-june2012-paper3 data-structures stack

Answer key

11.27.33 Stack: UGC NET CSE | June 2014 | Part 2 | Question: 40

What is the maximum number of parenthesis that will appear on the stack at any one time for parenthesis expression given by

$(()\ (())\ (()))$

A. 2
B. 3
C. 4
D. 5

ugcnetcse-june2014-paper2 data-structures stack

Answer key

11.27.34 Stack: UGC NET CSE | June 2014 | Part 3 | Question: 41

The reverse polish notation equivalent to the infix expression $((A+B)^*C+D)/(E+F+G)$

A. $AB+C^*D+EF+G+/$
B. $AB+CD^*+EF+G+/$
C. $AB+C^*D+EFG++/$
D. $AB+C^*D+E+FG+/$

ugcnetjune2014iii data-structures stack

Answer key

11.28 Time Complexity (1)

11.28.1 Time Complexity: GATE CSE 2025 | Set 2 | Question: 28

A meld operation on two instances of a data structure combines them into one single instance of the same data structure. Consider the following data structures:

P. Unsorted doubly linked list with pointers to the head node and tail node of the list.

Q. Min-heap implemented using an array.

R. Binary Search Tree.

Which ONE of the following options gives the worst-case time complexities for meld operation on instances of size n of these data structures?

A. $\mathrm{P}:\Theta(1), \mathrm{Q}:\Theta(n), \mathrm{R}:\Theta(n)$
B. $\mathrm{P}:\Theta(1), \mathrm{Q}:\Theta(n\log n), \mathrm{R}:\Theta(n)$
C. $\mathrm{P}:\Theta(n), \mathrm{Q}:\Theta(n\log n), \mathrm{R}:\Theta\left(n^2\right)$
D. $\mathrm{P}:\Theta(1), \mathrm{Q}:\Theta(n), \mathrm{R}:\Theta(n\log n)$

gatecse2025-set2 data-structures time-complexity two-marks

Answer key

11.29 Tree (29)

11.29.1 Tree: GATE CSE 1990 | Question: 13a

Consider the height-balanced tree T_t with values stored at only the leaf nodes, shown in Fig.4.

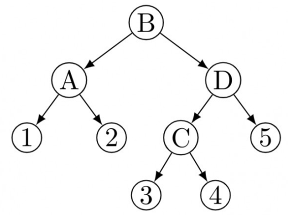


Fig.4

(i) Show how to merge to the tree, T_1 elements from tree T_2 shown in Fig.5 using node D of tree T_1.

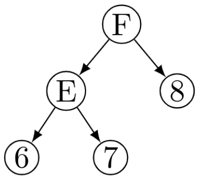


Fig.5

(ii) What is the time complexity of a merge operation of balanced trees T_1 and T_2 where T_1 and T_2 are of height h_1 and h_2 respectively, assuming that rotation schemes are given. Give reasons.

gate1990 data-structures tree descriptive

Answer key

11.29.2 Tree: GATE CSE 1992 | Question: 02,vii

A $2-3$ tree is such that

a. All internal nodes have either 2 or 3 children
b. All paths from root to the leaves have the same length

The number of internal nodes of a $2-3$ tree having 9 leaves could be

A. 4
B. 5
C. 6
D. 7

gate1992 tree data-structures normal multiple-selects

Answer key

11.29.3 Tree: GATE CSE 1994 | Question: 5

A $3-\text{ary}$ tree is a tree in which every internal node has exactly three children. Use induction to prove that the number of leaves in a $3-\text{ary}$ tree with n internal nodes is $2(n+1)$.

gate1994 data-structures tree proof descriptive

Answer key

11.29.4 Tree: GATE CSE 1998 | Question: 1.24

Which of the following statements is false?

A. A tree with a n nodes has $(n–1)$ edges
B. A labeled rooted binary tree can be uniquely constructed given its postorder and preorder traversal results.

C. A complete binary tree with n internal nodes has $(n+1)$ leaves.
D. The maximum number of nodes in a binary tree of height h is $2^{h+1}-1$

gate1998 data-structures tree multiple-selects normal

Answer key

11.29.5 Tree: GATE CSE 1998 | Question: 2.11

A complete n-ary tree is one in which every node has 0 or n sons. If x is the number of internal nodes of a complete n-ary tree, the number of leaves in it is given by

A. $x(n-1)+1$
B. $xn-1$
C. $xn+1$
D. $x(n+1)$

gate1998 data-structures tree normal

Answer key

11.29.6 Tree: GATE CSE 2002 | Question: 2.9

The number of leaf nodes in a rooted tree of n nodes, with each node having 0 or 3 children is:

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

gatecse-2002 data-structures tree normal

Answer key

11.29.7 Tree: GATE CSE 2004 | Question: 6

Level order traversal of a rooted tree can be done by starting from the root and performing

A. preorder traversal
B. in-order traversal
C. depth first search
D. breadth first search

gatecse-2004 data-structures tree easy

Answer key

11.29.8 Tree: GATE CSE 2005 | Question: 36

In a complete k-ary tree, every internal node has exactly k children. The number of leaves in such a tree with n internal node is:

A. nk
B. $(n-1)k+1$
C. $n(k-1)+1$
D. $n(k-1)$

gatecse-2005 data-structures tree normal

Answer key

11.29.9 Tree: GATE CSE 2007 | Question: 43

A complete $n-ary$ tree is a tree in which each node has n children or no children. Let I be the number of internal nodes and L be the number of leaves in a complete $n-ary$ tree. If $L=41$ and $I=10$, what is the value of n?

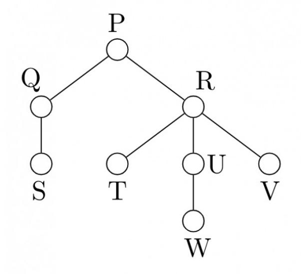
A. 3
B. 4
C. 5
D. 6

gatecse-2007 data-structures tree normal

Answer key

11.29.10 Tree: GATE CSE 2014 Set 3 | Question: 12

Consider the following rooted tree with the vertex labeled P as the root:



The order in which the nodes are visited during an in-order traversal of the tree is

A. SQPTRWUV B. SQPTUWRV C. SQPTWUVR D. SQPTRUWV

gatecse-2014-set3 data-structures tree easy

Answer key

11.29.11 Tree: GATE CSE 2014 Set 3 | Question: 41

Consider the pseudocode given below. The function $DoSomething()$ takes as argument a pointer to the root of an arbitrary tree represented by the $leftMostChild - rightSibling$ representation. Each node of the tree is of type $treeNode$.

```
typedef struct treeNode* treeptr;

struct treeNode
{
   treeptr leftMostChild, rightSibling;
};

int DoSomething (treeptr tree)
{
   int value=0;
   if (tree != NULL) {
      if (tree->leftMostChild == NULL)
         value = 1;
      else
      value = DoSomething(tree->leftMostChild);
      value = value + DoSomething(tree->rightSibling);
   }
   return(value);
}
```

When the pointer to the root of a tree is passed as the argument to $DoSomething$, the value returned by the function corresponds to the

A. number of internal nodes in the tree.
B. height of the tree.
C. number of nodes without a right sibling in the tree.
D. number of leaf nodes in the tree

gatecse-2014-set3 data-structures tree normal

Answer key

11.29.12 Tree: GATE CSE 2017 Set 1 | Question: 20

Let T be a tree with 10 vertices. The sum of the degrees of all the vertices in T is ________

gatecse-2017-set1 data-structures tree easy numerical-answers

Answer key

11.29.13 Tree: GATE CSE 2021 Set 1 | Question: 41

An $articulation\ point$ in a connected graph is a vertex such that removing the vertex and its incident edges disconnects the graph into two or more connected components.

Let T be a DFS tree obtained by doing DFS in a connected undirected graph G.

Which of the following options is/are correct?

A. Root of T can never be an articulation point in G.

B. Root of T is an articulation point in G if and only if it has 2 or more children.
C. A leaf of T can be an articulation point in G.
D. If u is an articulation point in G such that x is an ancestor of u in T and y is a descendent of u in T, then all paths from x to y in G must pass through u.

gatecse-2021-set1 multiple-selects data-structures tree two-marks

Answer key

11.29.14 Tree: GATE CSE 2025 | Set 1 | Question: 25

The height of any rooted tree is defined as the maximum number of edges in the path from the root node to any leaf node.

Suppose a Min-Heap T stores 32 keys. The height of T is ___________. (Answer in integer)

gatecse2025-set1 data-structures tree binary-heap numerical-answers easy one-mark

Answer key

11.29.15 Tree: UGC NET CSE | December 2004 | Part 2 | Question: 21

What item is at the root after the following sequence of insertions into an empty splay tree :
$1, 11, 3, 10, 8, 4, 6, 5, 7, 9, 2, ?$

A. 1
B. 2
C. 4
D. 8

ugcnetcse-dec2004-paper2 data-structures tree algorithm-design

Answer key

11.29.16 Tree: UGC NET CSE | December 2012 | Part 2 | Question: 16

In which tree, for every node the height of its left subtree and right subtree differ almost by 1?

A. Binary Search Tree
B. AVL Tree
C. Threaded Binary Tree
D. Complete Binary Tree

ugcnetcse-dec2012-paper2 data-structures tree binary-tree

Answer key

11.29.17 Tree: UGC NET CSE | December 2012 | Part 2 | Question: 25

Suppose that someone starts with a chain letter. Each person who receives the letter is asked to send it on to 4 other people. Some people do this, while some do not send any letter. How many people have seen the letter, including the first person, if none receives more than one letter and if the chain letter ends after there have been 100 people who read it but did not send it out? Also find out how many people sent out the letter?

A. 122 & 22
B. 111 & 11
C. 133 & 33
D. 144 & 44

ugcnetcse-dec2012-paper2 tree

Answer key

11.29.18 Tree: UGC NET CSE | December 2014 | Part 2 | Question: 02

A certain tree has two vertices of degree 4, one vertex of degree 3 and one vertex of degree 2. If the other vertices have degree 1, how many vertices are there in the graph ?

A. 5
B. $n-3$
C. 20
D. 11

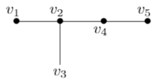
ugcnetcse-dec2014-paper2 data-structures tree

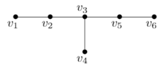
Answer key

11.29.19 Tree: UGC NET CSE | December 2015 | Part 2 | Question: 5

A tree with n vertices is called graceful, if its vertices can be labelled with integers 1, , ..., n such that the absolute value of the difference of the labels of adjacent vertices are all different. Which of the following trees are graceful?

a. 

b. 

c. 

A. a and b
B. b and c
C. a and c
D. a, b,and c

ugcnetcse-dec2015-paper2 data-structures tree

Answer key

11.29.20 Tree: UGC NET CSE | December 2018 | Part 2 | Question: 26

In a ternary tree, the number of internal nodes of degree $1, 2,$ and 3 is $4, 3,$ and 3 respectively. The number of leaf nodes in the ternary tree is

A. 9
B. 10
C. 11
D. 12

ugcnetcse-dec2018-paper2 binary-tree tree data-structures

Answer key

11.29.21 Tree: UGC NET CSE | July 2016 | Part 2 | Question: 23

Suppose you are given a binary tree with n nodes, such that each node has exactly eiter zero or two children. The maximum height of the tree will be

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

ugcnetcse-july2016-paper2 data-structures tree

Answer key

11.29.22 Tree: UGC NET CSE | July 2018 | Part 2 | Question: 29

A 5-ary tree in which every internal node has exactly 5 children. The number of left nodes in such a tree with 8 internal nodes will be:

A. 30
B. 33
C. 45
D. 125

ugcnetcse-july2018-paper2 data-structures tree

Answer key

11.29.23 Tree: UGC NET CSE | June 2008 | Part 2 | Question: 22

Which of the following can be the sequence of nodes examined in a binary search tree while searching for key 98?

A. $100, 50, 75, 60, 98$
B. $100, 120, 90, 95, 98$
C. $200, 70, 100, 95, 98$
D. $75, 150, 90, 80, 98$

ugcnetcse-june2008-paper2 binary-search-tree data-structures tree

11.29.24 Tree: UGC NET CSE | June 2010 | Part 2 | Question: 23

In a complete binary tree of n nodes, how far are the two most distant nodes ? Assume each edge in the path counts as !

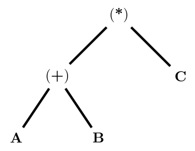
A. About $\log_2 n$
B. About $2\log_2 n$
C. About $n\log_2 n$
D. About $2n$

ugcnetcse-june2010-paper2 data-structures tree

Answer key

11.29.25 Tree: UGC NET CSE | June 2010 | Part 2 | Question: 32

Which of the following expression is represented by the parse tree ?



A. $(A+B)^*C$ B. $A+^*BC$ C. $A+B*C$ D. $A*C+B$

ugcnetcse-june2010-paper2 data-structures tree

Answer key

11.29.26 Tree: UGC NET CSE | June 2012 | Part 2 | Question: 13

Leaves of which of the following trees are at the same level?

A. Binary tree
B. B-tree
C. AVL-tree
D. Expression tree

ugcnetcse-june2012-paper2 programming tree

Answer key

11.29.27 Tree: UGC NET CSE | June 2012 | Part 2 | Question: 50

To represent hierarchical relationship between elements, which data structure is suitable?

A. Dequeue B. Priority C. Tree D. All of the above

data-structures ugcnetcse-june2012-paper2 tree easy

Answer key

11.29.28 Tree: UGC NET CSE | June 2012 | Part 3 | Question: 36

Number of binary trees formed with 5 nodes are

A. 32 B. 36 C. 120 D. 42

ugcnetcse-june2012-paper3 data-structures tree

Answer key

11.29.29 Tree: UGC NET CSE | November 2017 | Part 2 | Question: 22

The following numbers are inserted into an empty binary search tree in the given order: $10, 1, 3, 5, 15, 12, 16$. What is the height of the binary search tree?

A. 3 B. 4 C. 5 D. 6

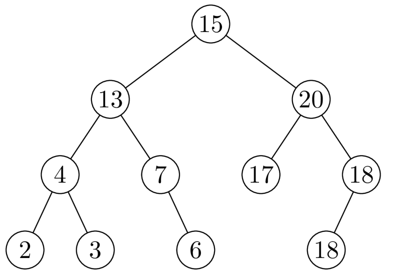
ugcnetcse-nov2017-paper2 binary-search-tree data-structures tree

Answer key

11.30 Tree Traversal (5)

11.30.1 Tree Traversal: UGC NET CSE | December 2015 | Part 2 | Question: 38

The inorder traversal of the following tree is



A. $2\ 3\ 4\ 6\ 7\ 13\ 15\ 17\ 18\ 18\ 20$
B. $20\ 18\ 18\ 17\ 15\ 13\ 7\ 6\ 4\ 3\ 2$
C. $15\ 13\ 20\ 4\ 7\ 17\ 18\ 2\ 3\ 6\ 18$
D. $2\ 4\ 3\ 13\ 7\ 6\ 15\ 17\ 20\ 18\ 18$

ugcnetcse-dec2015-paper2 data-structures tree-traversal

Answer key☟

11.30.2 Tree Traversal: UGC NET CSE | June 2006 | Part 2 | Question: 22

Preorder is also known as:

A. Depth first order
B. Breadth first order
C. Topological order
D. Linear order

ugcnetcse-june2006-paper2 data-structures tree-traversal

11.30.3 Tree Traversal: UGC NET CSE | June 2007 | Part 2 | Question: 22

Pre order is also known as:

A. Depth first order
B. Breadth first order
C. Topological order
D. Linear order

ugcnetcse-june2007-paper2 tree-traversal data-structures

11.30.4 Tree Traversal: UGC NET CSE | November 2017 | Part 2 | Question: 25

Post-order traversal of a given binary search tree T produces following sequence of keys: $3, 5, 7, 9, 4, 17, 16, 20, 18, 15, 14$. Which one of the following sequences of keys can be the result of an in-order traversal of the tree T?

A. $3,4,5,7,9,14,20,18,17,16,15$
B. $20,18,17,16,15,14,3,4,5,7,9$
C. $20,18,17,16,15,14,9,7,5,4,3$
D. $3,4,5,7,9,14,15,16,17,18,20$

ugcnetcse-nov2017-paper2 binary-search-tree tree-traversal data-structures

Answer key☟

11.30.5 Tree Traversal: UGC NET CSE | October 2022 | Part 1 | Question: 93

Consider the traversal of a tree

Preorder $\rightarrow$ ABCEIFJDGHKL
Inorder $\rightarrow$ EICFJBGDKHLA

Which of the following is correct post order traversal?

A. EIFJCKGLHDBA
B. FCGKLHDBUAE
C. FCGKLHDBAEIJ
D. IEJFCGKLHDBA

ugcnetcse-oct2022-paper1 binary-tree tree-traversal data-structures

Answer Keys

11.1.1	N/A	11.1.2	B	11.1.3	N/A	11.1.4	B	11.1.5	C
11.1.6	A	11.1.7	D	11.1.8	TBA	11.1.9	TBA	11.2.1	N/A

11.2.2	C	11.2.3	N/A	11.2.4	N/A	11.2.5	A	11.2.6	A
11.2.7	N/A	11.2.8	A	11.2.9	B	11.2.10	C	11.2.11	B
11.2.12	5	11.2.13	C	11.2.14	D	11.2.15	TBA	11.3.1	X
11.3.2	TBA	11.3.3	TBA	11.3.4	D	11.3.5	TBA	11.4.1	N/A
11.4.2	C	11.4.3	N/A	11.4.4	B	11.4.5	D	11.4.6	A
11.4.7	D	11.4.8	A	11.4.9	D	11.4.10	A	11.4.11	B
11.4.12	C	11.4.13	D	11.4.14	B	11.4.15	A	11.4.16	B
11.4.17	A	11.4.18	D	11.4.19	B	11.4.20	8	11.4.21	80
11.4.22	A	11.4.23	511	11.4.24	C	11.4.25	B	11.4.26	A
11.4.27	B	11.4.28	C	11.4.29	B	11.4.30	TBA	11.4.31	TBA
11.4.32	B	11.4.33	TBA	11.4.34	B	11.4.35	D	11.4.36	X
11.4.37	C	11.4.38	B	11.4.39	A	11.4.40	TBA	11.5.1	B
11.5.2	N/A	11.5.3	D	11.5.4	N/A	11.5.5	C	11.5.6	B
11.5.7	B	11.5.8	B	11.5.9	B	11.5.10	A	11.5.11	B
11.5.12	B	11.5.13	C	11.5.14	D	11.5.15	C	11.5.16	110
11.5.17	A	11.5.18	B	11.5.19	B	11.5.20	64	11.5.21	B
11.5.22	B	11.5.23	B	11.5.24	B	11.5.25	D	11.5.26	509
11.5.27	A	11.5.28	A;B	11.5.29	4:4	11.5.30	C	11.5.31	D
11.5.32	C	11.5.33	A	11.5.34	D	11.5.35	C	11.5.36	B
11.5.37	TBA	11.5.38	TBA	11.5.39	C	11.5.40	D	11.5.41	C
11.5.42	TBA	11.5.43	TBA	11.5.44	C	11.6.1	False	11.6.2	False
11.6.3	N/A	11.6.4	N/A	11.6.5	N/A	11.6.6	A;C;D	11.6.7	B
11.6.8	144	11.6.9	N/A	11.6.10	N/A	11.6.11	N/A	11.6.12	N/A
11.6.13	N/A	11.6.14	N/A	11.6.15	B	11.6.16	N/A	11.6.17	C
11.6.18	N/A	11.6.19	N/A	11.6.20	C	11.6.21	D	11.6.22	D
11.6.23	N/A	11.6.24	B	11.6.25	D	11.6.26	D	11.6.27	C
11.6.28	B	11.6.29	A	11.6.30	C	11.6.31	A	11.6.32	B
11.6.33	A	11.6.34	1	11.6.35	A	11.6.36	19	11.6.37	199
11.6.38	C	11.6.39	4	11.6.40	4.25	11.6.41	1 : 1	11.6.42	C
11.6.43	B	11.6.44	A;B;C	11.6.45	A;B;C	11.6.46	D	11.6.47	B
11.6.48	D	11.6.49	C	11.6.50	B	11.6.51	D	11.6.52	B
11.6.53	A	11.6.54	TBA	11.6.55	TBA	11.6.56	TBA	11.6.57	TBA
11.6.58	TBA	11.6.59	TBA	11.6.60	TBA	11.6.61	B	11.6.62	D
11.6.63	C	11.6.64	C	11.6.65	C	11.7.1	TBA	11.8.1	A
11.9.1	B	11.9.2	C	11.9.3	B	11.9.4	12	11.9.5	A
11.9.6	TBA	11.9.7	C	11.9.8	C	11.9.9	D	11.9.10	D
11.9.11	B	11.9.12	C	11.9.13	C	11.10.1	TBA	11.10.2	TBA
11.10.3	TBA	11.10.4	D	11.11.1	TBA	11.12.1	D	11.13.1	C
11.13.2	N/A	11.13.3	N/A	11.13.4	C	11.13.5	B	11.13.6	C
11.13.7	C	11.13.8	C	11.13.9	A	11.13.10	A	11.13.11	B

11.13.12	80
11.13.17	TBA
11.13.22	TBA
11.13.27	TBA
11.13.32	C
11.14.4	A
11.16.1	TBA
11.17.5	B
11.17.10	N/A
11.17.15	B
11.17.20	A
11.17.25	TBA
11.17.30	TBA
11.21.1	D
11.22.2	N/A
11.22.7	A
11.22.12	0
11.22.17	TBA
11.22.22	TBA
11.25.1	TBA
11.27.2	B
11.27.7	B
11.27.12	8
11.27.17	C
11.27.22	A;C
11.27.27	B
11.27.32	A
11.29.2	A;D
11.29.7	D
11.29.12	18
11.29.17	C
11.29.22	TBA
11.29.27	C
11.30.3	TBA

11.13.13	B
11.13.18	TBA
11.13.23	X
11.13.28	TBA
11.13.33	TBA
11.14.5	A
11.17.1	B
11.17.6	D
11.17.11	D
11.17.16	D
11.17.21	D
11.17.26	TBA
11.18.1	C
11.21.2	B
11.22.3	A
11.22.8	A
11.22.13	17
11.22.18	TBA
11.22.23	C
11.25.2	TBA
11.27.3	B
11.27.8	C
11.27.13	B;C;D
11.27.18	B
11.27.23	B
11.27.28	C
11.27.33	B
11.29.3	N/A
11.29.8	C
11.29.13	B
11.29.18	D
11.29.23	TBA
11.29.28	D
11.30.4	D

11.13.14	C
11.13.19	TBA
11.13.24	C
11.13.29	C
11.14.1	N/A
11.14.6	TBA
11.17.2	N/A
11.17.7	C
11.17.12	B
11.17.17	C
11.17.22	5:5
11.17.27	TBA
11.19.1	TBA
11.21.3	TBA
11.22.4	B
11.22.9	256
11.22.14	B
11.22.19	TBA
11.23.1	D
11.25.3	C
11.27.4	N/A
11.27.9	15
11.27.14	A
11.27.19	TBA
11.27.24	A
11.27.29	TBA
11.27.34	A
11.29.4	B;C
11.29.9	C
11.29.14	5:5
11.29.19	D
11.29.24	TBA
11.29.29	A
11.30.5	TBA

11.13.15	B
11.13.20	TBA
11.13.25	TBA
11.13.30	A
11.14.2	A
11.14.7	A
11.17.3	N/A
11.17.8	N/A
11.17.13	A
11.17.18	B
11.17.23	A
11.17.28	TBA
11.19.2	TBA
11.21.4	TBA
11.22.5	A
11.22.10	B
11.22.15	TBA
11.22.20	TBA
11.24.1	B
11.26.1	TBA
11.27.5	C
11.27.10	C
11.27.15	24:24
11.27.20	TBA
11.27.25	B
11.27.30	TBA
11.28.1	A
11.29.5	A
11.29.10	A
11.29.15	TBA
11.29.20	B
11.29.25	TBA
11.30.1	D

11.13.16	D
11.13.21	TBA
11.13.26	TBA
11.13.31	TBA
11.14.3	N/A
11.15.1	TBA
11.17.4	N/A
11.17.9	N/A
11.17.14	D
11.17.19	C
11.17.24	B
11.17.29	B
11.20.1	435:435
11.22.1	N/A
11.22.6	A
11.22.11	B
11.22.16	TBA
11.22.21	D
11.24.2	TBA
11.27.1	B
11.27.6	D
11.27.11	86 : 86
11.27.16	D
11.27.21	D
11.27.26	B
11.27.31	TBA
11.29.1	N/A
11.29.6	D
11.29.11	D
11.29.16	B
11.29.21	C
11.29.26	B
11.30.2	TBA

12 Programming and DS: Programming (1)

12.1 Java (1)

12.1.1 Java: UGC NET CSE | June 2011 | Part 2 | Question: 15

Portable program means

A. Program with wheels
B. Independent from its authors
C. Independent of platform
D. None of the above

ugcnetcse-june2011-paper2 programming java

Answer key☟

Answer Keys

12.1.1	TBA

13 Programming: Programming in Python (6)

13.0.1 GATE DS&AI 2024 | Question: 31

Consider the following Python function:

```
def fun(D, s1, s2):
    if s1 < s2:
        D[s1], D[s2] = D[s2], D[s1]
        fun(D, s1+1, s2-1)
```

What does this Python function fun ( ) do? Select the ONE appropriate option below.

A. It finds the smallest element in D from index $s1$ to $s2$, both inclusive.
B. It performs a merge sort in-place on this list D between indices $\mathrm{s}1$ and $\mathrm{s}2$, both inclusive.
C. It reverses the list D between indices $\mathrm{s}1$ and $\mathrm{s}2$, both inclusive.
D. It swaps the elements in D at indices $\mathrm{s}1$ and $\mathrm{s}2$, and leaves the remaining elements unchanged.

gate-ds-ai-2024 programming two-marks

Answer key

13.0.2 GATE DS&AI 2024 | Question: 29

Consider the function computes (X) whose pseudocode is given below:

computes (X)
$S[1] \leftarrow 1$
for $i \leftarrow 2$ to length (X)
$S[i] \leftarrow 1$
if $X[i-1] \leq X[i]$
$S[i] \leftarrow S[i]+S[i-1]$
end if
end for
return S

Which ONE of the following values is returned by the function computes (X) for $X=[6,3,5,4,10]$?

A. $[1,1,2,3,4]$
B. $[1,1,2,3,3]$
C. $[1,1,2,1,2]$
D. $[1,1,2,1,5]$

gate-ds-ai-2024 programming two-marks

Answer key

13.0.3 GATE DS&AI 2024 | Question: 28

Consider the following Python code:

```
def count(child_dict, i):
    if i not in child_dict.keys():
        return 1
    ans = 1
    for j in child_dict[i]:
        ans += count(child_dict, j)
    return ans

child_dict = dict()
child_dict[0] = [1, 2]
child_dict[1] = [3, 4, 5]
child_dict[2] = [6, 7, 8]
print(count(child_dict, 0))
```

Which ONE of the following is the output of this code?

A. 6 B. 1 C. 8 D. 9

gate-ds-ai-2024 programming two-marks

Answer key

13.1 List (1)

13.1.1 List: GATE DA 2025 | Question: 13

Consider the following Python declarations of two lists.

$$A=[1,2,3]$$
$$B=[4,5,6]$$

Which one of the following statements results in $\mathrm{A}=[1,2,3,4,5,6]$?

A. A.extend (B) B. A.append (B) C. A.update (B) D. A.insert(B)

gateda-2025 programming-in-python python-programming list easy one-mark

Answer key

13.2 Programming In Python (2)

13.2.1 Programming In Python: GATE DA 2025 | Question: 37

Consider the following Python code snippet.

$$
\begin{aligned}
&\mathrm{A}=\{\text{"this"}, \text{"that"}\}\\
&\mathrm{B}=\{\text{"that"}, \text{"other"}\}\\
&\mathrm{C}=\{\text{"other"}, \text{"this"}\}\\
&\text{while "other" in C}:\\
&\quad \text{if "this" in A}:\\
&\quad\quad \mathrm{A}, \mathrm{B}, \mathrm{C}=\mathrm{A}-\mathrm{B}, \mathrm{B}-\mathrm{C}, \mathrm{C}-\mathrm{A}\\
&\quad \text{if "that" in B}:\\
&\quad\quad \mathrm{A}, \mathrm{B}, \mathrm{C}=\mathrm{C} \mid \mathrm{A}, \mathrm{A} \mid \mathrm{B}, \mathrm{B} \mid \mathrm{C}
\end{aligned}
$$

When the above program is executed, at the end, which of the following sets contains "this"?

A. Only A
B. Only B
C. Only C
D. A, C

gateda-2025 programming-in-python python-programming two-marks

Answer key

13.2.2 Programming In Python: GATE DA 2025 | Question: 53

Consider the following Python code snippet.

```
def f(a,b):
  if (a==0):
      return b
  if (a%2==1):
      return 2*f((a-1)/2,b)
  return b+f(a-1,b)
print(f(15,10))
```

The value printed by the code snippet is _____________. (Answer in integer)

gateda-2025 programming-in-python python-programming numerical-answers easy two-marks

Answer key☟

Answer Keys

13.0.1	C	13.0.2	C	13.0.3	D	13.1.1	A	13.2.1	B
13.2.2	160:160								