CSIR-NET Dec-2019 Que Paper(Assam Region)

CSIR 27th Dec 2019 S2

Application No.	
Candidate Name	
Roll No.	
Test Date	27/12/2019
Test Time	2:30 PM - 5:30 PM
Subject	Mathematical Sciences

Section : **PART-A General Aptitude**

Q.1 Water drips out of the bottom of a cylindrical bucket that is initially full. The rate of dripping is proportional to the height of water column in the bucket. If the rate of dripping at half height is R, then the average rate of dripping until the bucket becomes almost empty, is

1. greater than R
2. R
3. between $R/2$ and R
4. less than $R/2$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932065**
Option 1 ID : **3398938029**
Option 2 ID : **3398938030**
Option 3 ID : **3398938031**
Option 4 ID : **3398938032**
Status : **Not Answered**
Chosen Option : **--**

Q.2 A unicellular organism reproduces by cell division. When two of the organisms come together they tend to destroy each other. If n is the number of cells, which of the following equations best represents the rate of change of the population [where α and β are positive constants]?

1. $\frac{dn}{dt} = \alpha n - \beta n^2$
2. $\frac{dn}{dt} = -\alpha n - \beta n^2$
3. $\frac{dn}{dt} = \alpha n + \beta n^2$
4. $\frac{dn}{dt} = -\alpha n + \beta n^2$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932061**
Option 1 ID : **3398938013**
Option 2 ID : **3398938014**
Option 3 ID : **3398938015**
Option 4 ID : **3398938016**

Status : **Not Answered**
Chosen Option : **--**

Q.3 Governor : State : :

1. ship : captain
2. admiral : navy
3. jail : prisoner
4. student : teacher

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932073**
Option 1 ID : **3398938061**
Option 2 ID : **3398938062**
Option 3 ID : **3398938063**
Option 4 ID : **3398938064**
Status : **Not Answered**
Chosen Option : **--**

Q.4 Person X purchases a house at a price P and sells it to Y at a profit of 10%. Y sells it back to X incurring a loss of 10%. As a result

1. X makes a profit of 11 % of P
2. Y incurs a loss of 10% of P
3. Y makes a profit of 11 % of P
4. Neither X nor Y gains or loses

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932060**
Option 1 ID : **3398938009**
Option 2 ID : **3398938010**
Option 3 ID : **3398938011**
Option 4 ID : **3398938012**
Status : **Not Answered**
Chosen Option : **--**

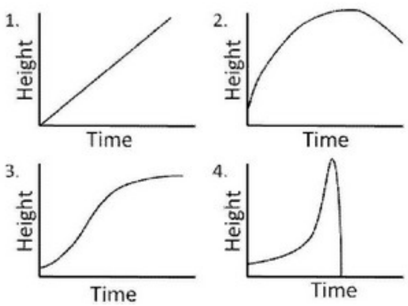
Q.5 Three metal cubes whose diagonals are $\sqrt{3}, 6\sqrt{3}$ and $8\sqrt{3}$ units respectively, are melted to make a new cube. The side of the new cube would be

1. 15 units
2. $10\sqrt{3}$ units
3. $15\sqrt{3}$ units
4. 9 units

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932069**
Option 1 ID : **3398938045**
Option 2 ID : **3398938046**
Option 3 ID : **3398938047**
Option 4 ID : **3398938048**
Status : **Marked For Review**
Chosen Option : **4**

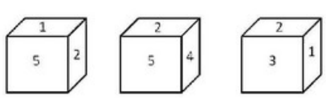
Q.6 Which of the following graphs correctly shows the growth of a sapling to a mature tree?



Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932066**
Option 1 ID : **3398938033**
Option 2 ID : **3398938034**
Option 3 ID : **3398938035**
Option 4 ID : **3398938036**
Status : **Marked For Review**
Chosen Option : **3**

Q.7 The following are the three positions of a die with numbers 1 to 6 written on its faces. Then the number 6 appears on the face opposite that of



1. 1
2. 2
3. 4
4. 5

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932070**
Option 1 ID : **3398938049**
Option 2 ID : **3398938050**
Option 3 ID : **3398938051**

Option 4 ID : **3398938052**
Status : **Marked For Review**
Chosen Option : **2**

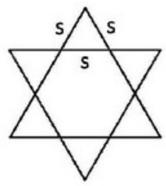
Q.8 In a group of researchers Biologists are thrice as many as Chemists whereas the Physicists are twice as many as Biologists. If there are 5 Chemists in the group, what is the total number of these three types of researchers?

1. 30
2. 45
3. 50
4. 75

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932059**
Option 1 ID : **3398938005**
Option 2 ID : **3398938006**
Option 3 ID : **3398938007**
Option 4 ID : **3398938008**
Status : **Marked For Review**
Chosen Option : **3**

Q.9 What is the area of the figure shown below, assuming all small triangles to be equilateral triangles of side S?



1. $3\sqrt{3}\,S^2$
2. $6\,S^2$
3. $4\sqrt{3}\,S^2$
4. $3\,S^2$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932068**
Option 1 ID : **3398938041**
Option 2 ID : **3398938042**
Option 3 ID : **3398938043**
Option 4 ID : **3398938044**
Status : **Not Answered**
Chosen Option : **--**

Q.10

"The father of my biological son is the only child of your parents."
The statement can be true

1. under no condition
2. only if a woman says so
3. only if a married man says so
4. only if an unmarried man says so

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932075**
Option 1 ID : **3398938069**
Option 2 ID : **3398938070**
Option 3 ID : **3398938071**
Option 4 ID : **3398938072**
Status : **Not Answered**
Chosen Option : **--**

Q.11 The product of the ten numbers 10, 11, 12, 19, 20, 23, 25, 33, 35, and 50 is divisible by 10^x. What is the largest possible value of x?

1. 4
2. 5
3. 6
4. 7

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932071**
Option 1 ID : **3398938053**
Option 2 ID : **3398938054**
Option 3 ID : **3398938055**
Option 4 ID : **3398938056**
Status : **Marked For Review**
Chosen Option : **3**

Q.12 The straight line $y_1 = 4$ and the curve $y_2 = \sin(4x)$, with x varying from 0 to 450,

1. do not intersect at all.
2. touch each other at only one point.
3. intersect at 5 points.
4. intersect at 10 points.

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932064**

Option 1 ID : **3398938025**
Option 2 ID : **3398938026**
Option 3 ID : **3398938027**
Option 4 ID : **3398938028**
Status : **Not Answered**
Chosen Option : **--**

Q.13 In an examination, if more than 15 questions are attempted, only the first 15 attempted ones are evaluated. Answers are awarded + 2 marks if correct and – 0.5 if wrong. A candidate answers 19 questions and gets 15 marks. How many questions are answered correctly in the first fifteen attempted?

1. 9
2. 10
3. 11
4. 12

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932063**
Option 1 ID : **3398938021**
Option 2 ID : **3398938022**
Option 3 ID : **3398938023**
Option 4 ID : **3398938024**
Status : **Marked For Review**
Chosen Option : **1**

Q.14 Birds beat their wings up and down but propel themselves forward because

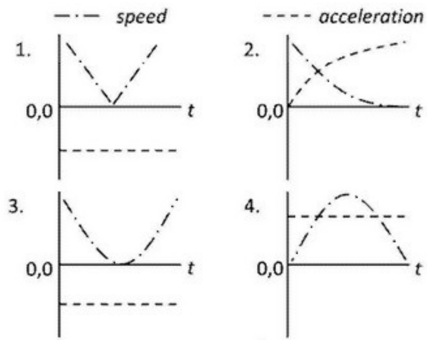
1. the neck is held at an angle with the body axis
2. the flight feathers make an angle with the wing axis
3. their body is streamlined
4. their tail is fan shaped

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932074**
Option 1 ID : **3398938065**
Option 2 ID : **3398938066**
Option 3 ID : **3398938067**
Option 4 ID : **3398938068**
Status : **Not Answered**
Chosen Option : **--**

Q.15

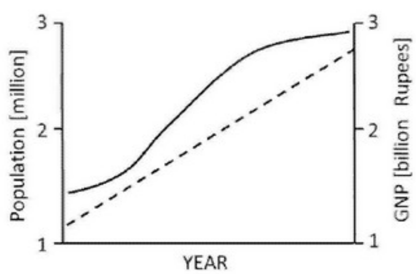
Which of the following graphs shows the speed and the acceleration of a ball thrown up from the Earth and falling back vertically?



Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932076**
Option 1 ID : **3398938073**
Option 2 ID : **3398938074**
Option 3 ID : **3398938075**
Option 4 ID : **3398938076**
Status : **Not Answered**
Chosen Option : **--**

Q.16 The graph shows the population (*solid line*) and the Gross National Product (GNP) (*dash line*) of a country over several years.



Which of the following statements can be inferred from the graph?

1. The rate of change is the same for both, the population and the GNP
2. The population has grown faster than the GNP over the entire period
3. Per capita income at the end of the period is greater than at the beginning
4. Per capita income increased because of growth in the population

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932058**
Option 1 ID : **3398938001**
Option 2 ID : **3398938002**
Option 3 ID : **3398938003**
Option 4 ID : **3398938004**
Status : **Not Answered**
Chosen Option : **--**

Q.17 An LED bulb costs 5 times as much as a filament bulb but consumes only 1/5 of electrical power. If C is the cost of the filament bulb and P is the electric power tariff, the extra cost of the LED bulb will be recovered (in comparison to the filament bulb) in usage time of

1. 5 years
2. 5 C/P
3. C/5P
4. C/P

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932067**
Option 1 ID : **3398938037**
Option 2 ID : **3398938038**
Option 3 ID : **3398938039**
Option 4 ID : **3398938040**
Status : **Not Answered**
Chosen Option : **--**

Q.18 An ant finds a sugar heap having 1000 grains. It takes one grain back to the anthill and then takes a friend along, to fetch one grain back each. Ants repeat the trips, each ant adding a new friend at every trip, until the heap is exhausted. The number of ants that went out is

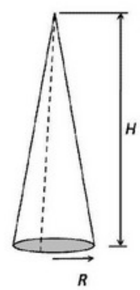
1. 256
2. 450
3. 512
4. 1000

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932062**
Option 1 ID : **3398938017**
Option 2 ID : **3398938018**
Option 3 ID : **3398938019**
Option 4 ID : **3398938020**
Status : **Not Answered**
Chosen Option : **--**

Q.19

A hollow paper cone of height H and radius R is cut along the dotted line and opened to form a sector of a circle. The angle subtended by the sector (in radians) is



1. $2\pi \frac{R}{H}$
2. $2\pi \frac{H}{\sqrt{R^2+H^2}}$
3. $2\pi \frac{R}{\sqrt{R^2+H^2}}$
4. $2\pi \frac{H}{R}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932077**
Option 1 ID : **3398938077**
Option 2 ID : **3398938078**
Option 3 ID : **3398938079**
Option 4 ID : **3398938080**
Status : **Not Answered**
Chosen Option : **--**

Q.20 Among the following pairs of numbers, the smallest difference is between

1. 1.0×10^{23} and 1.0×10^{-23}
2. 1.0×10^{-23} and -1.0×10^{-23}
3. 1.0×10^{23} and -1.0×10^{23}
4. 1.0×10^{23} and -1.0×10^{-23}

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932072**
Option 1 ID : **3398938057**
Option 2 ID : **3398938058**
Option 3 ID : **3398938059**
Option 4 ID : **3398938060**
Status : **Marked For Review**
Chosen Option : **2**

Section : **Part B Mathematical Sciences**

Q.1

Let $A = \begin{pmatrix} 1 & i \\ i & 1 \end{pmatrix}$ be a matrix. Which of the following is true?

1. $A^* = A^{-1}$
2. $AA^* = A^*A$
3. $A^* = A$
4. $A^2 = Id$ (2×2 identity matrix)

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932087**
Option 1 ID : **3398938117**
Option 2 ID : **3398938118**
Option 3 ID : **3398938119**
Option 4 ID : **3398938120**
Status : **Marked For Review**
Chosen Option : **1**

Q.2 Let A and B be invertible $n \times n$ matrices with entries in $\mathbb{R}$ such that AB is diagonalizable with eigenvalues $\lambda_1, \ldots, \lambda_n$. Which of the following is NOT always true?

1. BA is invertible
2. BA is diagonalizable
3. $BA = AB$
4. Eigenvalues of BA are $\lambda_1, \ldots, \lambda_n$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932086**
Option 1 ID : **3398938113**
Option 2 ID : **3398938114**
Option 3 ID : **3398938115**
Option 4 ID : **3398938116**
Status : **Not Answered**
Chosen Option : **--**

Q.3

Let $\alpha > 0$ be a real number. Then

$$\lim_{n\to\infty} \frac{1}{n^{\alpha+1}}(1^\alpha + 2^\alpha + \cdots + n^\alpha) \text{ is}$$

1. ∞
2. equal to 0
3. equal to 1
4. positive and strictly less than 1

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932082**
Option 1 ID : **3398938097**
Option 2 ID : **3398938098**
Option 3 ID : **3398938099**
Option 4 ID : **3398938100**
Status : **Marked For Review**
Chosen Option : **4**

Q.4

Which of the following is the Jordan canonical form of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ over $\mathbb{R}$?

1. $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 3 \end{bmatrix}$
2. $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 3 \end{bmatrix}$
3. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
4. $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 3 \end{bmatrix}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932088**
Option 1 ID : **3398938121**
Option 2 ID : **3398938122**
Option 3 ID : **3398938123**
Option 4 ID : **3398938124**
Status : **Marked For Review**
Chosen Option : **1**

Q.5

Let $f: \mathbb{R} \to \mathbb{R}$ be a continuous function and $(x_n)_{n\geq 1}$ be a bounded sequence of real numbers. Then which of the following is true?

1. $\liminf_{n\to\infty} f(x_n) = f\left(\liminf_{n\to\infty} x_n\right)$
2. $\limsup_{n\to\infty} f(x_n) = f\left(\limsup_{n\to\infty} x_n\right)$
3. $\liminf_{n\to\infty} f(x_n) \leq \limsup_{n\to\infty} x_n$
4. $\liminf_{n\to\infty} f(x_n) \leq f\left(\liminf_{n\to\infty} x_n\right)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932081**
Option 1 ID : **3398938093**
Option 2 ID : **3398938094**
Option 3 ID : **3398938095**
Option 4 ID : **3398938096**
Status : **Not Answered**
Chosen Option : **--**

Q.6 Let $f: X \to Y$ be a function and $(A_n)_{n\geq 1}$ be a sequence of subsets of X. For $A \subset X, A \neq \emptyset$, let $f(A) = \{f(a): a \in A\}$ and $f(\emptyset) = \emptyset$. Then which of the following is true?

1. $f\left(\bigcap_{n\geq 1} A_n\right) = \bigcap_{n\geq 1} f(A_n)$
2. $f\left(\bigcap_{n\geq 1} A_n\right)$ is a proper subset of $\bigcap_{n\geq 1} f(A_n)$
3. $f\left(\bigcup_{n\geq 1} A_n\right) = \bigcup_{n\geq 1} f(A_n)$
4. For any nonempty proper subset A of X, $f(A^c) = f(A)^c$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932080**
Option 1 ID : **3398938089**
Option 2 ID : **3398938090**
Option 3 ID : **3398938091**
Option 4 ID : **3398938092**
Status : **Not Answered**
Chosen Option : **--**

Q.7

Let $x > 100$ be a given real number, which is not an integer. Let S be the set of all rational numbers $r \le x$ of the form

$$r = [x] + \frac{a_1}{10} + \frac{a_2}{10^2} + \cdots + \frac{a_n}{10^n}$$

for some natural number $n \ge 1$, where $a_1, \ldots, a_n$ are integers such that $0 \le a_i \le 9$ and $[x]$ denotes the largest integer $\le x$. Then which one of the following is true?

1. S is infinite and the supremum of S is x
2. S is infinite and the supremum of S is an integer
3. S is finite and the supremum of S is x
4. S is finite and the supremum of S is an integer

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932079**
Option 1 ID : **3398938085**
Option 2 ID : **3398938086**
Option 3 ID : **3398938087**
Option 4 ID : **3398938088**
Status : **Not Answered**
Chosen Option : **--**

Q.8 Consider a quadratic form $Q(x,y,z)$ on $\mathbb{R}^3$. Let $E_Q = \{(x,y,z): Q\,(x,y,z) = 1\}$. For which of the following is E_Q a bounded subset of $\mathbb{R}^3$?

1. $Q(x,y,z) = x^2 + y^2 + z^2$
2. $Q(x,y,z) = x^2 + y^2 - z^2$
3. $Q(x,y,z) = x^2 - y^2 - z^2$
4. $Q(x,y,z) = -x^2 + y^2 - z^2$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932089**
Option 1 ID : **3398938125**
Option 2 ID : **3398938126**
Option 3 ID : **3398938127**
Option 4 ID : **3398938128**
Status : **Marked For Review**
Chosen Option : **1**

Q.9 Let $\mathbb{R}$ denote the set of real numbers and X be a non-empty set. Let Y be the set of all functions from $\mathbb{R}$ to X. Then which of the following is true?

1. If X is finite, then Y is countable
2. Y is always infinite
3. If Y is infinite, then Y is uncountable
4. If Y is uncountable, then X is uncountable

Options 1. 1
2. 2
3. 3

4. 4

Question Type : **MCQ**
Question ID : **3398932078**
Option 1 ID : **3398938081**
Option 2 ID : **3398938082**
Option 3 ID : **3398938083**
Option 4 ID : **3398938084**
Status : **Not Answered**
Chosen Option : **--**

Q.10 Let $f(t) = t^n + a_{n-1}t^{n-1} + \cdots + a_1 t + a_0$ be a non-constant even degree polynomial with real coefficients and $a_0 < 0$. Then the polynomial f

1. need not have a real root.
2. has at least two distinct real roots
3. has at least two real roots but need not be distinct
4. can have at most one real root

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932083**
Option 1 ID : **3398938101**
Option 2 ID : **3398938102**
Option 3 ID : **3398938103**
Option 4 ID : **3398938104**
Status : **Marked For Review**
Chosen Option : **2**

Q.11 Let A and B be 3×3 matrices with real entries.

Let $V_1 = \{v \in \mathbb{R}^3 \mid ABv = 0\}$,

$V_2 = \{v \in \mathbb{R}^3 \mid Bv = 0\}$, and

$V_3 = \{v \in \mathbb{R}^3 \mid Av = 0\}$.

Which of the following is necessarily true?

1. $\dim V_1 = \dim V_2 \Rightarrow A$ is invertible
2. $\dim V_1 = \dim V_3 \Rightarrow A$ is invertible
3. A is invertible $\Rightarrow \dim V_1 = \dim V_2$
4. A is invertible $\Rightarrow \dim V_1 = \dim V_3$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**

Question ID : **3398932085**
Option 1 ID : **3398938109**
Option 2 ID : **3398938110**
Option 3 ID : **3398938111**
Option 4 ID : **3398938112**
Status : **Not Answered**
Chosen Option : **--**

Q.12 Consider the ordered basis $v_1 = (1,0,0)$, $v_2 = (1,1,0)$, $v_3 = (1,1,1)$ of $\mathbb{R}^3$.
What are the co-ordinates of $(1,2,3)$ with respect to this basis?

1. $(-1,1,3)$
2. $(-1,-1,3)$
3. $(1,1,3)$
4. $(1,-1,3)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932084**
Option 1 ID : **3398938105**
Option 2 ID : **3398938106**
Option 3 ID : **3398938107**
Option 4 ID : **3398938108**
Status : **Marked For Review**
Chosen Option : **2**

Q.13 Which of the following sets lies in the region of convergence of $\sum_{n=0}^{\infty}(3z-2i)^{3n}$?

1. $\left\{x+\frac{2i}{3} : x \in \left(\frac{-1}{3},\frac{1}{3}\right)\right\}$
2. $\left\{x+\frac{2i}{3} : x \in \left(\frac{-1}{2},\frac{1}{9}\right)\right\}$
3. $\left\{x+\frac{2i}{3} : x \in \left(\frac{-1}{27},\frac{20}{27}\right)\right\}$
4. $\left\{x+\frac{2i}{3} : x \in \left(\frac{-5}{6},\frac{5}{6}\right)\right\}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932092**
Option 1 ID : **3398938137**
Option 2 ID : **3398938138**
Option 3 ID : **3398938139**
Option 4 ID : **3398938140**
Status : **Marked For Review**
Chosen Option : **1**

Q.14

Let S_5 denote the symmetric group on 5 letters. Which of the following is always true?

1. If $\sigma \in S_5$ is a k-cycle, then σ^i is also a k-cycle for all $2 \leq k \leq 5$ and $i \geq 1$.
2. If $\sigma, \tau \in S_5$ have both order 5, then $\sigma\tau$ also has order 5
3. Any 3-cycle in S_5 can be written as a product of two 5-cycles
4. Any 2-cycle in S_5 can be written as a product of two 5-cycles

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932095**
Option 1 ID : **3398938149**
Option 2 ID : **3398938150**
Option 3 ID : **3398938151**
Option 4 ID : **3398938152**
Status : **Not Answered**
Chosen Option : **--**

Q.15 Let $\alpha \in \mathbb{R}$. Consider $\mathbb{R}$ and $\mathbb{R}^2$ with the usual topology. Consider the set $A = \{(x,y) \in \mathbb{R}^2 / xy = 1\} \cup \{(0,0)\}$ in $\mathbb{R}^2$ with subspace topology. The maps $f_1 : A \to \mathbb{R}$ and $f_2 : A \to \mathbb{R}$ are given by $f_1(x,y) = x + \alpha$ and $f_2(x,y) = y$. Which of the following statements is true?

1. The map f_2 is continuous but f_1 is not continuous
2. The maps f_1 and f_2 are open maps
3. The maps f_1 and f_2 are closed maps
4. The set $\{(x,y) \in A \mid f_1(x,y) = f_2(x,y)\}$ is closed

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932097**
Option 1 ID : **3398938157**
Option 2 ID : **3398938158**
Option 3 ID : **3398938159**
Option 4 ID : **3398938160**
Status : **Not Answered**
Chosen Option : **--**

Q.16 Let $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ be the open unit disc and $f : \mathbb{D} \to \mathbb{C}$ a holomorphic function such that $|f(z)| \leq 1$ on $\mathbb{D}$. Suppose that $f(0) = \frac{1}{\sqrt{2}} + \frac{i}{\sqrt{2}}$. Then

1. $f\left(-\frac{1}{2}\right) = \frac{1}{\sqrt{2}} - \frac{i}{\sqrt{2}}$
2. $f\left(-\frac{1}{2}\right) = \frac{1}{\sqrt{3}} - \frac{i}{\sqrt{3}}$
3. $f\left(\frac{1}{2}\right) = \frac{1}{\sqrt{2}} + \frac{i}{\sqrt{2}}$
4. $f\left(\frac{1}{2}\right) = \frac{1}{\sqrt{3}} + \frac{i}{\sqrt{3}}$

Options 1. 1

2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932093**
Option 1 ID : **3398938141**
Option 2 ID : **3398938142**
Option 3 ID : **3398938143**
Option 4 ID : **3398938144**
Status : **Marked For Review**
Chosen Option : **3**

Q.17 Let f be a non-constant entire function and γ the positively oriented circle $\{z \in \mathbb{C} : |z| = 2\}$. Then

$\frac{1}{\pi}\int_{\gamma} \frac{f(z)}{z^2+1} dz$ equals

1. $f(1) + f(-1)$
2. $f(1) - f(-1)$
3. $f(i) + f(-i)$
4. $f(i) - f(-i)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932090**
Option 1 ID : **3398938129**
Option 2 ID : **3398938130**
Option 3 ID : **3398938131**
Option 4 ID : **3398938132**
Status : **Marked For Review**
Chosen Option : **4**

Q.18 Let F be a finite field of order q. What is the number of 2-dimensional subspaces of the vector space F^3 over F?

1. q^3
2. q^2
3. $(q^3 - 1)/(q - 1)$
4. $q^3 - 1$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932096**
Option 1 ID : **3398938153**
Option 2 ID : **3398938154**
Option 3 ID : **3398938155**

Option 4 ID : **3398938156**
Status : **Not Answered**
Chosen Option : **--**

Q.19 For which value of a among the following does $f(z) = \frac{az+2}{3z+1}$ map the upper half plane $\mathbb{H} = \{z \in \mathbb{C}: z = x + iy, y > 0\}$ to $\mathbb{H}$?

1. 1
2. 3
3. 5
4. 7

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932091**
Option 1 ID : **3398938133**
Option 2 ID : **3398938134**
Option 3 ID : **3398938135**
Option 4 ID : **3398938136**
Status : **Marked For Review**
Chosen Option : **4**

Q.20 Let R_1 be the ring $\mathbb{Z}/(11\,\mathbb{Z})$ and let R_2 be the ring $\mathbb{Z}/(13\,\mathbb{Z})$. Let

A = number of ideals in the product ring $R_1 \times R_2$

B = number of ring homomorphisms $R_1 \to R_2$ sending 1 to 1

C = number of ring homomorphisms $R_2 \to R_1$ sending 1 to 1

What is $A + B + C$?

1. 3
2. 4
3. 6
4. 8

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932094**
Option 1 ID : **3398938145**
Option 2 ID : **3398938146**
Option 3 ID : **3398938147**
Option 4 ID : **3398938148**
Status : **Not Answered**
Chosen Option : **--**

Q.21

Let $|f(x)| \leq 4|x|$ for $x \in \mathbb{R}$. The largest possible value of $|x(1)|$ where $x'(t) = f(x(t)), t > 0, x(0) = 3,$ is

1. $3e^4$
2. $4e^3$
3. $12e^3$
4. $12e^4$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932098**
Option 1 ID : **3398938161**
Option 2 ID : **3398938162**
Option 3 ID : **3398938163**
Option 4 ID : **3398938164**
Status : **Not Answered**
Chosen Option : **--**

Q.22 Assume that $a, b \in \mathbb{R}\setminus\{0\}$ and $a^2 \neq b^2$. Suppose that the Gauss-Seidel method is used to solve the system of equations

$$\begin{bmatrix} a & b \\ b & a \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}.$$

Then the set of all values of (a, b) such that the method converges for every choice of initial vector is

1. $\{(a,b) \mid a^2 < b^2\}$
2. $\{(a,b) \mid a < |b|\}$
3. $\{(a,b) \mid |b| < |a|\}$
4. $\{(a,b) \mid a^2 + b^2 < 1\}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932102**
Option 1 ID : **3398938177**
Option 2 ID : **3398938178**
Option 3 ID : **3398938179**
Option 4 ID : **3398938180**
Status : **Not Answered**
Chosen Option : **--**

Q.23

If $\varphi: [0,1] \to \mathbb{R}$ is continuous and satisfies

$$\int_0^x (x-t)^2 \varphi(t)dt = x^4 + x^5,$$

then $\varphi(1) =$

1. 18
2. 30
3. 42
4. 48

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932104**
Option 1 ID : **3398938185**
Option 2 ID : **3398938186**
Option 3 ID : **3398938187**
Option 4 ID : **3398938188**
Status : **Marked For Review**
Chosen Option : **3**

Q.24 Let $u(x,y,z) = C_1$ and $v(x,y,z) = C_2$ be two independent families of smooth surfaces. Let $P, Q, R \in C^1(\mathbb{R}^3)$ and for any $\xi \in \mathbb{R}^3$, that lies on the curve of intersection of $u(x,y,z) = C_1$ and $v(x,y,z) = C_2$, $(P(\xi), Q(\xi), R(\xi))$ is in the direction of the tangent to the curve of intersection at ξ. Then a general solution z of $P\frac{\partial z}{\partial x} + Q\frac{\partial z}{\partial y} = R$ is implicitly given by

1. $u + v = f(u+v)$ for every $f \in C^1(\mathbb{R})$
2. $uv = f(u)$ for every $f \in C^1(\mathbb{R})$
3. $u = f(uv)$ for every $f \in C^1(\mathbb{R})$
4. $uv = f(uv)$ for every $f \in C^1(\mathbb{R})$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932101**
Option 1 ID : **3398938173**
Option 2 ID : **3398938174**
Option 3 ID : **3398938175**
Option 4 ID : **3398938176**
Status : **Not Answered**
Chosen Option : **--**

Q.25

Let $\bar{q} = (q_1, \dots, q_n)$ be the generalized coordinates and $\bar{p} = (p_1, \dots, p_n)$ be the generalized momenta of a system. Let the Poisson bracket of two quantities f, g be denoted by $[f, g]_{\bar{q},\bar{p}}$ and the Hamiltonian of the system be H. Then which of the following statements is true?

1. If $\frac{\partial f}{\partial t} = 0, [H, f]_{\bar{q},\bar{p}} = 0$ then f is a conserved quantity
2. If f is a conserved quantity then $[f, p_i]_{\bar{q},\bar{p}} = 0,\ 1 \le i \le n$
3. If f is a conserved quantity then $[f, q_i]_{\bar{q},\bar{p}} = 0,\ 1 \le i \le n$
4. There exists a canonical transformation $(\bar{q}, \bar{p}) \to (\bar{Q}, \bar{P})$ such that $[f, g]_{\bar{q},\bar{p}} \neq [f, g]_{\bar{Q},\bar{P}}$ for some f, g

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932105**
Option 1 ID : **3398938189**
Option 2 ID : **3398938190**
Option 3 ID : **3398938191**
Option 4 ID : **3398938192**
Status : **Not Answered**
Chosen Option : **--**

Q.26 The 2nd order partial differential equation

$$e^x \frac{\partial^2 u}{\partial x^2} + (x^2 + y^2 - 1) \frac{\partial^2 u}{\partial y^2} = 0 \text{ is}$$

1. elliptic inside the unit circle with centre at $(0,0)$
2. hyperbolic outside the unit circle with centre at $(0,0)$
3. elliptic outside the unit circle with centre at $(0,0)$
4. parabolic for $x, y \in \mathbb{R}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932100**
Option 1 ID : **3398938169**
Option 2 ID : **3398938170**
Option 3 ID : **3398938171**
Option 4 ID : **3398938172**
Status : **Marked For Review**
Chosen Option : **3**

Q.27

The critical point $(0,0)$ for the system of equations

$$x'(t) = x^2 + y^2 - 2x$$
$$y'(t) = 3x^2 - x + 3y$$

is a

1. stable point
2. source point
3. saddle point
4. spiral stable point

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932099**
Option 1 ID : **3398938165**
Option 2 ID : **3398938166**
Option 3 ID : **3398938167**
Option 4 ID : **3398938168**
Status : **Not Answered**
Chosen Option : **--**

Q.28 The extremal for the following functional

$$\int_0^1 \left(\alpha t x(t) + (x'(t))^2\right) dt, \qquad \alpha \neq 0,$$

where $x(0) = 1, x'(0) = 0$, is

1. $\frac{\alpha}{12} t^3 + 1$
2. $t^3 + \alpha t^2 + 1$
3. $t^2 + t + 1$
4. $t^4 + \alpha t^2 + 1$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932103**
Option 1 ID : **3398938181**
Option 2 ID : **3398938182**
Option 3 ID : **3398938183**
Option 4 ID : **3398938184**
Status : **Marked For Review**
Chosen Option : **1**

Q.29 Let X_1, X_2 be i.i.d. random variables from an exponential distribution with mean $\frac{1}{\theta}$ where $\theta > 0$. Suppose that the prior distribution for θ is exponential with mean 1. Then the Bayes estimator for θ with respect to the squared error loss function is

1. $\frac{X_1+X_2}{2} + 1$
2. $\frac{2}{X_1+X_2}$
3. $\frac{3}{X_1+X_2+1}$
4. $\frac{1}{3(X_1+X_2)}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932112**
Option 1 ID : **3398938217**
Option 2 ID : **3398938218**
Option 3 ID : **3398938219**
Option 4 ID : **3398938220**
Status : **Not Answered**
Chosen Option : **--**

Q.30 Let $N, X_1, X_2, X_3, \ldots$ be independent random variables where N has Poisson (λ) distribution and X_k has normal distribution with mean k and variance k^2 for each $k \geq 1$. Then, the variance of X_{N+1} is

1. λ
2. $\lambda^2 + 3\lambda + 1$
3. $\lambda^2 + 4\lambda + 2$
4. $\lambda^2 + 4\lambda + 1$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932107**
Option 1 ID : **3398938197**
Option 2 ID : **3398938198**
Option 3 ID : **3398938199**
Option 4 ID : **3398938200**
Status : **Not Answered**
Chosen Option : **--**

Q.31

Consider the set Ω of all 4-tuples (x_1, x_2, x_3, x_4) of integers such that each $x_i \geq 0$ and $x_1 + x_2 + x_3 + x_4 = 90$. If a point is selected uniformly at random from Ω, the conditional probability that $x_1 \geq 1$ given that $x_3 \geq 44$ and $x_4 \geq 44$ equals

1. $\frac{1}{4}$
2. $\frac{1}{3}$
3. $\frac{2}{5}$
4. $\frac{1}{8}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932106**
Option 1 ID : **3398938193**
Option 2 ID : **3398938194**
Option 3 ID : **3398938195**
Option 4 ID : **3398938196**
Status : **Not Answered**
Chosen Option : **--**

Q.32 In a block design with b blocks and v treatments, every treatment pair occurs exactly once in each block. Then the resulting design will be

1. connected and incomplete
2. not connected and complete
3. connected and complete
4. not connected and incomplete

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932116**
Option 1 ID : **3398938233**
Option 2 ID : **3398938234**
Option 3 ID : **3398938235**
Option 4 ID : **3398938236**
Status : **Not Answered**
Chosen Option : **--**

Q.33 In a simple linear regression model, assume that the random errors $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_n$ are uncorrelated and homoscedastic. Then we may conclude that the residuals $e_1, e_2, \ldots, e_n$ are

1. uncorrelated and homoscedastic
2. correlated and homoscedastic
3. uncorrelated and heteroscedastic
4. correlated and heteroscedastic

Options 1. 1
2. 2

3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932113**
Option 1 ID : **3398938221**
Option 2 ID : **3398938222**
Option 3 ID : **3398938223**
Option 4 ID : **3398938224**
Status : **Not Answered**
Chosen Option : **--**

Q.34 Let $X_1, X_2, \dots, X_n$, be a random sample from $N(\theta, 1)$ distribution. For testing $H_0: \theta = 0$ against $H_1: \theta < 0$, if the UMP test is used and if the observed sample mean is 1, then

1. the test is biased
2. H_0 is rejected at 5% level of significance
3. H_0 is **NOT** rejected at 1% level of significance
4. p-value of the test is less than $\frac{1}{2}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932111**
Option 1 ID : **3398938213**
Option 2 ID : **3398938214**
Option 3 ID : **3398938215**
Option 4 ID : **3398938216**
Status : **Not Answered**
Chosen Option : **--**

Q.35 Consider a Markov chain with state space $S = \{0,1,\dots,1000\}$ and transition probabilities given by $p_{i,i+1} = 1$ for $0 \le i \le 999$ and $p_{1000,1000} = p_{1000,0} = \frac{1}{2}$.
Then

1. $\lim_{n\to\infty} p_{ij}^{(n)} = \frac{1}{1000}$ for all i, j
2. $\lim_{n\to\infty} p_{ij}^{(n)} = \frac{1}{1000}$ for all $i, j \le 999$
3. $\lim_{n\to\infty} p_{ij}^{(n)} = \frac{1}{1001}$ for all i, j
4. $\lim_{n\to\infty} p_{ij}^{(n)} = \frac{1}{1002}$ for all $i, j \le 999$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932108**
Option 1 ID : **3398938201**
Option 2 ID : **3398938202**
Option 3 ID : **3398938203**
Option 4 ID : **3398938204**

Status : **Not Answered**
Chosen Option : **--**

Q.36 The goal is to estimate the unknown parameter μ as accurately as possible. You are offered a choice between two data sets. Assume $n \geq 2$.

(A) : $X_1, X_2, \ldots, X_n$ i. i. d. normal with mean μ and variance 1

(B): $Y_1, Y_2, \ldots, Y_n$ i. i. d. normal with mean 2μ and variance 2

Then

1. data (A) is preferable
2. data (B) is preferable
3. both data sets are equally good
4. which data set is preferable depends on the value of n

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932117**
Option 1 ID : **3398938237**
Option 2 ID : **3398938238**
Option 3 ID : **3398938239**
Option 4 ID : **3398938240**
Status : **Not Answered**
Chosen Option : **--**

Q.37 Let $X_1, X_2, \ldots, X_n$ be i.i.d. $\mathrm{Uniform}(0, \theta)$ random variables where $\theta > 0$. Then, a consistent estimator of θ is

1. $\min(X_1, \ldots, X_n) + \frac{1}{n}$
2. $\frac{1}{n}(X_1 + \cdots + X_n)$
3. $\max(X_1, \ldots, X_n) - \frac{1}{n}$
4. $\frac{n}{X_1 + \cdots + X_n}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932110**
Option 1 ID : **3398938209**
Option 2 ID : **3398938210**
Option 3 ID : **3398938211**
Option 4 ID : **3398938212**
Status : **Not Answered**
Chosen Option : **--**

Q.38

X is a Poisson random variable with parameter 20. The conditional distribution of Y given $X = k$ is $\text{Binomial}\left(k, \frac{1}{2}\right)$ for $k \geq 1$ and $P(Y = 0|X = 0) = 1$. Then the distribution (unconditional) of Y is

1. $\text{Poisson}(10)$
2. $\text{Poisson}(20)$
3. $\text{Poisson}(40)$
4. $\text{Binomial}\left(20, \frac{1}{2}\right)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932109**
Option 1 ID : **3398938205**
Option 2 ID : **3398938206**
Option 3 ID : **3398938207**
Option 4 ID : **3398938208**
Status : **Not Answered**
Chosen Option : **--**

Q.39 From a population of $N = nk$ units, a sample of size n is drawn using linear systematic sampling scheme. Then the inclusion probability of the i^{th} unit for $i = 1, \dots, N$ is

1. $\frac{1}{N}$
2. $\frac{1}{n}$
3. $\frac{1}{k}$
4. $\frac{k!}{N!}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932115**
Option 1 ID : **3398938229**
Option 2 ID : **3398938230**
Option 3 ID : **3398938231**
Option 4 ID : **3398938232**
Status : **Not Answered**
Chosen Option : **--**

Q.40

Suppose $B = \left(\left(b_{ij}\right)\right) \sim W_p(k, \Sigma)$ (Wishart distribution), where $p = 7,\ k = 12$ and $\Sigma = \left(\left(\sigma_{ij}\right)\right)$ is a positive definite matrix. Then the distribution of

$\frac{\sum_{i=1}^{p}\sum_{j=1}^{p} b_{ij}}{\sum_{i=1}^{p}\sum_{j=1}^{p} \sigma_{ij}}$ is

1. χ_1^2
2. χ_7^2
3. χ_{12}^2
4. χ_5^2

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MCQ**
Question ID : **3398932114**
Option 1 ID : **3398938225**
Option 2 ID : **3398938226**
Option 3 ID : **3398938227**
Option 4 ID : **3398938228**
Status : **Not Answered**
Chosen Option : **--**

Section : **Part C Mathematical Sciences**

Q.1 Let A be a 3×3 matrix over $\mathbb{C}$. Let $\omega = e^{2\pi i/3}$. Which of the following are true?

1. If $A^3 = I$, then the eigenvalues of A are $1, \omega, \omega^2$
2. If $A^3 = I$, then every eigenvalue of A is in the set $\{1, \omega, \omega^2\}$
3. If the eigenvalues of A are $1, \omega, \omega^2$, then $A^3 = I$
4. If every eigenvalue of A is in the set $\{1, \omega, \omega^2\}$, then $A^3 = I$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932132**
Option 1 ID : **3398938297**
Option 2 ID : **3398938298**
Option 3 ID : **3398938299**
Option 4 ID : **3398938300**
Status : **Marked For Review**
Chosen Option : **2**

Q.2

Consider the infinite series

$$\sum_{n=1}^{\infty}(-1)^n \frac{\cos(nx)}{n^2+x^2}, \quad \text{where } x \in \mathbb{R}.$$

The largest set on which it converges uniformly is:

1. $\mathbb{R}$
2. $\mathbb{R}\setminus\{0\}$
3. $\mathbb{R}\setminus\{n\pi : n \in \mathbb{Z}\}$
4. $[0, 2\pi]$

Options 1. 1
2. 2
3. 3
4. 4

Question Type :	**MSQ**
Question ID :	**3398932120**
Option 1 ID :	**3398938249**
Option 2 ID :	**3398938250**
Option 3 ID :	**3398938251**
Option 4 ID :	**3398938252**
Status :	**Marked For Review**
Chosen Option :	**1**

Q.3 Let V be an n dimensional inner product space over $\mathbb{R}$, where $n \geq 2$. A linear map $T: V \to V$ is said to be an orthogonal map if $\langle Tv, w\rangle = \langle v, T^{-1}w\rangle$ for all $v, w \in V$. Which of the following are true?

1. T is orthogonal $\Rightarrow$ T is diagonalizable over $\mathbb{R}$
2. T diagonalizable over $\mathbb{R}$ $\Rightarrow$ T is orthogonal
3. T is orthogonal $\Leftrightarrow \langle Tv, Tw\rangle = \langle v, w\rangle$ for all $v, w \in V$
4. T is orthogonal $\Leftrightarrow \langle Tv, Tv\rangle = \langle v, v\rangle$ for all $v \in V$

Options 1. 1
2. 2
3. 3
4. 4

Question Type :	**MSQ**
Question ID :	**3398932134**
Option 1 ID :	**3398938305**
Option 2 ID :	**3398938306**
Option 3 ID :	**3398938307**
Option 4 ID :	**3398938308**
Status :	**Not Answered**
Chosen Option :	**--**

Q.4

Let I be any interval in $\mathbb{R}$. Let $f, g: I \to \mathbb{R}$ be uniformly continuous functions. If $h(x) = f(x)g(x)$, then h is uniformly continuous if

1. either f or g is bounded
2. I is compact
3. I is bounded
4. I is closed

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932121**
Option 1 ID : **3398938253**
Option 2 ID : **3398938254**
Option 3 ID : **3398938255**
Option 4 ID : **3398938256**
Status : **Not Answered**
Chosen Option : **--**

Q.5 Let (x_n) be a sequence of real numbers with $|x_n| > 2$. Then which of the following are true?

1. $\lim_{n\to\infty} x_n = \infty \Rightarrow \lim_{n\to\infty} \left(1 + \frac{1}{x_n}\right)^{x_n} = \infty$
2. $\lim_{n\to\infty} x_n = \infty \Rightarrow \lim_{n\to\infty} \left(1 + \frac{1}{x_n}\right)^{x_n} = 1$
3. $\lim_{n\to\infty} x_n = -\infty \Rightarrow \lim_{n\to\infty} \left(1 + \frac{1}{x_n}\right)^{x_n} = 0$
4. $\lim_{n\to\infty} x_n = -\infty \Rightarrow \lim_{n\to\infty} \left(1 + \frac{1}{x_n}\right)^{x_n} > 1$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932118**
Option 1 ID : **3398938241**
Option 2 ID : **3398938242**
Option 3 ID : **3398938243**
Option 4 ID : **3398938244**
Status : **Marked For Review**
Chosen Option : **4**

Q.6 For $x, y \in \mathbb{R}^2$ define $\langle x, y\rangle = x^t A y$, where A is a 2×2 matrix with real entries. For which of the following choices of A does this define an inner product on $\mathbb{R}^2$?

1. $A = \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}$
2. $A = \begin{bmatrix} -3 & 2 \\ 2 & -1 \end{bmatrix}$
3. $A = \begin{bmatrix} 2 & 2 \\ 2 & 1 \end{bmatrix}$
4. $A = \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix}$

Options 1. 1

2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932133**
Option 1 ID : **3398938301**
Option 2 ID : **3398938302**
Option 3 ID : **3398938303**
Option 4 ID : **3398938304**
Status : **Not Answered**
Chosen Option : **--**

Q.7 Let V be a finite dimensional vector space over a field K. Then, which of the following are true?

1. V is not a union of two proper subspaces
2. If V has exactly two subspaces, then V is isomorphic to K as a vector space
3. V is not a union of finitely many proper subspaces
4. If $\dim V > 1$, then the intersection of all non-zero subspaces of V is a non-zero subspace

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932129**
Option 1 ID : **3398938285**
Option 2 ID : **3398938286**
Option 3 ID : **3398938287**
Option 4 ID : **3398938288**
Status : **Not Answered**
Chosen Option : **--**

Q.8 Let $v_1,\ v_2,\ w_1,\ w_2$ be vectors in $\mathbb{R}^4$ such that $v_1,\ v_2,\ v_1+w_1,\ v_2+\ w_2$ is a basis of $\mathbb{R}^4$. Which of the following are bases of $\mathbb{R}^4$?

1. $v_1,\ v_2,\ 2v_1+3w_2,\ 5v_2-3w_1$
2. $v_1,\ v_2,\ 2v_1+\ 2w_1,\ v_1+w_2$
3. $v_1+v_2,\ v_2,\ w_1,\ 2v_1+5v_2-4w_1$
4. $v_1+v_2,\ v_2,\ w_1+w_2,\ 2v_1+v_2+w_1+w_2$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932130**
Option 1 ID : **3398938289**
Option 2 ID : **3398938290**
Option 3 ID : **3398938291**
Option 4 ID : **3398938292**
Status : **Not Answered**
Chosen Option : **--**

Q.9 Let (X, d) be a metric space. Which of the following are NOT in general a metric on X?

1. $\rho(x,y) = (d(x,y))^2$
2. $\rho(x,y) = \sqrt{d(x,y)}$
3. $\rho(x,y) = \min\{d(x,y), 1\}$
4. $\rho(x,y) = \begin{cases} 0 \text{ if } d(x,y) = 0 \\ 1 \text{ if } d(x,y) > 0 \end{cases}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932127**
Option 1 ID : **3398938277**
Option 2 ID : **3398938278**
Option 3 ID : **3398938279**
Option 4 ID : **3398938280**
Status : **Marked For Review**
Chosen Option : **2,3,4**

Q.10 Which of the following matrices are diagonalizable over $\mathbb{C}$?

1. $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
2. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{bmatrix}$
3. $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
4. $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932128**
Option 1 ID : **3398938281**
Option 2 ID : **3398938282**
Option 3 ID : **3398938283**
Option 4 ID : **3398938284**
Status : **Marked For Review**
Chosen Option : **2,4**

Q.11

Let T be a 3×3 matrix with entries in $\mathbb{R}$. Consider the system of linear equations $T\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$. Which of the following are true?

1. Rank of $T \le 2 \implies$ the system has a non-zero solution
2. Rank of $T \le 1 \implies$ the system has infinitely many solutions
3. Rank of $T \ge 2 \implies$ any two solutions of the system are linearly dependent
4. Rank of $T \ge 1 \implies$ every $\begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{pmatrix} \in \mathbb{R}^3$ is a solution of the system

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932135**
Option 1 ID : **3398938309**
Option 2 ID : **3398938310**
Option 3 ID : **3398938311**
Option 4 ID : **3398938312**
Status : **Marked For Review**
Chosen Option : **4**

Q.12 Consider $f_n(x) = \frac{1}{n} e^{-x/n}$ for $x \in [0, \infty)$. Then which of the following are true?

1. $\{f_n\}$ converges uniformly
2. The sequence of derivatives $\{f_n'\}$ converges uniformly
3. $\lim_{n\to\infty} \int_0^\infty f_n(x)\,dx \neq \int_0^\infty \left(\lim_{n\to\infty} f_n(x)\right) dx$
4. $\lim_{n\to\infty} \int_0^\infty f_n(x)\,dx = \int_0^\infty \left(\lim_{n\to\infty} f_n(x)\right) dx$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932123**
Option 1 ID : **3398938261**
Option 2 ID : **3398938262**
Option 3 ID : **3398938263**
Option 4 ID : **3398938264**
Status : **Marked For Review**
Chosen Option : **1,2,3**

Q.13

Let T_1, T_2 be linear operators on $\mathbb{R}^2$ such that $T_1T_2 = 0$. Which of the following are necessarily true?

1. 0 is an eigenvalue of T_1 or 0 is an eigenvalue of T_2
2. There exists a nonzero vector $w \in \mathbb{R}^2$ such that $T_1w = T_2w = 0$
3. $T_2T_1 = 0$
4. $T_1 = 0$ or $T_2 = 0$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932131**
Option 1 ID : **3398938293**
Option 2 ID : **3398938294**
Option 3 ID : **3398938295**
Option 4 ID : **3398938296**
Status : **Not Answered**
Chosen Option : **--**

Q.14 Let $f: \mathbb{R}^2 \to \mathbb{R}$ be defined as $f(x,y) = x|x| + |y|$. Then which of the following are true?

1. f is differentiable at $(0,0)$
2. f is not differentiable at $(0,0)$ but all its directional derivatives at $(0,0)$ exist
3. $\frac{\partial f}{\partial x}(0,0)$ exists and equals 0
4. $\frac{\partial f}{\partial y}(0,0)$ exists and equals 0

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932126**
Option 1 ID : **3398938273**
Option 2 ID : **3398938274**
Option 3 ID : **3398938275**
Option 4 ID : **3398938276**
Status : **Not Answered**
Chosen Option : **--**

Q.15 Let $f: [a,b) \to \mathbb{R}$ be a continuous function. Define $F: [a,b) \to \mathbb{R}$ by
$F(x) = \max_{t \in [a,x]} f(t)$

Then which of the following are true?

1. F need not be continuous
2. F is necessarily monotonic
3. F is necessarily bounded
4. F is Riemann integrable on $[a,x]$ for every $x \in [a,b)$

Options 1. 1
2. 2

3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932122**
Option 1 ID : **3398938257**
Option 2 ID : **3398938258**
Option 3 ID : **3398938259**
Option 4 ID : **3398938260**
Status : **Not Answered**
Chosen Option : **--**

Q.16 Let $P(x)$ be a polynomial with real coefficients and of degree $n \geq 1$. Then which of the following are true?

1. If n is odd, then $P(x)$ has a real root
2. If $P(x)$ has only real roots then its derivative $P'(x)$ has only real roots
3. If $P'(x)$ has only real roots, then $P(x)$ has only real roots
4. If n is odd, then $P(x)$ takes every real value as x varies over reals

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932119**
Option 1 ID : **3398938245**
Option 2 ID : **3398938246**
Option 3 ID : **3398938247**
Option 4 ID : **3398938248**
Status : **Marked For Review**
Chosen Option : **1**

Q.17 Let $f: \mathbb{R}^2 \to \mathbb{R}$ be defined as

$$f(x,y) = \begin{cases} \dfrac{xy^3}{x^2+y^6} & \text{if } (x,y) \neq (0,0) \\ 0 & \text{if } (x,y) = (0,0) \end{cases}$$

Then which of the following are true?

1. f is bounded on $\mathbb{R}^2$
2. the restriction of f to each line of the form $y = mx$ is continuous at $(0,0)$
3. f is continuous at $(0,0)$
4. f is not continuous at $(0,0)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932125**
Option 1 ID : **3398938269**
Option 2 ID : **3398938270**
Option 3 ID : **3398938271**
Option 4 ID : **3398938272**
Status : **Marked For Review**

Chosen Option : **2,4**

Q.18 For any interval I of $\mathbb{R}$ let $BV(I)$ denote the space of all functions on I which are of bounded variation. Then which of the following statements are true?

1. If f, g belong to $BV([a,b])$ then the product $f.g$ belongs to $BV([a,b])$
2. If $\{f_n\}$ is a sequence in $BV([a,b])$ that converges to f pointwise, then f belongs to $BV([a,b])$
3. If $f: [0,\infty) \to \mathbb{R}$ is a function such that f restricted to $[n, n+1]$ belongs to $BV([n, n+1])$ for $n = 0, 1, 2, \ldots$, then f belongs to $BV\big([0,\infty)\big)$
4. The function $f(x) = \begin{cases} \frac{e^x - 1}{x} & \text{if } x \neq 0 \\ 1 & \text{if } x = 0 \end{cases}$ belongs to $BV([a,b])$ for any $a < b$.

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932124**
Option 1 ID : **3398938265**
Option 2 ID : **3398938266**
Option 3 ID : **3398938267**
Option 4 ID : **3398938268**
Status : **Marked For Review**
Chosen Option : **1,2,4**

Q.19 Let $K \subset \mathbb{R}^2$ be an arbitrary non-empty set and let $\pi_1(x,y) = x$ and $\pi_2(x,y) = y$ be the projections from $\mathbb{R}^2$ onto the first and second coordinates respectively. Which of the following statements are true?

1. If K is compact, then $\pi_1(K)$ and $\pi_2(K)$ are both compact
2. If $\pi_1(K)$ and $\pi_2(K)$ are both compact, then K is compact
3. If K is connected, then both $\pi_1(K)$ and $\pi_2(K)$ are connected
4. If $\pi_1(K)$ and $\pi_2(K)$ are both connected, then K is connected

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932147**
Option 1 ID : **3398938357**
Option 2 ID : **3398938358**
Option 3 ID : **3398938359**
Option 4 ID : **3398938360**
Status : **Not Answered**
Chosen Option : **--**

Q.20

Let X be a topological space and let A and B be non-empty subsets of X. Suppose $A \cup B$ and $A \cap B$ are connected. Then, which of the following statements are true?

1. At least one of A and B is connected
2. If A is closed and B is open, then both A and B are connected
3. If A and B are open sets, then both A and B are connected
4. If A and B are closed sets, then both A and B are connected

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932146**
Option 1 ID : **3398938353**
Option 2 ID : **3398938354**
Option 3 ID : **3398938355**
Option 4 ID : **3398938356**
Status : **Not Answered**
Chosen Option : **--**

Q.21 How many 3-sylow subgroups does the symmetric group S_4 have?

1. 8
2. 4
3. 2
4. 1

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932143**
Option 1 ID : **3398938341**
Option 2 ID : **3398938342**
Option 3 ID : **3398938343**
Option 4 ID : **3398938344**
Status : **Marked For Review**
Chosen Option : **2**

Q.22 Let f be a holomorphic function on the open unit disc $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ such that $f\left(\frac{1}{n}\right) = \frac{2n+1}{2n-1}$ for $n = 1, 2, ...$ Let $\Im(w)$ denote the imaginary part of a complex number w. Then, which of the following are true?

1. $\Im(f(i/2)) > 0$ and $\Im(f(-i/2)) < 0$
2. $\Im(f(i/2)) < 0$ and $\Im(f(-i/2)) > 0$
3. $\Im(f(i/2)) > 0$ and $\Im(f(-i/2)) > 0$
4. $\Im(f(i/2)) < 0$ and $\Im(f(-i/2)) < 0$

Options 1. 1
2. 2

3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932137**
Option 1 ID : **3398938317**
Option 2 ID : **3398938318**
Option 3 ID : **3398938319**
Option 4 ID : **3398938320**
Status : **Not Answered**
Chosen Option : **--**

Q.23 Which of the following statements are correct?

1. The fields $\mathbb{Q}(\sqrt{5})$ and $\mathbb{Q}(\sqrt{7})$ are isomorphic as vector spaces over $\mathbb{Q}$
2. The fields $\mathbb{Q}(\sqrt{5})$ and $\mathbb{Q}(\sqrt{7})$ are isomorphic as fields
3. The Galois group of $\mathbb{Q}(\sqrt{5})/\mathbb{Q}$ is isomorphic to the Galois group of $\mathbb{Q}(\sqrt{7})/\mathbb{Q}$
4. The fields $\mathbb{Q}(\sqrt{5},\sqrt{7})$ and $\mathbb{Q}(\sqrt{5}+\sqrt{7})$ are isomorphic as fields

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932145**
Option 1 ID : **3398938349**
Option 2 ID : **3398938350**
Option 3 ID : **3398938351**
Option 4 ID : **3398938352**
Status : **Not Answered**
Chosen Option : **--**

Q.24 Let γ be the positively oriented unit circle in the complex plane. The line integral

$$\oint_{\gamma} e^{2\bar{z}} dz$$

equals

1. 0
2. 1
3. $4\pi i$
4. $-2\pi i$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932136**
Option 1 ID : **3398938313**
Option 2 ID : **3398938314**
Option 3 ID : **3398938315**

Option 4 ID : **3398938316**
Status : **Not Answered**
Chosen Option : **--**

Q.25 Let $\mathbb{D}^* = \{z \in \mathbb{C} : 0 < |z| < 1\}$ be the punctured unit disc in the complex plane. Suppose $f: \mathbb{D}^* \to \mathbb{C}$ is a holomorphic function that satisfies $|f(z)| \leq \frac{1}{|z|}$ for $z \in \mathbb{D}^*$. Such an f

1. necessarily extends to a holomorphic function on the unit disc
2. necessarily has an essential singularity at $z = 0$
3. has at most a simple pole at $z = 0$
4. can have a pole of order 2 at $z = 0$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932138**
Option 1 ID : **3398938321**
Option 2 ID : **3398938322**
Option 3 ID : **3398938323**
Option 4 ID : **3398938324**
Status : **Not Answered**
Chosen Option : **--**

Q.26 The number of $(x_1, x_2, x_3) \in \mathbb{Z}^3$ such that $x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0$ and such that $x_1 + x_2 + x_3 = 9$ is

1. 55
2. odd
3. $\binom{9}{3}$
4. divisible by 3

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932141**
Option 1 ID : **3398938333**
Option 2 ID : **3398938334**
Option 3 ID : **3398938335**
Option 4 ID : **3398938336**
Status : **Answered**
Chosen Option : **2,4**

Q.27

Let $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ be the open unit disc in $\mathbb{C}$ and let $f : \mathbb{D} \to \mathbb{D}$ be a non-constant holomorphic function. Suppose that $f(1/3) = 0$. Which of the following are possible values of $\left|f\left(\frac{1}{2}\right)\right|$?

1. $^4/_5$
2. $^3/_5$
3. $^2/_5$
4. $^1/_5$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932139**
Option 1 ID : **3398938325**
Option 2 ID : **3398938326**
Option 3 ID : **3398938327**
Option 4 ID : **3398938328**
Status : **Not Answered**
Chosen Option : **--**

Q.28 Let $I = \langle xy - 1\rangle \subseteq \mathbb{C}[x, y]$ be an ideal. Which of the following are true?

1. I is a maximal ideal of $\mathbb{C}[x, y]$
2. I is a prime ideal of $\mathbb{C}[x, y]$
3. $\mathbb{C}[x, y]/I$ has infinitely many prime ideals
4. $\mathbb{C}[x, y]/I$ is a finite set

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932144**
Option 1 ID : **3398938345**
Option 2 ID : **3398938346**
Option 3 ID : **3398938347**
Option 4 ID : **3398938348**
Status : **Not Answered**
Chosen Option : **--**

Q.29 Let $\mathbb{R}^*$ be the multiplicative group of nonzero real numbers. Which of the following statements are true?

1. If $H \subseteq \mathbb{R}^*$ is a subgroup such that $x^2 \in H$ for all $x \in \mathbb{R}^*$, then $H = \mathbb{R}^*$
2. If $H \subseteq \mathbb{R}^*$ is a subgroup such that $x^3 \in H$ for all $x \in \mathbb{R}^*$, then $H = \mathbb{R}^*$
3. There is no subgroup of $\mathbb{R}^*$ of index 2
4. There is no subgroup of $\mathbb{R}^*$ of index 3

Options 1. 1
2. 2
3. 3

4. 4

Question Type : **MSQ**
Question ID : **3398932140**
Option 1 ID : **3398938329**
Option 2 ID : **3398938330**
Option 3 ID : **3398938331**
Option 4 ID : **3398938332**
Status : **Not Answered**
Chosen Option : **--**

Q.30 Let p, q be prime numbers such that $q-1$ is divisible by p. How many distinct group homomorphisms $f: \mathbb{Z}/p\mathbb{Z} \to \left(\mathbb{Z}/q\mathbb{Z}\right)^*$ are there? Here $\left(\mathbb{Z}/q\mathbb{Z}\right)^*$ denotes the group of units in the ring $\mathbb{Z}/q\mathbb{Z}$.

1. 0
2. 1
3. $\dfrac{q-1}{p}$
4. p

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932142**
Option 1 ID : **3398938337**
Option 2 ID : **3398938338**
Option 3 ID : **3398938339**
Option 4 ID : **3398938340**
Status : **Marked For Review**
Chosen Option : **4**

Q.31 Consider a circular disc in the xy-plane with the center at $(0,0)$ and radius one. A simple pendulum of length ℓ and mass m is attached to the rim of the disc. Suppose the disc is rotating with a constant angular velocity ω about the origin and the pendulum is moving in the same plane. Assume that the gravitational force is acting along the positive y-axis and $\theta(t)$ denotes the angle of deviation of the pendulum from the mean position at time t. Then a Lagrangian of the system is

1. $L = \frac{1}{2} ml^2\dot{\theta}^2 + ml\omega^2 \sin(\dot{\theta}t - \omega t) + mgl\cos\theta$
2. $L = \frac{1}{2} ml^2\dot{\theta}^2 + ml\omega\dot{\theta} \sin(\theta - \omega t) + mgl\cos\theta$
3. $L = \frac{1}{2} m(l^2\dot{\theta}^2 + \omega^2) + ml\omega\dot{\theta} \sin(\theta - \omega t) + mgl\cos\theta - mg\sin\omega t$
4. $L = \frac{1}{2} ml^2\dot{\theta}^2 + ml\omega\dot{\theta}^2 \sin(\dot{\theta}t - \omega t) + mgl\sin\theta$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932159**
Option 1 ID : **3398938405**

Option 2 ID : **3398938406**
Option 3 ID : **3398938407**
Option 4 ID : **3398938408**
Status : **Not Answered**
Chosen Option : **--**

Q.32 Consider the problem of minimizing /maximizing

$$J[y] = \int_0^{\pi/8} (y'^2 + 2yy' - 16y^2)dx,$$

subject to $y(0) = 0,\ y\left(\frac{\pi}{8}\right) = 1.$ Then

1. every extremizer of J is a minimizer
2. every extremizer of J is a maximizer
3. there exists an extremizer of J which is not a minimizer
4. there exists an extremizer of J which is not a maximizer

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932156**
Option 1 ID : **3398938393**
Option 2 ID : **3398938394**
Option 3 ID : **3398938395**
Option 4 ID : **3398938396**
Status : **Marked For Review**
Chosen Option : **3,4**

Q.33 Consider the integral equation

$$\varphi(x) - \lambda \int_0^{2\pi} \cos(x-t)\varphi(t)dt = f(x), x \in [0,2\pi],$$

where $f \in C[0,2\pi]$.

Then which of the following statements are true?

1. If $\lambda = 10$ and $f(x) = \cos x$, then the integral equation has a solution
2. If $\lambda = \frac{1}{\pi}$ and $f(x) = \cos x$, then the integral equation has no solution
3. For every $\lambda \in \mathbb{R}$ and $f(x) = \cos 2x$, the integral equation has a solution
4. For every $\lambda \in \mathbb{R}$ and $f(x) = \sin 2x$, the integral equation has unique solution

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932158**
Option 1 ID : **3398938401**

Option 2 ID : **3398938402**
Option 3 ID : **3398938403**
Option 4 ID : **3398938404**
Status : **Not Answered**
Chosen Option : **--**

Q.34 Consider the first order initial value problem $y'(x) = -y(x), x > 0, y(0) = 1$ and the corresponding numerical scheme $4\left(\frac{y_{n+1}-y_{n-1}}{2h}\right) - 3\left(\frac{y_{n+1}-y_n}{h}\right) = -y_n$, with $y_0 = 1, y_1 = e^{-h}$, where h is the step size. Then which of the following statements are true?

1. The order of the scheme is 1
2. The order of the scheme is 2
3. $|y_n - y(nh)| \to \infty$ as $n \to \infty$
4. $|y_n - y(nh)| \to 0$ as $n \to \infty$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932154**
Option 1 ID : **3398938385**
Option 2 ID : **3398938386**
Option 3 ID : **3398938387**
Option 4 ID : **3398938388**
Status : **Not Answered**
Chosen Option : **--**

Q.35 Is Jacobi's necessary condition satisfied by the admissible extremal for

$$J[y] = \int_0^b (y'^2 - y^2)dx\ ?$$

1. Yes, for all values of b
2. No, for any value of b
3. Yes, for $b < \pi$
4. Yes, for $b \geq \pi$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932155**
Option 1 ID : **3398938389**
Option 2 ID : **3398938390**
Option 3 ID : **3398938391**
Option 4 ID : **3398938392**
Status : **Not Answered**
Chosen Option : **--**

Q.36

Let $p \in C^1[0,1], q \in C[0,1]$ and p be positive. Consider a solution $x > 0$ of the boundary value problem

$p(t)x''(t) + p'(t)x'(t) + q(t)x(t) = \beta x(t), t \in (0,1), x'(0) = 0 = x'(1)$, where $\beta \in \mathbb{R}$. If $\int_0^1 q(t)dt > 0$ then which of the following statements are true?

1. $\beta \in (-4,-1]$
2. $\beta \in (-1,0]$
3. $\beta \in (0,\infty)$
4. $\beta \in (-\infty,-4]$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932150**
Option 1 ID : **3398938369**
Option 2 ID : **3398938370**
Option 3 ID : **3398938371**
Option 4 ID : **3398938372**
Status : **Not Answered**
Chosen Option : **--**

Q.37 Let $K: [a,b] \times [a,b] \to \mathbb{R}$ be a nonzero continuous map with $K(x,t) = K(t,x)$, for $t, x \in [a,b]$ and $I : C[a,b] \to C[a,b]$ be the identity operator. Define $T, S: C[a,b] \to C[a,b]$ such that for $\varphi \in C[a,b], x \in [a,b]$

$$(T\varphi)(x) = \int_a^x K(x,t)\varphi(t)dt, (S\varphi)(x) = \int_a^b K(x,t)\varphi(t)dt.$$

Then which of the following statements are true?

1. $\forall \lambda \in \mathbb{R} \setminus \{0\}$, the only solution of $(I - \lambda T)\varphi = 0$ is $\varphi \equiv 0$
2. $\forall \lambda \in \mathbb{R} \setminus \{0\}, \forall f \in C[a,b]$, there exists a unique solution of $(I - \lambda T)\varphi = f$
3. $\forall \lambda \in \mathbb{R} \setminus \{0\}, \forall f \in C[a,b]$, there exists a unique solution of $(I - \lambda S)\varphi = f$
4. $\exists \lambda \in \mathbb{R} \setminus \{0\}$ such that $(I - \lambda S)\varphi = 0$ has a nonzero solution

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932157**
Option 1 ID : **3398938397**
Option 2 ID : **3398938398**
Option 3 ID : **3398938399**
Option 4 ID : **3398938400**
Status : **Not Answered**
Chosen Option : **--**

Q.38

Let $B(0,1) = \{(x,y) \in \mathbb{R}^2 : x^2 + y^2 < 1\}$. Consider $u \in C^2(\overline{B(0,1)})$, satisfying $\Delta u + \lambda u = 0$ in $B(0,1)$, $\frac{\partial u}{\partial n} = 0$ on $\partial(B(0,1))$. Then

1. $\lambda \geq 0$
2. $\lambda < 0$
3. $\lambda = 0$ implies $u = 0$
4. $\lambda = 0$ implies u is a constant

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932152**
Option 1 ID : **3398938377**
Option 2 ID : **3398938378**
Option 3 ID : **3398938379**
Option 4 ID : **3398938380**
Status : **Not Answered**
Chosen Option : **--**

Q.39 Consider the integration formula

$$\int_{x_0}^{x_1} f(x)dx = \frac{h}{2}[f(x_0) + f(x_1)] + ph^2(f'(x_0) - f'(x_1)),$$

where $h = x_1 - x_0$. Then the constant p such that the above formula gives the exact value for the highest degree polynomial and the degree d of the corresponding polynomial are given by

1. $p = \frac{1}{6}, d = 4$
2. $p = \frac{1}{12}, d = 3$
3. $p = \frac{1}{6}, d = 3$
4. $p = \frac{1}{12}, d = 4$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932153**
Option 1 ID : **3398938381**
Option 2 ID : **3398938382**
Option 3 ID : **3398938383**
Option 4 ID : **3398938384**
Status : **Not Answered**
Chosen Option : **--**

Q.40

Let $g: \mathbb{R} \to \mathbb{R}$ be locally Lipschitz and $xg(x) \leq 0, \forall x \in \mathbb{R}$. Then which of the following statements are true for the initial value problem

$x'(t) = g(x(t)), \quad x(0) = x_0 \in \mathbb{R}$.

1. There exists a local solution
2. For any $x_0 \in \mathbb{R}$, the solution exists on $[0, \infty)$
3. There is a finite time blow-up for some x_0
4. All the solutions are bounded on $[0, \infty)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932148**
Option 1 ID : **3398938361**
Option 2 ID : **3398938362**
Option 3 ID : **3398938363**
Option 4 ID : **3398938364**
Status : **Not Answered**
Chosen Option : **--**

Q.41 Let $f: \mathbb{R}^2 \to (-\infty, 0]$ be such that $f(0,0) = 0$. Consider the following system of ODEs

$x'(t) = f(x(t), y(t)), \quad y'(t) = y^2(t), t > 0$.

A set $S \subseteq \mathbb{R}^2$ is said to be positively invariant set if the following holds. Assume that $(x(0), y(0)) \in S$. Then for $t \geq 0$, if the solution $(x(t), y(t))$ exists, then $(x(t), y(t)) \in S$. Then which of the following sets are positively invariant

1. $\{(x, y) \in \mathbb{R}^2 : x \leq 0, y \leq 0\}$
2. $\{(x, y) \in \mathbb{R}^2 : \ y \geq 0\}$
3. $\{(x, y) \in \mathbb{R}^2 : x \leq 0, y \leq -1\}$
4. $\{(x, y) \in \mathbb{R}^2 : x \leq 0, y \geq 0\}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932149**
Option 1 ID : **3398938365**
Option 2 ID : **3398938366**
Option 3 ID : **3398938367**
Option 4 ID : **3398938368**
Status : **Not Answered**
Chosen Option : **--**

Q.42

If $u(x, y)$ is the solution of the following problem

$u\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 1$, such that $u(x_0(s), y_0(s)) = u_0(s)$, where

$x_0(s) = s,\ y_0(s) = s,\ u_0(s) = {}^{s}/_{2}$. Then $u(2,1)$ is equal to

1. $1/2$
2. $-(1/2)$
3. 1
4. -1

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932151**
Option 1 ID : **3398938373**
Option 2 ID : **3398938374**
Option 3 ID : **3398938375**
Option 4 ID : **3398938376**
Status : **Not Answered**
Chosen Option : **--**

Q.43 Consider two samples of sizes n_1 and n_2 drawn from a finite population of size $N \geq 10$, using SRSWR and SRSWOR respectively. Suppose population coefficients of variation of the two sample means are the same. Assume that the population mean is positive. Which of the following are true?

1. $n_1 \geq n_2$
2. If $n_1 = n_2$, then $n_2 = 1$
3. $N(n_1 - n_2) = n_2(n_1 - 1)$
4. $n_2(N-1) = n_1(N - n_2)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932173**
Option 1 ID : **3398938461**
Option 2 ID : **3398938462**
Option 3 ID : **3398938463**
Option 4 ID : **3398938464**
Status : **Not Answered**
Chosen Option : **--**

Q.44

Let $X_1, X_2, \ldots, X_m$ be a random sample from a continuous distribution F and let $Y_1, \ldots, Y_n$ be a random sample from a continuous distribution G. We want to test the hypothesis $H_o: F(x) = G(x)\ \forall x$ versus $H_1: G(x) = F(x-\theta), \forall x$, for some fixed $\theta\ (\neq 0)$. Assume that $X_1, \ldots, X_m, Y_1, \ldots, Y_n$ are independent. Let R_{m+j} denote the rank of Y_j in the combined ordering and $S = \sum_{j=1}^{n} R_{m+j}$. Which of the following are true?

1. Under H_o, $P[R_{m+j} = k] = \frac{1}{n+m}$ for $k = 1, 2, \cdots, n+m$
2. If the observed value of S is $\frac{n(n+m+1)}{2}$, then the large sample test does not reject H_0 at level α, for all $0 < \alpha < 1$
3. If $\theta > 0$, a large value of S supports H_1
4. The assumption $n = m$ is needed to obtain the asymptotic null distribution of $\frac{S - E_{H_0}[S]}{\sqrt{\mathrm{Var}_{H0}(S)}}$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932169**
Option 1 ID : **3398938445**
Option 2 ID : **3398938446**
Option 3 ID : **3398938447**
Option 4 ID : **3398938448**
Status : **Not Answered**
Chosen Option : **--**

Q.45 Consider a 2-way analysis of variance experiment with 4 rows, 3 columns and a single observation per cell. The experiment was carried out keeping cells (1,1), (2,2), (3,2) and (4,1) empty. Let $\alpha_i,\ i = 1, 2, 3, 4$ be the row effects and $\beta_j,\ j = 1,2,3$ be the column effects. Which of the following statements are true?

1. Only 2 linearly independent elementary contrasts of α are estimable
2. the elementary contrast $\beta_1 - \beta_2$ is estimable
3. the contrast $\alpha_1 - \alpha_2 + \alpha_3 - \alpha_4$ is not estimable
4. the contrast $\alpha_1 - \alpha_3$ is estimable

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932171**
Option 1 ID : **3398938453**
Option 2 ID : **3398938454**
Option 3 ID : **3398938455**
Option 4 ID : **3398938456**
Status : **Not Answered**
Chosen Option : **--**

Q.46

X is a random variable with normal distribution having mean 1 and variance 4.
Which of the following are true?

1. $E[X^2] = 18$
2. $\mathrm{Var}(X^2) = 48$
3. $E\,[\min(X, 3)] < 1$
4. $E[(X+1)^2] \leq E[(X-1)^2]$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932164**
Option 1 ID : **3398938425**
Option 2 ID : **3398938426**
Option 3 ID : **3398938427**
Option 4 ID : **3398938428**
Status : **Not Answered**
Chosen Option : **--**

Q.47 P is the transition matrix of a finite state space Markov chain. Which of the following statements are necessarily true? (Below I denotes the identity matrix of the same size as P).

1. If P is irreducible then P^2 is irreducible
2. If P is not irreducible then P^2 is not irreducible
3. If P is irreducible then $\frac{I+P}{2}$ is irreducible
4. If P is irreducible and aperiodic, then P^3 is irreducible

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932162**
Option 1 ID : **3398938417**
Option 2 ID : **3398938418**
Option 3 ID : **3398938419**
Option 4 ID : **3398938420**
Status : **Not Answered**
Chosen Option : **--**

Q.48

Consider a LP problem:

Maximize $z = \underline{c}'\underline{x}$ subject to $A\underline{x} \le \underline{b}$, $\underline{x} \ge \underline{0}$.

Which of the following are true?

1. If the primal has an optimal solution, then the dual also has an optimal solution.
2. The primal can have an optimal solution and the dual may have no feasible solution.
3. The dual can have an optimal solution and the primal may have no feasible solution.
4. If the primal has no feasible solution then the dual also has no feasible solution.

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932176**
Option 1 ID : **3398938473**
Option 2 ID : **3398938474**
Option 3 ID : **3398938475**
Option 4 ID : **3398938476**
Status : **Not Answered**
Chosen Option : **--**

Q.49 Let X and Y be two random variables on a probability space. Consider the following statements

A. Each of X and Y is normally distributed

B. X and Y are independent

C. The conditional distribution of X given $Y = y$ and the conditional distribution of Y given $X = x$ are normal for all x and y.

Then for (X, Y) to have a bivariate normal distribution

1. A alone is sufficient
2. A and B together are sufficient
3. A and B are necessary
4. C is necessary

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932172**
Option 1 ID : **3398938457**
Option 2 ID : **3398938458**
Option 3 ID : **3398938459**
Option 4 ID : **3398938460**
Status : **Not Answered**
Chosen Option : **--**

Q.50

Suppose Y_1 and Y_2 are i.i.d. $\text{Uniform}(0,\theta)$, where $\theta > 0$. Define $M = \text{Max}\{Y_1, Y_2\}$. Which of the following are confidence intervals for θ with confidence coefficient 0.91?

1. $\left[M, \frac{10}{3}M\right]$
2. $\left[\frac{9}{10}M, \frac{10}{3}M\right]$
3. $\left[\frac{1}{2}M, \frac{10}{3}M\right]$
4. $\left[\frac{1}{2}M, 2M\right]$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932168**
Option 1 ID : **3398938441**
Option 2 ID : **3398938442**
Option 3 ID : **3398938443**
Option 4 ID : **3398938444**
Status : **Not Answered**
Chosen Option : **--**

Q.51 Let $X_1, X_2, \ldots, X_n$ be i.i.d. random variables with probability mass function given by $p_\theta(x) = \left(\frac{\theta}{2}\right)^{|x|} (1-\theta)^{1-|x|}$ for $x = -1,0,1$, where $\theta \in (0,1)$. Then

1. $\sum_{i=1}^{n} |X_i|$ is complete sufficient for θ
2. $\frac{1}{n}\sum_{i=1}^{n} X_i$ is MLE of θ
3. $\frac{1}{n}\sum_{i=1}^{n} |X_i|$ is MLE of θ
4. $\frac{1}{n}\sum_{i=1}^{n} X_i$ is unbiased for θ

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932165**
Option 1 ID : **3398938429**
Option 2 ID : **3398938430**
Option 3 ID : **3398938431**
Option 4 ID : **3398938432**
Status : **Not Answered**
Chosen Option : **--**

Q.52

For a 2^4 factorial experiment with 4 treatments A, B, C, D each at 2 levels, 4 blocks of size 4 each were available. If the key block is

(1) (bc) (acd) (abd)

which of the following treatment combinations are confounded?

1. ABC
2. ABD
3. ACD
4. BCD

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932174**
Option 1 ID : **3398938465**
Option 2 ID : **3398938466**
Option 3 ID : **3398938467**
Option 4 ID : **3398938468**
Status : **Not Answered**
Chosen Option : **--**

Q.53 Let N_t be the number of customers that enter my shop up-to time t. Assume that $(N_t)_{t\geq 0}$ is Poisson process with parameter $\lambda = 5$. Whenever a customer enters, a fair die (usual die with six faces) is rolled. Let X be the number of 1's up-to time 10 and Y be the number of 2's up-to time 10. Which of the following are correct?

1. X, Y are independent
2. $X + Y \leq 50$
3. The joint distribution of (X, Y) is multinomial
4. X, Y are Poisson random variables

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932177**
Option 1 ID : **3398938477**
Option 2 ID : **3398938478**
Option 3 ID : **3398938479**
Option 4 ID : **3398938480**
Status : **Not Answered**
Chosen Option : **--**

Q.54

Let $X_1, X_2, \dots, X_n$ be i.i.d. from Poisson (λ) where $\lambda > 0$. Consider testing $H_0: \lambda \leq \lambda_0$ versus $H_1: \lambda > \lambda_0$.

Let Test A be the test that rejects H_0 if $\sum_{i=1}^{n} X_i > k$ where k is such that $P(\sum_{i=1}^{n} X_i > k \,|\lambda = \lambda_0) = \alpha$.

Let Test B be the test that rejects H_0 if $\sum_{i=1}^{n} X_i < k$ where k is such that $P(\sum_{i=1}^{n} X_i < k \,|\lambda = \lambda_0) = \alpha$.
Then,

1. Test A is the likelihood ratio test of size α
2. Test B is the likelihood ratio test of size α
3. Test A is a UMP test of size α
4. Test B is a UMP test of size α

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932167**
Option 1 ID : **3398938437**
Option 2 ID : **3398938438**
Option 3 ID : **3398938439**
Option 4 ID : **3398938440**
Status : **Not Answered**
Chosen Option : **--**

Q.55 Suppose the hazard rate function of the lifetime T of a system is $h(t) = t^2$ for $t > 0$. Then which of the following are true?

1. The probability that the system fails prior to 3 time units is $\frac{1}{9}$
2. The probability that the system fails at time $\frac{1}{3}$ given $T \geq \frac{1}{3}$ is $\frac{1}{9}$
3. The probability density function of T is $f(x) = t^2 e^{-(t^3/3)}$ for $t > 0$
4. $E[T^3] = 3$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932175**
Option 1 ID : **3398938469**
Option 2 ID : **3398938470**
Option 3 ID : **3398938471**
Option 4 ID : **3398938472**
Status : **Not Answered**
Chosen Option : **--**

Q.56

Let $X_1, X_2, \ldots$ be i.i.d. with mean μ and variance $\sigma^2 > 0$. Let $Z_n = \frac{(X_1 + \ldots + X_n)^2}{n}$.
Then which of the following are true?

1. $Z_n \to \mu^2$ with probability one
2. If $\mu \neq 0$ then $Z_n \to \infty$ with probability one
3. If $\mu = 0$ then $\frac{Z_n}{\sigma^2}$ converges in distribution
4. If $\mu = 0$ then $\frac{Z_n}{\sigma^2}$ converges in distribution to standard normal

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932161**
Option 1 ID : **3398938413**
Option 2 ID : **3398938414**
Option 3 ID : **3398938415**
Option 4 ID : **3398938416**
Status : **Not Answered**
Chosen Option : **--**

Q.57 Let $X_1, X_2, \ldots, X_n$ be a random sample from an exponential (λ) distribution, $\lambda > 0$, i.e.,

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & \text{if } \; x > 0 \\ 0 & \text{otherwise} \end{cases}$$

Let $\overline{X}_n = \frac{1}{n}\sum_{i=1}^{n} X_i$. Then which of the following are correct?

1. $\overline{X}_n$ is MLE of λ
2. $\frac{1}{\overline{X}_n}$ is MLE of λ
3. $\frac{1}{n}\left(\frac{1}{X_1} + \frac{1}{X_2} + \cdots + \frac{1}{X_n}\right)$ is MLE of λ
4. $\frac{1}{\overline{X}_n}$ is an unbiased estimator of λ

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932166**
Option 1 ID : **3398938433**
Option 2 ID : **3398938434**
Option 3 ID : **3398938435**
Option 4 ID : **3398938436**
Status : **Not Answered**
Chosen Option : **--**

Q.58

Which of the following conditions imply that $X_n \to X$ in distribution as $n \to \infty$?

1. $X_n^2 \to X^2$ with probability one
2. $E[|X_n - X|^2] \to 0$
3. $E\left[e^{i\lambda X_n}\right] \to E\left[e^{i\lambda X}\right]$ for all $\lambda \in \mathbb{R}$
4. $X_n \to X$ with probability one

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932160**
Option 1 ID : **3398938409**
Option 2 ID : **3398938410**
Option 3 ID : **3398938411**
Option 4 ID : **3398938412**
Status : **Not Answered**
Chosen Option : **--**

Q.59 Let $X_1, X_2, \ldots$ be i.i.d. random variables from a distribution F. Let
$Y_n = \min\{X_1, \cdots, X_n\}$.
If nY_n converges in distribution to exponential distribution with mean $1/2$, then F could be

1. $N(0,1)$
2. $\text{Uniform}(0,1)$
3. $\text{Uniform}(0,\frac{1}{2})$
4. $\text{Uniform}(0,2)$

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932163**
Option 1 ID : **3398938421**
Option 2 ID : **3398938422**
Option 3 ID : **3398938423**
Option 4 ID : **3398938424**
Status : **Not Answered**
Chosen Option : **--**

Q.60 Let (Y_i, X_i) $i = 1, \ldots, n$ be observations where X_i are the regressers and Y_i are response variables which follow Bernoulli distribution with probability of success $\pi(X_i)$, $i = 1, \ldots, n$. Suppose the log-odds ratio is a linear function with intercept α and slope β. Which of the following statements are true?

1. If $\beta > 0$ then $\pi(x)$ is an increasing function of x
2. $E[Y \mid X] = e^{\alpha + \beta X}$
3. If $x = -\frac{\alpha}{\beta}$ with $\beta \neq 0$, then $\pi(x) = \frac{1}{2}$
4. If $x = -\frac{\alpha}{\beta}$ then $\pi(x + c) = \pi(x - c)$ for any c.

Options 1. 1
2. 2
3. 3
4. 4

Question Type : **MSQ**
Question ID : **3398932170**
Option 1 ID : **3398938449**
Option 2 ID : **3398938450**
Option 3 ID : **3398938451**
Option 4 ID : **3398938452**
Status : **Not Answered**
Chosen Option : **--**

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JOINT CSIR -UGC NET DEC. 2019 Final Answer Key on which result will be compiled

SNO	QUESTION ID	CORRECT OPTION(S)	SNO	QUESTION ID	CORRECT OPTION(S)	SNO	QUESTION ID	CORRECT OPTION(S)	SNO	QUESTION ID	CORRECT OPTION(S)
001	3398932058	3398938003	021	3398932078	3398938083	061	3398932118	3398938244			
002	3398932059	3398938007	022	3398932079	3398938085	062	3398932119	3398938245, 3398938246, 3398938248			
003	3398932060	3398938009	023	3398932080	3398938091	063	3398932120	3398938249			
004	3398932061	3398938013	024	3398932081	3398938096	064	3398932121	3398938254, 3398938255			
005	3398932062	3398938019	025	3398932082	3398938100	065	3398932122	3398938258, 3398938260			
006	3398932063	3398938021	026	3398932083	3398938102	066	3398932123	3398938261, 3398938262, 3398938263			
007	3398932064	3398938025	027	3398932084	3398938106	067	3398932124	3398938265, 3398938268			
008	3398932065	3398938030	028	3398932085	3398938111	068	3398932125	3398938269, 3398938270, 3398938272			
009	3398932066	3398938035	029	3398932086	3398938115	069	3398932126	3398938275			
010	3398932067	3398938038	030	3398932087	3398938118	070	3398932127	3398938277			
011	3398932068	3398938041	031	3398932088	3398938121	071	3398932128	3398938282, 3398938283, 3398938284			
012	3398932069	3398938048	032	3398932089	3398938125	072	3398932129	3398938285, 3398938286			
013	3398932070	3398938050	033	3398932090	3398938132	073	3398932130	3398938289, 3398938290			
014	3398932071	3398938055	034	3398932091	3398938136	074	3398932131	3398938293			
015	3398932072	3398938058	035	3398932092	3398938137	075	3398932132	3398938298, 3398938299			
016	3398932073	3398938062	036	3398932093	3398938143	076	3398932133	3398938304			
017	3398932074	3398938066	037	3398932094	3398938146	077	3398932134	3398938307, 3398938308			
018	3398932075	3398938070	038	3398932095	3398938151	078	3398932135	3398938309, 3398938310, 3398938311			
019	3398932076	3398938073	039	3398932096	3398938155	079	3398932136	3398938315			
020	3398932077	3398938079	040	3398932097	3398938160	080	3398932137	3398938317			
			041	3398932098	3398938161	081	3398932138	3398938323			
			042	3398932099	3398938167	082	3398932139	3398938328			
			043	3398932100	3398938171	083	3398932140	3398938330, 3398938332			
			044	3398932101	3398938174	084	3398932141	3398938333, 3398938334			
			045	3398932102	3398938179	085	3398932142	3398938340			
			046	3398932103	3398938181	086	3398932143	3398938342			
			047	3398932104	3398938187	087	3398932144	3398938346, 3398938347			
			048	3398932105	3398938189	088	3398932145	3398938349, 3398938351, 3398938352			
			049	3398932106	3398938195	089	3398932146	3398938355, 3398938356			
			050	3398932107	3398938200	090	3398932147	3398938357, 3398938359			
			051	3398932108	3398938204	091	3398932148	3398938361, 3398938362, 3398938364			
			052	3398932109	3398938205	092	3398932149	3398938365, 3398938366, 3398938368			
			053	3398932110	3398938211	093	3398932150	3398938371			
			054	3398932111	3398938215	094	3398932151	3398938374			
			055	3398932112	3398938219	095	3398932152	3398938377, 3398938380			
			056	3398932113	3398938224	096	3398932153	3398938382			

NB:Correct Option ID '..............' means the question cancelled

JOINT CSIR -UGC NET DEC. 2019 Final Answer Key on which result will be compiled

SNO	QUESTION ID	CORRECT OPTION(S)	SNO	QUESTION ID	CORRECT OPTION(S)	SNO	QUESTION ID	CORRECT OPTION(S)	SNO	QUESTION ID	CORRECT OPTION(S)
			057	3398932114	3398938227	097	3398932154	3398938385 , 3398938387			
			058	3398932115	3398938231	098	3398932155	3398938391			
			059	3398932116	3398938235	099	3398932156	3398938393 , 3398938396			
			060	3398932117	3398938238	100	3398932157	3398938397 , 3398938398 , 3398938400			
						101	3398932158	3398938401 , 3398938402 , 3398938403			
						102	3398932159	3398938406 , 3398938407			
						103	3398932160	3398938410 , 3398938411 , 3398938412			
						104	3398932161	3398938414 , 3398938415			
						105	3398932162	3398938418 , 3398938419 , 3398938420			
						106	3398932163	3398938423			
						107	3398932164	3398938426 , 3398938427			
						108	3398932165	3398938429 , 3398938431			
						109	3398932166	3398938434			
						110	3398932167	3398938437 , 3398938439			
						111	3398932168	3398938441 , 3398938442 , 3398938443			
						112	3398932169	3398938445 , 3398938446 , 3398938447			
						113	3398932170	3398938449 , 3398938451			
						114	3398932171	3398938454 , 3398938456			
						115	3398932172	3398938458 , 3398938460			
						116	3398932173	3398938461 , 3398938462 , 3398938463 , 3398938464			
						117	3398932174	3398938465 , 3398938468			
						118	3398932175	3398938471 , 3398938472			
						119	3398932176	3398938473			
						120	3398932177	3398938477 , 3398938480			

NB:Correct Option ID '..............' means the question cancelled