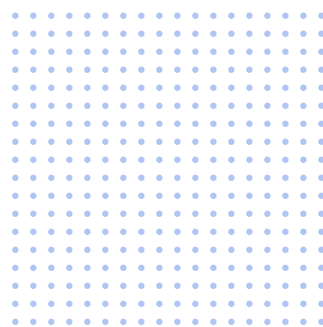




FOR JNU EE EXAM PREPARATION

JNU EE 2022

Question Paper · Ph.D Computational Biology and Bioinformatics - Track 3 Mathematics

EXAM	YEAR	TYPE
JNU EE	2022	Question Paper

SUBJECT
Ph.D Computational Biology and Bioinformatics - Track 3 Mathematics

Test Date : 10 Dec 2022**Test Slot : Slot 1****Subject : TRCM-Computational Biology & Bioinformatics Track -3
Mathematics****Sl. No.1****QBID:1122181**

Statement I: The mapping $T: \mathbb{R}^3 \rightarrow \mathbb{R}$ defined by $T(x, y, z) = z$ for all $(x, y, z) \in \mathbb{R}^3$ is a linear transformation.

Statement II: The mapping $T: \mathbb{R}^3 \rightarrow \mathbb{R}$ defined by $T(x, y, z) = z$ for all $(x, y, z) \in \mathbb{R}^3$ is not a linear transformation.

1. Both Statement I and statement II are true
2. Both Statement I and statement II are false
3. Statement I is true but statement II is false
4. Statement I is false but statement II is true

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17521]

2[Option ID=17522]

3[Option ID=17523]

4[Option ID=17524]

Sl. No.2**QBID:1122182**

Statement I: There exists a basis for each finite dimensional vector space.

Statement II: In the vector space $V_n(\mathbb{F})$, any two bases have the same number of elements.

1. Both Statement I and statement II are true
2. Both Statement I and statement II are false
3. Statement I is true but statement II is false
4. Statement I is false but statement II is true

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17525]

2[Option ID=17526]

3[Option ID=17527]
4[Option ID=17528]

Sl. No.3
QBID:1122183

Let, W_1 and W_2 be any two subspace of $V(F)$. Then,

- A. Their intersection is also a subspace.
- B. Their union is always a subspace.
- C. Their union is subspace iff one is contained in the other.
- D. Their intersection is never a subspace.
- E. Their union is never a subspace.

- 1. A only
- 2. B only
- 3. A and C only
- 4. D and E only

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17529]
2[Option ID=17530]
3[Option ID=17531]
4[Option ID=17532]

Sl. No.4
QBID:1122184

Which of the following matrices are Hermitian?

A. $\begin{bmatrix} 2 & 2+3i & 4-5i \\ 2-3i & 5 & 6+2i \\ 4+5i & 6-2i & -7 \end{bmatrix}$

B. $\begin{bmatrix} 3 & 2-i & 4+i \\ 2-i & 6 & i \\ 4+i & i & 7 \end{bmatrix}$

C. $\begin{bmatrix} 4 & -3 & 5 \\ -3 & 2 & 1 \\ 5 & 1 & -6 \end{bmatrix}$

D. All of the above

E. None of the above

1. E only

2. D only

3. A and B only

4. A and C only

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17533]

2[Option ID=17534]

3[Option ID=17535]

4[Option ID=17536]

Sl. No.5

QBID:1122185

The rank of the matrix A, where $A = \begin{bmatrix} 3 & 0 & 2 & 2 \\ -6 & 42 & 24 & 54 \\ 21 & -21 & 0 & -15 \end{bmatrix}$ is

1. Rank (A)=0

2. Rank (A)=1

3. Rank (A)=2

4. Rank (A)=3

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17537]

2[Option ID=17538]

3[Option ID=17539]

4[Option ID=17540]

Sl. No.6

QBID:1122186

Let, V be a vector space of functions with basis $S = \{\sin t, \cos t, e^{3t}\}$, and let $D: V \rightarrow V$ be the differential operator defined by $D(f(t)) = \frac{d(f(t))}{dt}$.

Then the matrix representing D in the basis S is

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

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

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

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

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17541]

2[Option ID=17542]

3[Option ID=17543]

4[Option ID=17544]

Sl. No.7

QBID:1122187

Statement I: Suppose $T: V \rightarrow V$ is linear. Then Kernel of T is invariant under T .

Statement II: Suppose $T: V \rightarrow V$ is linear. Then image of T is not invariant under T .

1. Both Statement I and statement II are true

2. Both Statement I and statement II are false

3. Statement I is true but statement II is false

4. Statement I is false but statement II is true

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17545]

2[Option ID=17546]

3[Option ID=17547]

4[Option ID=17548]

Sl. No.8

QBID:1122188

Let, $A = \begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}$. Then the eigenvalues are

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

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17549]
2[Option ID=17550]
3[Option ID=17551]
4[Option ID=17552]

Sl. No.9
QBID:1122189

Statement I: In the vector space $F[x]$ of all polynomials over the field F , the infinite set $S = \{1, x, x^2, x^3, \dots\}$ is linearly independent.

Statement II: In the vector space $F[x]$ of all polynomials over the field F , the infinite set $S = \{1, x, x^2, x^3, \dots\}$ is linearly dependent.

1. Both Statement I and statement II are true
2. Both Statement I and statement II are false
3. Statement I is true but statement II is false
4. Statement I is false but statement II is true

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17553]
2[Option ID=17554]
3[Option ID=17555]
4[Option ID=17556]

Sl. No.10
QBID:1122190

Statement I: The transpose A^T of a square matrix A has the same Eigen values as A .

Statement II: The Eigen values of a skew-symmetric matrix are always a real and non-zero.

1. Both Statement I and statement II are true
2. Both Statement I and statement II are false
3. Statement I is true but statement II is false
4. Statement I is false but statement II is true

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17557]

2[Option ID=17558]

3[Option ID=17559]

4[Option ID=17560]

Sl. No.11

QBID:1122191

If in a fluid, while applying Newton's second law of motion, compressibility force is neglected then what equation is obtained?

1. Navier Stoke's equation
2. Reynold's equation of motion
3. Euler's equation of motion
4. Continuity equation for fluid flow

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17561]

2[Option ID=17562]

3[Option ID=17563]

4[Option ID=17564]

Sl. No.12

QBID:1122192

Water is flowing through a pipe of 3.8 cm diameter under a pressure of 20 N/cm^2 (gauge) and with mean velocity of 3.7 m/s. Find the total head or total energy per unit weight of the water at a cross section which is 7 m above of the datum line.

1. 56.14 m
2. 28.07 m
3. 84.18 m
4. 10.52 m

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17565]
2[Option ID=17566]
3[Option ID=17567]
4[Option ID=17568]

Sl. No.13
QBID:1122193

If two constraints do not intersect in the positive quadrant of the graph, then

1. The problem is infeasible
2. The solution is unbounded
3. One of the constraints is redundant
4. The solution is bounded

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17569]
2[Option ID=17570]
3[Option ID=17571]
4[Option ID=17572]

Sl. No.14
QBID:1122194

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

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

- (1) 1
(2) 2
(3) 3

(4) 4

1[Option ID=17573]
 2[Option ID=17574]
 3[Option ID=17575]
 4[Option ID=17576]

Sl. No.15

QBID:1122195

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

1. A^3 divided by 1
2. A^3 divided by 2
3. A^3 divided by 3
4. A^3 divided by 6

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17577]
 2[Option ID=17578]
 3[Option ID=17579]
 4[Option ID=17580]

Sl. No.16

QBID:1122196

Let G be a connected planar graph with 10 vertices, if the number of edges on each face is three, then the number of edges in G is

1. 3
2. 10
3. 24
4. 30

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17581]
 2[Option ID=17582]
 3[Option ID=17583]
 4[Option ID=17584]

Sl. No.17

QBID:1122197

In network topology, the property between two graphs so that both have got same incidence matrix is known as

1. Tree
2. Tree compliment
3. Isomorphism
4. Polymorphism

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17585]

2[Option ID=17586]

3[Option ID=17587]

4[Option ID=17588]

Sl. No.18

QBID:1122198

In linear programming problem, the solution exists in convex set and the convex set have optimal solution at

1. Extreme point
2. Boundary points
3. Inside points
4. Local minima only

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17589]

2[Option ID=17590]

3[Option ID=17591]

4[Option ID=17592]

Sl. No.19

QBID:1122199

The characteristic root of the system $\frac{dx}{dt} = 6x - 3y$, $\frac{dy}{dt} = 2x + y$, is

1. 3, 4
2. -3, 4
3. 3, -4
4. -3, -4

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17593]
 2[Option ID=17594]
 3[Option ID=17595]
 4[Option ID=17596]

Sl. No.20
 QBID:1122200

The self-adjoint equation of

$$(1-t^2)\frac{d^2x}{dt^2} - 2t\frac{dx}{dt} + n(n+1)x = 0$$

is

1. $\frac{d}{dt}\left[(1-t^2)\frac{dx}{dt}\right] + n(n+1)x = 0$
2. $\frac{d}{dt}\left[(1-2t)\frac{dx}{dt}\right] + n(n+1)x = 0$
3. $\frac{d}{dt}\left[2(1-t)\frac{dx}{dt}\right] + n(n+1)x = 0$
4. $\frac{d}{dt}\left[(1-t)\frac{dx}{dt}\right] + n(n+1)x = 0$

- (1) 1
 (2) 2
 (3) 3
 (4) 4

1[Option ID=17597]
 2[Option ID=17598]
 3[Option ID=17599]
 4[Option ID=17600]

Sl. No.21
 QBID:1122201

The eigenvalues of $y'' - 4\lambda y' + 4\lambda^2 = 0$; $y'(1)=0$, $y(2)+2y'(2)=0$ are

- A. $1/2$
 B. $-1/2$
 C. $1/4$
 D. $-1/4$

- (1) 1
 (2) 2
 (3) 3
 (4) 4

1[Option ID=17601]
 2[Option ID=17602]
 3[Option ID=17603]
 4[Option ID=17604]

Sl. No.22
 QBID:1122202

Statement I: For each eigenvalues of a Sturm-Liouville problem, there exists one and only one linearly independent eigenfunction.

Statement II: The eigenvalues of a Sturm-Liouville problem can be arranged to form a strictly decreasing infinite sequence (i.e. $\lambda_n \rightarrow -\infty$ as $n \rightarrow \infty$).

1. Both Statement I and statement II are true
2. Both Statement I and statement II are false
3. Statement I is true but statement II is false
4. Statement I is false but statement II is true

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17605]

2[Option ID=17606]

3[Option ID=17607]

4[Option ID=17608]

Sl. No.23

QBID:1122203

$U(x,t) = e^{-kt} \sin x$ satisfies

1. Wave equation
2. Heat equation
3. Laplace equation
4. Fourier equation

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17609]

2[Option ID=17610]

3[Option ID=17611]

4[Option ID=17612]

Sl. No.24

QBID:1122204

The critical point (0,0) of the system,

$$\frac{dx}{dt} = 2x - 7y,$$

$$\frac{dy}{dt} = 3x - 8y,$$

is

1. Node
2. Spiral point
3. Saddle point
4. Center

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17613]

2[Option ID=17614]

3[Option ID=17615]

4[Option ID=17616]

Sl. No.25

QBID:1122205

The Wronskian of the set $\{\sin 3x, \cos 3x\}$ is

1. 3
2. -3
3. -2
4. 2

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17617]

2[Option ID=17618]

3[Option ID=17619]

4[Option ID=17620]

Sl. No.26

QBID:1122206

The solutions $\sin x$ and $\cos x$ of

$$\frac{d^2y}{dx^2} + y = 0$$

are

- A. Linearly independent
 - B. $W(\sin x, \cos x) \neq 0$
 - C. Linearly dependent
 - D. $W(\sin x, \cos x) = 0$
1. A and D only
 2. B and C only
 3. A and B only
 4. C and D only

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17621]

2[Option ID=17622]

3[Option ID=17623]

4[Option ID=17624]

Sl. No.27

QBID:1122207

The solution of

$$y' + y = \sin x$$

is

1. $y = ce^{-x} + \frac{1}{2} \sin x - \frac{1}{2} \cos x$
2. $y = ce^x + \frac{1}{2} \sin x - \frac{1}{2} \cos x$
3. $y = ce^{-x} + \sin x + \cos x$
4. $y = ce^x + \sin x - \cos x$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17625]

2[Option ID=17626]

3[Option ID=17627]

4[Option ID=17628]

Sl. No.28

QBID:1122208

Bessel's and Stirling's interpolation formulae yield good estimates, if the values of u and v in general lie between

1. -1 and +1
2. -0.5 and 1
3. -0.5 and 0.5
4. 0 and 1

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17629]
2[Option ID=17630]
3[Option ID=17631]
4[Option ID=17632]

Sl. No.29
QBID:1122209

If g is continuous on interval (a, b) and $g(x) \in [a, b]$ for all $x \in [a, b]$, then g has a fixed point in $[a, b]$, if $g'(x)$ exist on (a, b) and a positive constant $k < 1$ exist with $|g'(x)| \leq k$ or $g'(x) \leq k$ for all $x \in (a, b)$ then

1. The fixed point in (a, b) is unique
2. The fixed point in (a, b) is not unique
3. There is no fixed point in (a, b)
4. The fixed point in (a, b) is not computable

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17633]
2[Option ID=17634]
3[Option ID=17635]
4[Option ID=17636]

Sl. No.30
QBID:1122210

Given that

x	1	2	3	4	5
u	3	5	8	18	28

Find the value of $\nabla^2 u_4$

1. 5
2. 7
3. 9
4. 18

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17637]
2[Option ID=17638]
3[Option ID=17639]
4[Option ID=17640]

Sl. No.31
QBID:1122211

Binomial expansion method is based on the principle that with n known entries

1. n^{th} finite difference $\Delta^n y_0 = 0$
2. we take $(E - 1)^n y_0 > 0$
3. $y_n - \binom{n}{1} y_{n-1} + \binom{n}{2} y_{n-2} + \dots + (-1)^n y_0 \neq 0$
4. We take $(E - 1)^n y_0 < 0$

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17641]
2[Option ID=17642]
3[Option ID=17643]
4[Option ID=17644]

Sl. No.32
QBID:1122212

In a binomial distribution if mean=4 and variance=2.4. What is the value of n ?

1. 5
2. 8
3. 10
4. 12

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17645]

2[Option ID=17646]

3[Option ID=17647]

4[Option ID=17648]

Sl. No.33

QBID:1122213

If the coefficient of kurtosis γ_2 of a distribution is zero, the frequency curve is

1. Leptokurtic

2. Platykurtic

3. Mesokurtic

4. Skewed

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17649]

2[Option ID=17650]

3[Option ID=17651]

4[Option ID=17652]

Sl. No.34

QBID:1122214

Geometric mean is a good measure of central value if the data are

1. categorical

2. on ordinal scale

3. in ratios or proportions

4. in binary

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17653]

2[Option ID=17654]

3[Option ID=17655]

4[Option ID=17656]

Sl. No.35

QBID:1122215

A lot contains 20 articles. The probability that the lot contains exactly 2 defective articles is 0.4 and the probability that the lot contains exactly 3 defective articles is 0.6. Articles are drawn from the lot at random one by one without replacement and are tested till all defective articles are found. What is the probability that the testing procedure ends at the twelfth testing ?

1. 11/900
2. 19/990
3. 99/1900
4. 111/9100

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17657]

2[Option ID=17658]

3[Option ID=17659]

4[Option ID=17660]

Sl. No.36

QBID:1122216

If the two lines of regression are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$, the regression line of x on y is

1. $x + 2y - 5 = 0$
2. $2x + 3y - 8 = 0$
3. any of the two lines
4. none of the two lines

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=17661]

2[Option ID=17662]

3[Option ID=17663]

4[Option ID=17664]

Sl. No.37

QBID:1122217

A die is thrown, if it shows a six, we draw a ball from a bag containing 2 black balls and 6 white balls. If it does not show a six, then we toss a coin. Then the sample space of this experiment consists of

1. 10 points
2. 13 points
3. 18 points
4. 21 points

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17665]

2[Option ID=17666]

3[Option ID=17667]

4[Option ID=17668]

Sl. No.38

QBID:1122218

If X is a Poisson variate such that $2P(X=0)+P(X=2)=2P(X=1)$, then variance is

1. 1
2. 1.5
3. 2
4. 4

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17669]

2[Option ID=17670]

3[Option ID=17671]

4[Option ID=17672]

Sl. No.39

QBID:1122219

Let $f(x) = \begin{cases} \frac{5}{x^6}, & x \geq 1 \\ 0, & \text{otherwise} \end{cases}$. What bound does Chebyshev's inequality give for probability $P(X \geq 2.5)$

1. 4/5
2. 5/28
3. 14/15
4. 1/15

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17673]

2[Option ID=17674]

3[Option ID=17675]

4[Option ID=17676]

Sl. No.40

QBID:1122220

The random variable X follows a distribution function such that it has MGF given by

$$M_x(t) = \frac{1}{6}e^{-2t} + \frac{1}{3}e^{-t} + \frac{1}{4}e^t + \frac{1}{5}e^{2t}. \text{ What is the } (|X| \leq 1) ?$$

1. 1/3

2. 1/4

3. 7/12

4. 5/12

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=17677]

2[Option ID=17678]

3[Option ID=17679]

4[Option ID=17680]