Roll No. ....

B030701T

M. Sc. (First Semester)

EXAMINATION, 2022-23

(NEP)

MATHEMATICS

(Real Analysis)

Time : Two Hours] [*Maximum Marks : 75*

Note : This paper consists of three Sections A, B and C. Carefully read the instructions of each Section in solving the question paper. Candidates have to write their answers in the given answer-copy only. No separate answer-copy **(B Copy)** will be provided.

Section—A

(Short Answer Type Questions)

Note : All questions are compulsory. Answer the following questions as short answer type questions. Each question carries 5 marks.

1. (A) Find the value of :

$$\int_0^{\frac{\pi}{2}} \cos x \, d(\sin x)$$

(B) If :

$$f \in R(\alpha) \text{ on } [a, b]$$

and

$$f(x) \geq 0 \ \forall x \in [a, b],$$

then show that :

$$\int_a^b f \, d\alpha \geq 0.$$

(C) Show that the sequence $\{f_n\}$, where $f_n(x) = \frac{\sin nx}{\sqrt{n}}$ is uniformly convergent on $[0, \pi]$.

(D) Show that the series :

$$\frac{\cos x}{1^p} + \frac{\cos 2x}{2^p} + \frac{\cos 3x}{3^p} + \dots\dots\dots$$

converges uniformly on **R** (the set of real numbers), if $p > 1$.

(E) Consider the power series :

$$f(x) = \sum_{n=2}^{\infty} (\log n) x^n$$

Find the radius of convergence of the power series.

(F) Find the radius of convergence of the series :

$$1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots\dots\dots$$

(G) Show that the limit :

$$\lim_{(x,y)\to(0,0)} \frac{x + \sqrt{y}}{x^2 + y^2}$$

does not exist.

(H) Let :

$$f : \mathbb{R}^2 \to \mathbb{R}^3, f(x, y) = (x, xy^3, x^2y^5)$$

Find total derivatives of f.

(I) Show that the equation :

$$y^2 - yx^2 - 2x^5 = 0$$

has a unique solution $y = g(x)$ near the point $(1, -1)$ and find $g'(x)$ at $(1, -1)$.

Section—B

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

2. (a) If f is monotonic on $[a, b]$ and α is monotonic and continuous on $[a, b]$, then show that $f \in R(\alpha)$.

(b) If :

$$f(x) \leq g(x) \text{ on } [a, b],$$

then show that :

$$\int_a^b f\, d\alpha \leq \int_a^b g\, d\alpha.$$

Or

3. If P^* is a refinement of P, then show that :

$$L(P, f, \alpha) \leq L(P^*, f, \alpha)$$

Or

4. (a) Find the value of p, so that the series :

$$\sum_{n=1}^{\infty} \frac{(-1)^n}{n^p} \frac{x^{2n}}{1+x^{2n}}$$

is uniformly convergent for all real x.

(b) Show that :

$$\int_0^1 \left[\sum_{n=1}^{\infty} \frac{x^n}{n^2} \right] dx = \sum_{n=1}^{\infty} \frac{1}{n^2 (n+1)}$$

Or

5. Show that the series :

$$\sum_{n=1}^{\infty}\left[\frac{nx}{1+n^2x^2}-\frac{(n-1)x}{1+(n-1)^2x^2}\right]$$

can be integrated term by term on $[0,1]$ while it is not uniformly covergent on [0, 1] .

Section—C

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

6. Assuming the expansion :

$$\log(1+x)=x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots\ldots$$

for $-1 < x \le 1$, prove that :

$$\int_0^1 \frac{\log(1+x)}{x}\,dx = 1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\ldots..$$

Or

7. (a) Show that a function of bounded variation is bounded.

(b) Determine whether the function :

$$f(x)=\begin{cases} x^2 \sin\dfrac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

is of bounded variation or not on the interval [0, 1].

Or

8. (a) Let E be an open set of R^n and $f : E \to R^n$ be a map. If f is differentiable at 'a' with total derivative $f'(a)$, then show that directional derivative $D_u f(a)$ exists for any unit vector $u \in R^n$ and $f'(a)(u) = D_u f(a)$.

(b) A function $f : R^2 \to R$ is defined by $f(x, y) = xy$. Let $v = (1, 2)$ and $a = (a_1, a_2)$ be two elements of R^2, then find the directional derivative of f in the direction of v at a.

Or

9. (a) Consider the map :

$$f(x, y) = (x^3, y^3)$$

Show that f' is locally invertible about any point (a, b), where $a \neq 0, b \neq 0$ and by inverse function theorem. Find the Jacobian matrix of the inverse map.

(b) Find up to degree 2 the Taylor polynomial of $f(x, y) = \sin xy$ about the point $\left(1, \frac{\pi}{2}\right)$.

Roll No. ....

B030702T

M. Sc. (First Semester)

EXAMINATION, 2022-23

(NEP)

MATHEMATICS

(Topology)

Time : Two Hours] *[Maximum Marks : 75*

Note : This paper consists of three Sections A, B and C. Carefully read the instructions of each Section in solving the question paper. Candidates have to write their answers in the given answer-copy only. No separate answer-copy **(B Copy)** will be provided.

Section—A

(Short Answer Type Questions)

Note : All questions are compulsory. Answer the following questions as short answer type questions. Each question carries 5 marks.

1. (A) Let $X = \{a, b, c\}$ and

$$T = \{\phi, X, \{a\}, \{b\}, \{a, b\}\}$$

Show that T is a topology on X.

(B) Define limit point of topological space.

(C) Define interior of a set.

(D) Define neighbourhood of a point.

(E) Define sub-base of topological space.

(F) Define continuity in metric space.

(G) Define Lindelof space.

(H) Give an example of T_0-space which is not a T_1-space.

(I) Give *two* examples of T_2-Space.

Section—B

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

2. Prove that every metric space is a topological space.

Or

3. In any topological space, prove that :

$$\bar{A} = A \cup D(A)$$

Or

4. In a topological space an arbitrary union of open sets is open and a finite intersection of open sets is open.

Or

5. A subset of a topological space (X, T) is open iff $A^\circ = A$.

Section—C

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

6. Show that composition of two continuous functions is continuous.

Or

7. Prove that homomorphism is an equivalence relation in the family of topological space.

Or

8. State and prove Urysohn's lemma.

Or

9. Define T_1-space and show that every T_1-space is T_0-space.

Roll No. ....

B030703T

M. Sc. (First Semester)

EXAMINATION, 2022-23

(NEP)

MATHEMATICS

(Advanced Complex Analysis)

Time : Two Hours] [*Maximum Marks : 75*

Note : This paper consists of three Sections A, B and C. Carefully read the instructions of each Section in solving the question paper. Candidates have to write their answers in the given answer-copy only. No separate answer-copy **(B Copy)** will be provided.

Section—A

(Short Answer Type Questions)

Note : All questions are compulsory. Answer the following questions as short answer type questions. Each question carries 5 marks.

1. (A) Describe the stereographic projection of points on the unit sphere $x^2 + y^2 + z^2 = 1$ in $\mathbf{R}^3$ to the extended complex plane, $z = 0$.

(B) State and prove Cauchy's inequality.

(C) Find the zeros and discuss the nature of singularity of the function :

$$f(z) = \frac{(z-2)}{z^2} \sin\left(\frac{1}{z-1}\right)$$

(D) If $a > e$, use Rouche's theorem to prove that the equation $e^z = az^n$ has n roots inside the circle $|z| = 1$.

(E) What is the form of a bilinear transformation which has one finite fixed point α and the other fixed point infinity (∞) ?

(F) The power series :

$$z + \frac{1}{2}z^2 + \frac{1}{3}z^3 + \ldots\ldots$$

and

$$i\pi - (z-2) + \frac{1}{2}(z-2)^2 - \frac{1}{3}(z-2)^3 + \ldots.$$

have no common region of convergence. Prove that they are nevertheless analytic continuation of the same function.

(G) Find the relation between Riemann Zeta function and Gamma function.

(H) Find the order of polynomial function of degree n.

(I) State Bieberbach conjecture and $\frac{1}{4}$ theorem.

Section—B

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

2. State and prove Maximum Modulus principle.

Or

3. (a) Let :

(i) $f(z)$ is analytic in a domain D defined by $|z| < R$,

(ii) $|f(z)| \leq M$, for every z in D,

(iii) $f(0) = 0$

Then :

$$|f(z)| \leq \frac{M}{R}|z|$$

Also if the equality occurs for any one z, then $f(z) = \frac{M}{R} z e^{i\alpha}$, where α is real constant.

(b) Show that a function analytic at every point and finite at infinity, is constant.

Or

4. Using the method of contour integration, show that if $0 < a < 1$, then :

$$\int_0^\infty \frac{x^{a-1}}{1+x} dx = \frac{\pi}{\sin(\pi a)}$$

Or

5. Show that the transformation $w = \dfrac{iz + 2}{4z + j}$ maps the real axis in the z-plane into a circle in the w-plane. Find the centre and radius of the circle and the point in the z-plane which is mapped on the centre of the circle.

Section—C

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

6. State and prove Mittag-Leffer's theorem.

Or

7. (a) Show that there cannot be more than one analytic continuation of a function $f(z)$ into the same domain.

   (b) Prove that the unit circle $|z| = 1$ is a natural boundary of the function :

$$f(z) = \sum_{n=0}^{\infty} z^{n!}$$

Or

8. (a) Find the canonical product associated with sequence of negative integers.

   (b) State and prove Hadamard's three circles theorem.

Or

9. (a) If $f(z)$ is univalent in a domain D, then show that $f'(z) \neq 0$ in D.

   (b) Show that the order of a canonical product is equal to the exponent of convergence of its zeros.

Roll No. ....

B030704T

M. Sc. (First Semester)

EXAMINATION, 2022-23

(NEP)

MATHEMATICS

(Dynamic of Rigid Bodies)

Time : Two Hours] [*Maximum Marks : 75*

Note : This paper consists of three Sections A, B and C. Carefully read the instructions of each Section in solving the question paper. Candidates have to write their answers in the given answer-copy only. No separate answer-copy **(B Copy)** will be provided.

Section—A

(Short Answer Type Questions)

Note : All questions are compulsory. Answer the following questions as short answer type questions. Each question carries 5 marks.

1. (A) Find the moment of inertia of a circular plate about its diameter.

   (B) State and prove D'Alembert's principle.

   (C) Derive Hamilton's equations of motion.

   (D) Find the moment of inertia of the arc of a circle about an axis through its middle point perpendicular to its plane.

   (E) Show that the momental ellipsoid at a point on the edge of the circular base of a thin hemispherical shell is $2x^2 + 5(y^2 + z^2) - 3zx =$ constant.

   (F) Define generanlized coordinates and find the Lagrangian function for a simple pendulum and also obtain equation describing its motion.

(G) Show that at the centre of quadrant of an ellipse, the principal axes in its plane are included at an angle $\frac{1}{2}\tan^{-1}\left(\frac{4}{\pi}\frac{ab}{a^2-b^2}\right)$ to the axes.

(H) When a body moves under the action of a system of conservative forces, prove that the sum of its kinetic and potential energies is constant throughout the motion.

(I) State and prove Principle of Least Action.

Section—B

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

2. A solid body of density ρ, is in the shape of the solid formed by the revolution of the cardioid $r = a(1 + \cos\theta)$ about the initial line. Show that its moment of inertia about a straight line

through the pole perpendicular to the initial line is $\frac{352}{105}\pi\rho a^2$.

Or

3. A rod of length $2a$, is suspended by a string of length l, attached to one end. If the string and rod revolve about the vertical with uniform angular velocity and their inclination to the vertical be θ and ϕ respectively, show that :

$$\frac{3l}{a} = \frac{(4\tan\theta - 3\tan\phi)\,.\,\sin\phi}{(\tan\phi - \tan\theta)\,.\,\sin\theta}$$

Or

4. A perfectly rough circular horizontal board is capable of revolving freely round a vertical axis through the centre. A man whose weight is equal to that of the board walks on and around it at the edge, when he has completed the circuit. What will be his position in space ?

Or

5. (a) A rectangular plate swings in a vertical plane about one of its centre. If its period is one second, find the length of the diagonal.

   (b) Find the position of the centre of percussion of a sector of a circle, axis in the plane of the sector, perpendicular to its symmetrical radius, and passing through the centre of the circle.

Section—C

(Long Answer Type Questions)

Note : This section contains four questions from which *one* question is to be answered as long question. Each question carries 15 marks.

6. A particle P moves on a smooth horizontal circular wire of radius *a* which is free to rotate about a vertical axis through a point O,

distance 'c' from the centre C. If the $\angle PCO = \theta$, show that :

$$a\ddot{\theta} + \omega(a - c\cos\theta) = c\omega^2 \sin\theta$$

where ω is the angular velocity of the wire.

Or

7. A uniform bar of length '$2a$' is hung from a fixed point by a string of length 'b' fastened to one end of the bar. Show that when the system makes small normal oscillation in a vertical plane the length 'l' of the equivalent simple pendulum is a root of the quadratic $l^2 - \left(\frac{4a}{3} + b\right)l + \frac{ab}{3} = 0$.

Or

8. A solid cube is in motion about an angular point which is fixed. If there are no external forces and $\omega_1, \omega_2, \omega_3$ are the angular velocities

about the edges through the fixed point, prove that :

$$\omega_1 + \omega_2 + \omega_3 = \text{constant}$$

and $$\omega_1^2 + \omega_2^2 + \omega_3^2 = \text{constant}$$

Or

9. Use Hamilton's equation to write down the equations of motions of a pendulum bob suspended from a coil spring and allowed to swing in a vertical plane.

Roll No. ....

O. M. R. Serial No. | | | | | | | |

Question Booklet Number
292376

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Advanced Real Analysis)

Paper Code							
B	0	3	0	8	0	1	T

Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks : 75*

SEAL

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page)

(शेष निर्देश अन्तिम पृष्ठ पर)

1. Let :

$$f(x)=\log e\left(\frac{1}{x}\right), \forall x\in(0,1]$$

then :

(A) $f\in L^p(0,1] \forall 1\le p<\infty$

(B) $f\in L^\infty(0,1]$

(C) $\exists p$ such that $1\le p<\infty, f\notin L^p(0,1]$

(D) None of the above

2. Let ϕ be a convex function on $(-\infty,\infty), f$ an integrable function over $[0,1]$ such that ϕ of is also integrable over $[0,1]$, then which of the following is necessarily true ?

(A) $\phi\left(\int_0^1 f(x)dx\right) > \int_0^1 (\phi o f)(x)dx$

(B) $\phi\left(\int_0^1 f(x)dx\right) = \int_0^1 (\phi o f)(x)dx$

(C) $\phi\left(\int_0^1 f(x)dx\right) \le \int_0^1 (\phi o f)(x)dx$

(D) None of the above

3. Let v be a signed measure on measurable space (X, M). Then :

(A) Every measurable subset of positive set is positive

(B) There exists a measurable subset of positive set which is not positive.

(C) Both (A) and (B) are true

(D) Both (A) and (B) are false

4. Let U be a signed measure on measurable space (X, M). Then there is a positive set A for v and a negative set B for v for which $X = A\cup B$ and $A\cap B=\phi$. This is the statement of :

(A) Jensen's Inequality

(B) Holder's Inequality

(C) The Hahn Decomposition theorem

(D) None of the above

5. Let v be a signed measure, A is measurable set (w. r. to v) and $\forall$ measurable set $E\subseteq A$, $v(E)\ge 0$ then :

(A) A is said to be positive (w. r. to v)

(B) A is said to be negative (w. r. to v)

(C) A can never be positive

(D) Both (B) and (C) are true

6. A continuous function f on (a,b) is convex if and only if :

(A) $f\left(\frac{x_1+x_2}{2}\right) > \frac{f(x_1)+f(x_2)}{2}, \forall x_1,x_2\in(a,b)$

(B) $f\left(\frac{x_1+x_2}{2}\right) \le \frac{f(x_1)+f(x_2)}{2}, \forall x_1,x_2\in(a,b)$

(C) $f\left(\frac{x_1+x_2}{2}\right) > \frac{f(x_1)+f(x_2)}{2}$ for some $x_1,x_2\in(a,b)$

(D) None of the above

7. Let ϕ be twice differentiable map on (a,b), then :

(A) ϕ is convex $\Leftrightarrow$ ϕ'' is non-negative

(B) ϕ is convex $\Leftrightarrow$ ϕ'' is negative

(C) Both (A) and (B) are true

(D) None of the above

8. Let G_δ be countable intersection of open sets. Then which of the following is true ?

(A) G_δ is not measurable.

(B) G_δ is not measurable because open sets are Borel sets.

(C) Each G_δ is measurable.

(D) None of the above

9. Let F_σ be the countable union of closed sets. Then which of the following is necessarily true ?

(A) F_σ is measurable

(B) F_σ is not measurable

(C) F_σ is not measurable because closed sets are not Borel sets

(D) None of the above

10. Consider the following statements :

P : If a set is measurable then it is also a Borel set.

Q : If a set has measure zero then it is also a countable set.

Then :

(A) P is true.

(B) Q is true.

(C) Both P and Q are true.

(D) Both P and Q are false.

11. Let $f : [a,b] \to \mathbf{R}$ be a of bounded map and $\langle P_1, P_2 \dots\dots\dots P_n \dots\dots\dots \rangle$ be a sequence of partitions of [a, b] such that :

$$\lim_{n\to\infty}\left[U(f,P_n)-L(f,P_n)\right]=0$$

then :

(A) f is Riemann Integrable over $[a,b]$

(B) f can't be Riemann Integrable over $[a,b]$

(C) $f(x)=0\ \forall x\in[a,b]$

(D) $f(x)=f(x+1)\ \forall x\in[a,b]$

12. Let f be Integrable over E and C be a measurable subset of E, χ_c denotes characteristic function.

Then :

(A) $\int_c f = \int_E f \cdot \chi_c$

(B) $\int_c f \neq \int_E f \cdot \chi_c$

(C) $\int_c f > \int_E f \cdot \chi_c$

(D) None of the above

13. Let f be Integrable over **R** and $f = 0$, almost everywhere (a.e) on **R**. Then :

(A) $\int_A f \neq 0$ for some measurable set A

(B) $\int_A f < 0$ for some measurable set A

(C) $\int_A f = 0$ for some measurable set A

(D) None of the above

14. Let f be Integrable over **R** with $\int_A f = 0$ for all measurable sets A. Then :

(A) $f = 0$ almost everywhere on **R**

(B) $f(x) \neq 0 \forall x \in \mathbf{R}$

(C) f can never assume the value '0'

(D) None of the above

15. Let $f = 0$ almost everywhere on **R**. Then :

(A) $\int_0 f = 0$ for every open set 0

(B) $\int_0 f \neq 0$ for every open set 0

(C) $\int_0 f \neq 0$ for any open set 0

(D) None of the above

16. Let f and g be a measurable function on E and

$$h = \frac{1}{2}\left[(f+g)^2 - f^2 - g^2\right]$$

Then :

(A) h is measurable

(B) h can't be measurable

(C) h is measurable only if $m^*(E) = 0$

(D) None of the above

17. Let I = $[a,b]$ be a closed interval. Then which of the following is true ?

(A) $m^*(I) = 5$

(B) I is measurable.

(C) I is not measurable.

(D) None of the above

18. Let $f:(1,\infty) \to \mathbf{R}$ be a map such that :

$$f(x) = \frac{\sqrt{x}}{1+\log_e x}, x > 1$$

Then :

(A) $f \in L^p(E) \forall p$

(B) $f \in L^p(E)$ if $p \neq 2$

(C) $f \in L^p(E) \Leftrightarrow p = 2$

(D) None of the above

19. If A is measurable set of finite outer measure that is contained in B, then :

(A) $m^*(B \sim A) > m^*(B) - m^*(A)$

(B) $m^*(B \sim A) < m^*(B) - m^*(A)$

(C) $m^*(B \sim A) = m^*(B) - m^*(A)$

(D) $m^*(B \sim A) = m^*(A) + m^*(B)$

20. Which of the following is not true ?

(A) The translate of a measurable is measurable

(B) The translate of a measurable set is need not be measurable

(C) The Borel σ algebra is contained in every σ algebra that contains all open sets.

(D) The Borel σ algebra is the intersection of all the σ algebras of subsets of **R** that contains the open sets.

21. If $\{A_k\}_{k=1}$ is asceding collection of measurable sets, then :

(A) $m\left(\bigcup_{k=1}^{\infty} A_k\right) = \lim_{k\to\infty} m(Ak)$

(B) $m\left(\bigcup_{k=1}^{\infty} A_k\right) = 1 - \lim_{k\to\infty} m(A_k)$

(C) $m\left(\bigcup_{k=1}^{\infty} A_k\right) = 1 + \lim_{k\to\infty} m(A_k)$

(D) None of the above

22. Let $\{E_k\}_{k=1}^{\infty}$ be a countable collection of measurable sets for which $\sum_{k=1}^{\infty} m(E_k) < \infty$, then :

(A) almost all $x \in \mathbf{R}$ belongs to all $E_{k's}$.

(B) all $x \in \mathbf{R}$ belongs to at most finitely many of the $E_k / E_{k's}$

(C) almost all $x \in \mathbf{R}$ belongs to at most finitely many of the E_k's

(D) None of the above

23. Which of the following is not true for the set function of Lebesgue measure ?

(A) For any finite disjoint collection $\{E_k\}_{k=1}^{n}$ of measure set :

$$m\left(\bigcup_{k=1}^{n} E_k\right) = \sum_{k=1}^{n} m(E_k)$$

(B) For any countable collection $\{E_k\}_{k=1}^{\infty}$ of measurable sets that covers a measurable set E :

$$m(E) \geq \sum_{k=1}^{\infty} m(E_k)$$

(C) Ff A and B are measurable sets and $A \subseteq E$ then $m(A) \leq m(B)$.

(D) None of the above

24. Which of the following is false ?

(A) f be an extended measurable real valued function on E and $f = g$ a. e. on E, then g is measurable on E.

(B) Let f be an extended measurable real-valued function on E and $f = g$ a. e. on E, then g need not be measurable on E.

(C) A monotone function that is defined on an interval is measurable.

(D) None of the above

25. Which of the following is false ?

(A) Let f and g be measurable function on E that are finite a. e. on E the fg is measurable on E.

(B) Let f and g be measurable function on E that are finite a. e. on E then fg need not be measurable on E.

(C) Let f and g be measurable function on E that are finite a. e. on E, then $f+g$ is measurable on E.

(D) None of the above

26. Let $f(x) = e^{4x}$. Then :

(A) f is not convex on $[-1,1]$

(B) f is not convex on $[-1, \infty)$

(C) f is convex on $(-1, 1)$

(D) None of the above

27. Let $f:[0,1] \to \mathbf{R}$ be a map such that $f(x) = x^2$, then :

(A) $\phi[\lambda x_1 + (1-\lambda)x_2] \leq \lambda\phi(x_1) + (1-\lambda)\phi(x_2) \forall \lambda \in [0,1]$

(B) $\phi[\lambda x_1 + (1-\lambda)x_2] > \lambda\phi(x_1) + (1-\lambda)\phi(x_2) \forall \lambda \in [0,1]$

(C) $\phi[\lambda x_1 + (1-\lambda)x_2] > \lambda\phi(x_1) + (1-\lambda)\phi(x_2)$ for some $\lambda \in [0,1]$

(D) None of the above

28. If

$A = \{\alpha_1, \alpha_2 .... \alpha_n\} \subseteq \mathbf{R}$,

and $m^*(A)$ denotes Lebesgue outer measure of A, then $m^*(A)$ is :

(A) 0

(B) n

(C) less than n

(D) None of the above options

29. If $A = [0,5], B = [3,6]$, then :

(A) $m^*(A) < m^*(B)$

(B) $m^*(A) > m^*(B)$

(C) $m^*(A) = m^*(B)$

(D) $m^*(A) = m^*(B) - 1$

30. If A_1 and A_2 are measurable sets, then $A_1 \cup A_2$ is :

(A) measurable

(B) non-measurable

(C) measurable only if $A_1 \cap A_2 = \phi$

(D) None of the above options

31. If $\Omega = \{a,b,c,d\}, F = \{\phi, \Omega\}$, then :

(A) F is not σ-algebra

(B) F is not algebra

(C) F is σ-algebra

(D) None of the above options

32. If $A \subseteq B$, then which of the following is necessarily true ?

(A) $m^*(A) = m^*(B)$

(B) $m^*(A) > m^*(B)$

(C) $m^*(A) \leq m^*(B)$

(D) None of the above options

33. If $I = [a,b]$ where $a, b \in \mathbf{R}, a < b$, then :

(A) $m^*(I) = b - a$

(B) $m^*(I) = a - b$

(C) $m^*(I) = \infty$

(D) $m^*(I) = -\infty$

34. Let $f : X \to \mathbf{R}$ be a map, X is measurable sets and

$$E = \{x \in X \mid f(x) > c\},$$

then f is measurable if :

(A) E is non-measurable

(B) E is measurable

(C) E is infinite

(D) None of the above options

35. If A_1 and A_2 are measurable subsets of $[a,b]$, then $A_1 \Delta A_2$ is :

(A) Measurable set

(B) Non-measurable set

(C) Integrable set

(D) None of the above options

36. A subset G = (2, 6] of an interval [1, 6] is .... in [1, 6].

(A) closed

(B) open

(C) Neither open nor closed

(D) Either open or closed

37. If X is a set and if F is a σ-algebra of subsets of X, then which one the following need not be true ?

(A) the empty set $\phi \in F$

(B) $X \in F$

(C) If $A \in F \Rightarrow A^c = X - A \in F$

(D) every singleton set with elements from X is in F.

38. If A_1 and A_2 are measurable subset of $[a,b]$, then :

I – $A_1 \cup A_2$ is measurable

II – $A_1 \cap A_2$ is measurable

(A) Only I is true

(B) Only II is true

(C) Both I and II are true

(D) Both I and II are false

39. A cantor set C ....

(A) is countable

(B) is uncountable and its measure 0

(C) countable and its measure 0

(D) None of the above

40. If A = {1, 2, 3}, F be an algebra on A, $\{1\} \in F$, then which of the following is necessarily true ?

(A) $\{1,2\} \in F$

(B) $\{1,3\} \in F$

(C) $\{2,3\} \in F$

(D) None of the above

41. If A and B are two sets in F with $A \subseteq B$, then $m(A) \le m(B)$ (where m is measure). This property is called :

(A) Finite additivity

(B) Countable additivity

(C) Triangle inequality

(D) Monotonicity

42. Let $A = Q^c \cap [0,1]$, then :

(A) $m^*(A) = 1$

(B) $m^*(A) = 0$

(C) $m^*(A) = \frac{1}{2}$

(D) None of the above

43. If A is a set, which of the following is the smallest σ-algebra of subsets of A ?

(A) $\{\phi, A\}$

(B) $\{\phi\}$

(C) $\{A\}$

(D) None of the above

44. If A and B are bounded sets for which $\exists \alpha > 0$ such that $|a-b| \geq \alpha$ for all $a \in A$, and $b \in B$, then :

(A) $m^*(A \cup B) = m^*(A) - m^*(B)$

(B) $m^*(A \cup B) = m^*(A) + m^*(B)$

(C) $m^*(A \cup B) = m^*(A) + m^*(B) - m^*(AB)$

(D) None of the above

45. Consider the following statements :

P : If A is countable set, then $m^*(A) = 0$.

Q : If $m^*(A) = 0$, then A is countable.

Then :

(A) P is true

(B) Q is true

(C) Both P and Q are true

(D) Both P and Q are false

46. If E_1 and E_2 are measurable sets and m is Lebesgue measure, then which of the following is necessarily true ?

(A) $m(E_1 \cup E_2) + m(E_1 \cap E_2) = m(E_1)$

(B) $m(E_1 \cup E_2) + m(E_1 \cap E_2) = m(E_2)$

(C) $m(E_1 \cup E_2) + m(E_1 \cap E_2) = m(E_1) + m(E_2)$

(D) None of the above

47. Let E be a bounded measurable set of real numbers. Suppose $\exists$ a bounded, countably infinite set of real numbers Ω for which $\{\lambda + E\}_{\lambda \in \Omega}$ is disjoint. Then :

(A) $m(E) \geq 2$

(B) $m(E) \leq -2$

(C) $m(E) = \infty$

(D) $m(E) = 0$

48. Let E be a subset of real numbers. Then :

$$\bigcap_{k=1}^{\infty} \left\{ x \in E \mid f(x) > c - \frac{1}{k} \right\}$$

equals to :

(A) $\{x \in E \mid f(x) < c\}$

(B) $\{x \in E \mid f(x) \geq c\}$

(C) $\{x \in E \mid f(x) < c - 1\}$

(D) None of the above

49. Let $f : [0,1] \to \mathbf{R}$ be a map such that $f(x) = x^2$, then :

(A) f is measurable

(B) f is not measurable

(C) Both (A) and (B) are false

(D) None of the above

50. Which of the following statements is false ?

(A) The outer measure of an interval is its length

(B) Outer measure is translation invariant

(C) Outer measure in finitely additive

(D) Outer measure is not finitely additive

51. Which one of the following is true ?

(A) Outer measure of a singleton set is 1.

(B) Outer measure of a singleton set is 0.

(C) Outer measure of a countable set is ∞.

(D) Outer measure of a finite set is the number of elements in the set.

52. A set E is said to be measurable if :

(A) for each set A,

$$m^*(A)=m^*(A\cap E)+m^*\left(A\cap E^c\right)$$

(B) for each set A,

$$m^*(A)>m^*(A\cap E)+m^*\left(A\cap E^c\right)$$

(C) for each set A,

$$m^*(A)<m^*(A\cap E)+m^*\left(A\cap E^c\right)$$

(D) $m^*(A)=m^*(A\cap E)+m^*\left(A\cap E^c\right)$

for some A.

53. Let $\{E_1, E_2, \ldots\ldots\ldots, E_n\}$ be a disjoint collection of measurable set. Then :

(A) $m^*\left(\bigcup_{k=1}^{n} E_k\right)=\sum_{k=1}^{n} m^*(E_k)$

(B) $m^*\left(\bigcup_{k=1}^{n} E_k\right)>\sum_{k=1}^{n} m^*(E_k)$

(C) $m^*\left(\bigcup_{k=1}^{n} E_k\right)<\sum_{k=1}^{n} m^*(E_k)$

(D) None of the above

54. Which one of the following is true ?

(A) Lebesgue measure is not countably additive.

(B) Lebesgue measure is countably additive.

(C) Lebesgue measure is not translation invariant.

(D) Labesgue measure assigns the value 0 to the intervals

55. Outer measure is translation invariant, that is, for any set A and number y, then which of the following is true ?

(A) $m^*(A+y)=m^*(A)$

(B) $m^*(A+y)>m^*(A)$

(C) $m^*(A+y)<m^*(A)$

(D) None of the above

56. Consider the following statements :

P : If A and B are disjoint subsets of real numbers then :

$$m^*(A \cup B) = m^*(A) + m^*(B)$$

Q : There are disjoint sets of real numbers A and B such that :

$$m^*(A \cup B) < m^*(A) + m^*(B)$$

Then :

(A) P is true

(B) Q is true

(C) Both P and Q are true

(D) Both P and Q are false

57. Let f be an extended real valued function defined on E and $f^+(x) = \max\{f(x), 0\}$ and $f(x) = \max\{-f(x), 0\}\ \forall x \in E$, then :

(A) f is measurable $\Leftrightarrow$ both f^+ and f^- are measurable

(B) f is measurable $\Leftrightarrow$ f^+ is measurable

(C) f is measurable $\Leftrightarrow$ f^- is measurable

(D) None of the above

58. If for $k = 1,2,3$, $f_k : E \to \mathbf{R}$ are measurable then :

(A) $\max\{f_1, f_2, f_3\}$ is not measurable.

(B) $\max\{f_1, f_2, f_3\}$ is measurable.

(C) max $\{f_1, f_2\}$ is measurable but max $\{f_1, f_2, f_3\}$ is not measurable.

(D) max $\{f_1, f_3\}$ is measurable but max $\{f_1, f_2, f_3\}$ is not measurable

59. If for K = 1, 2, 3, $f_k : E \to \mathbf{R}$ are measurable, then :

(A) $\min\{f_1, f_2, f_3\}$ is not measurable

(B) min $\{f_1, f_2\}$ is not measurable

(C) min $\{f_1, f_2, f_3\}$ is measurable

(D) min $\{f_1, f_2\}$ is measurable but min $\{f_1, f_2, f_3\}$ is not measurable.

60. Let f be a continuous map. Then which of the following is necessarily true ?

(A) For any Borel set B, f^{-1}(B) is also a Borel set.

(B) For any Borel set B, f^{-1} (B) is not necessarily a Borel set.

(C) There exists a Borel set B such that $f^{-1}(B)$ is not measurable.

(D) None of the above

61. Let $I \subseteq \mathbf{R}$ be an interval and $f : I \to \mathbf{R}$ be a monotonic function. Then :

(A) f is not necessarily measurable

(B) f is measurable

(C) f is measurable only if f is onto

(D) None of the above

62. Which one of the following is false ?

(A) A real valued function that is continuous on its measurable domain is measurable.

(B) A monotonic function that is defined on an interval is measurable.

(C) A monotonic function that is defined on an interval need not be measurable.

(D) Let f be extended measurable real valued function on E and $f = g$, a. e on E, then g is measurable on E.

63. If M is any set, the characteristic function X_M of the set M is the function given by :

(A) $X_M(x) = \begin{cases} 1 & \text{if } x \in M \\ 0 & \text{if } x \notin M \end{cases}$

(B) $X_M(x) = \begin{cases} 0 & \text{if } x \in M \\ 1 & \text{if } x \notin M \end{cases}$

(C) $X_M(x) = \begin{cases} 1 & \text{if } x \in M \\ -1 & \text{if } x \notin M \end{cases}$

(D) None of the above

64. Let f be a function defined on E and

$$f^+(x) = \max\{f(x), 0\},$$

$$f^-(x) = \max\{-f(x), 0\},$$

then which one of the following is false ?

(A) If f is measurable on E, then $|f|$ is measurable

(B) If f is measurable on E, then $|f|$ is not measurable

(C) If f^+ is measurable on E, then for $C \in \mathbf{R}$ Cf^+ is measurable

(D) None of the above

65. If $\{f_n\}$ is a sequence of measurable functions on $[a,b]$ such that the sequence $\{fn(x)\}$ is :

(A) Non-measurable function

(B) Measurable function

(C) Not defined

(D) None of the above

66. Every continuous function is :

(A) Non-measurable function

(B) Derivable

(C) Measurable functions

(D) Integrable

67. Let E be a subset of R and

$$X_E(x)=\begin{cases}1, & x\in E\\ 0, & x\notin E\end{cases}$$

then for $E_1, E_2 \subseteq R$ which of the following is true ?

(A) $X_{E_1}(x).X_{E_2}(x)=X_{E_1\cup E_2}(x)$

(B) $X_{E_1}(x).X_{E_2}(x)=X_{E_1}(x)$

(C) $X_{E_1}(x).X_{E_2}(x)=X_{E_1\cap E_2}(x)$

(D) None of the above

68. Let f be a non-negative measurable function on E, then $\int_E f=0$ if and only if :

(A) $f<0$ a. e. (almost everywhere on E)

(B) $f=0$ a. e. on E

(C) $f>0$ a. e. on E

(D) None of the above

69. Let the functions f and g be integrable over E, then for any α and β :

(A) $\int_E(\alpha f+\beta g)=\alpha\int_E f+\beta\int_E g$

(B) $\int_E(\alpha f+\beta g)=\alpha\int_E f-\beta\int_E g$

(C) $\int_E(\alpha f+\beta g)=-\alpha\int_E f+\beta\int_E g$

(D) $\int_E(\alpha f+\beta g)=-\alpha\int_E f-\beta\int_E g$

70. The upper Riemann Integral of f over $[a,b]$ denoted by $(R)\int_a^{-b} f(x)dx$:

(A) $(R)\int_a^{-b} f=\sup.\{L(f,P)|$ P is partition of $[a,b]\}$

(B) $(R)\int_a^{-b} f=\inf.\{U(f,P)|$ p is partition of $[a,b]\}$

(C) $(R)\int_a^{-b} f=\sup.\{U(f,P)|$ p is partition of $[a,b]\}$

(D) $(R)\int_a^{-b} f=\inf.\{L(f,P)|$ p is partition of $[a,b]\}$

71. A bounded real valued function f defined on closed bounded interval $[a,b]$ is Riemann Integrable over $[a,b]$ if :

(A) $(R)\int_{-a}^{b} f<(R)\int_a^{-b} f$

(B) $(R)\int_{-a}^{b} f=(R)\int_a^{-b} f$

(C) $(R)\int_{-a}^{b} f>(R)\int_a^{-b} f$

(D) $(R)\int_{-a}^{b} f\geq(R)\int_a^{-b} f$

72. Let $f:\mathrm{E}\to\mathbf{R}$, $g:\mathrm{E}\to\mathbf{R}$ be non-negative measurable function, then for any $\alpha>0$ and $\beta>0$:

(A) $\int_{\mathrm{E}}(\alpha f+\beta g)=\alpha\int_{\mathrm{E}}f$

(B) $\int_{\mathrm{E}}(\alpha f+\beta g)=\beta\int_{\mathrm{E}}g$

(C) $\int_{\mathrm{E}}(\alpha f+\beta g)=\alpha\int_{\mathrm{E}}f+\alpha\int_{\mathrm{E}}g$

(D) $\int_{\mathrm{E}}(\alpha f+\beta g)=\alpha\int_{\mathrm{E}}f+\beta\int_{\mathrm{E}}g$

73. Let $f,g:\mathrm{X}\to\mathbf{R}$ be two non-negative measurable functions with $f\le g$ on X. Then :

(A) $\int_{\mathrm{X}}f\le\int_{\mathrm{X}}g$

(B) $\int_{\mathrm{X}}f>\int_{\mathrm{X}}g$

(C) $\int_{\mathrm{X}}f=0$

(D) $\int_{\mathrm{X}}g=0$

74. Let :

$$\langle f_1,f_2,f_3,\ldots\ldots f_n,\ldots\ldots\rangle$$

be a sequence of non-negative measurable functions on E. If $\langle f_n\rangle\to f$ pointwise a. e. (almost everywhere) on E, then :

(A) $\int_{\mathrm{E}}f\le\liminf\int_{\mathrm{E}}f_n$

(B) $\int_{\mathrm{E}}f>\liminf\int_{\mathrm{E}}f_n$

(C) Both (A) and (B) are true

(D) Neither (a) nor (b) is true

75. Let :

$$f:[a,b]\to\mathbf{R}$$

be a montonic function. Then :

(A) f is continuous on $[a,b]$

(B) f is strictly increasing on $[a,b]$

(C) f is strictly decreasing on $[a,b]$

(D) f is continuous on $[a,b]$ except the set of measure zero.

76. Let $f:\mathrm{E}\to\mathbf{R}$ be an integral function over E. Let X, Y $\subseteq$ E such that $\mathrm{X}\cap\mathrm{Y}=\phi$ and X, Y are measurable. Then :

(A) $\int_{\mathrm{X}\cup\mathrm{Y}}f=\int_{\mathrm{X}}f-\int_{\mathrm{Y}}f$

(B) $\int_{\mathrm{X}\cup\mathrm{Y}}f=\left(\int_{\mathrm{X}}f\right)\left(\int_{\mathrm{Y}}f\right)$

(C) $\int_{\mathrm{X}\cup\mathrm{Y}}f=\int_{\mathrm{Y}}f-\int_{\mathrm{X}}f$

(D) $\int_{\mathrm{X}\cup\mathrm{Y}}f=\int_{\mathrm{X}}f+\int_{\mathrm{Y}}f$

77. Let E be a set of measure zero and define $f(x)=\infty\ \forall x\in\mathrm{E}$ (Assume convention 0. $\infty=0$) then :

(A) $\int_{\mathrm{E}}f=0$

(B) $\int_{\mathrm{E}}f=\infty$

(C) $\int_{\mathrm{E}}f>2$

(D) None of the above

78. Let $f:[0,1]\to \mathbf{R}$ be a map defined as :

$$f(x)=\begin{cases}1, & x\in Q\cap[0,1]\\ -1, & x\in Q^c\cap[0,1]\end{cases}$$

Then :

(A) f is Riemann Integrable

(B) f is not Riemann Integrable

(C) $U(f,p)=3\forall$ partition P of $[0,1]$

(D) None of the above

79. Let $f:[a,b]\to \mathbf{R}$ be a montonic function.

Then :

(A) f is Riemann integrable

(B) f is not Riemann Integrable

(C) $\int_a^{-b} f(x)dx \neq \int_{-a}^{b} f(x)dx$

(D) $\int_a^{-b} f(x)dx < \int_{-a}^{b} f(x)dx$

80. Lebesgue integral of the Dirichlet function f defined on $[0,1]$ by :

$$f(x)=\begin{cases}1 & \text{if} \quad x\in[0,1]\cap Q\\ 0 & \text{if} \quad x\in[0,1]\cap Q^c\end{cases}$$

is :

(A) doesn't exist

(B) 0

(C) 1

(D) None of the above

81. Let f be a non-negative measurable function on E, then for any $\lambda>0$:

(A) $m\{x\in E | f(x)\le\lambda\}\ge\frac{1}{\lambda}.\int_E f.$

(B) $m\{x\in E | f(x)\ge\lambda\}=\frac{1}{\lambda}.\int_E f$

(C) $m\{x\in E | f(x)\ge\lambda\}\ge\frac{1}{\lambda}.\int_E f$

(D) $m\{x\in E | f(x)\ge\lambda\}>\frac{1}{\lambda}.\int_E f$

82. Let f be a non-negative measurable function on E, and if E_0 is a subset of E of measure zero, then :

(A) $\int_E f=\int_{E_0} f$

(B) $\int_E f=\int_{E\sim E_0} f-\int_{E_0} f$

(C) $\int_E f=\int_{E\sim E_0} f$

(D) None of the above

83. A non-negative measurable function f on a measurable set E is said to be Integrable over E if :

(A) $\int_E f=0$

(B) $\int_E f<\infty$

(C) $\int_E f=\infty$

(D) None of the above

84. Let the non-negative function f be Integrable over E, then :

(A) f is finite a. e. (almost everywhere) on E.

(B) f is zero a. e. on E

(C) f is constant a. e. on E

(D) None of the above

85. For an extended real valued function f on E, positive part f^+ of f is given by :

(A) $f^+(x) = \max\{-f(x), 0\}$ for all $x \in E$

(B) $f^+(x) = \max\{f(x), 0\}$ for all $x \in E$

(C) $f^+(x) = -\max\{f(x), 0\}$ for all $x \in E$

(D) $f^+(x) = \min\{f(x), 0\}$ for all $x \in E$

86. For an extended real valued function f on E, negative part f^{-1} of f is given by :

(A) $f^-(x) = \min\{f(x), 0\}$ for all $x \in E$

(B) $f^-(x) = \max\{f(x), 0\}$ for all $x \in E$

(C) $f^-(x) = \min\{-f(x), 0\}$ for all $x \in E$

(D) $f^-(x) = \max\{-f(x), 0\}$ for all $x \in E$

87. If $|f|$ is Integrable over E, then the Integral of f over E is given by :

(A) $\int_E f = \int_E f^+ - \int_E f^-$

(B) $\int_E f = \int_E f^+ + \int_E f^-$

(C) $\int_E f = \int_E f^- - \int_E f^+$

(D) None of the above

88. Let f be Integrable over E, then :

(A) $\int_E f > \int_{E \sim E_0} f$ if $E_0 \subseteq E$ and $m(E_0) = 0$

(B) $\int_E f < \int_{E \sim E_0} f$ if $E_0 \subseteq E$ and $m(E_0) = 0$

(C) $\int_E f = \int_{E \sim E_0} f$ if $E_0 \subseteq E$ and $m(E_0) = 0$

(D) None of the above

89. Let f be integrable over E and $\{E_n\}_{n=1}^{\infty}$ a disjoint countable collection of measurable subsets of E whose union is E, then :

(A) $\int_E f < \sum_{n=1}^{\infty} \int_{E_n} f$

(B) $\int_E f > \sum_{n=1}^{\infty} \int_{E_n} f$

(C) $\int_E f = \sum_{n=1}^{\infty} \int_{E_n} f$

(D) None of the above

90. Let f be Integrable over E. If $\{E_n\}_{n=1}^{\infty}$ is an ascending countable collection of measurable subsets of E, then :

(A) $\bigcup_{n=1}^{\infty} \int_{E_n} f = \lim_{n\to\infty} \int_{E_n} f$

(B) $\bigcup_{n=1}^{\infty} \int_{E_n} f < \lim_{n\to\infty} \int_{E_n} f$

(C) $\bigcup_{n=1}^{\infty} \int_{E_n} f > \lim_{n\to\infty} \int_{E_n} f$

(D) None of the above

91. A family F of measurable functions on E is said to be uniformly integrable over E provided :

(A) for each $\in > 0, \exists \delta > 0$ and an $f \in F$, if $A \subseteq E$ is measurable and $m(A) < \delta$, then $\int_A |f| < \in$, $m^*(A) = -2$.

(B) For each $\in > 0, \exists \delta > 0$ such that for each $f \in F$, if $A \subseteq E$ is measurable and $m(A) < \delta$, then $\int_A |f| <' \in$.

(C) There is a $\in > 0$, $\exists \delta > 0$ such that for each $f \in F$, if $A \subseteq E$ is measurable and $m(A) < \delta$, then $\int_A |f| < \in$.

(D) None of the above

92. Let $f : [a,b] \to \mathbf{R}$ be a bounded map such that :

$$\sup_{x\in[a,b]} f(x) = M \quad \inf_{x\in[a,b]} f(x) = m$$

then :

(A) $m(b-a) \le \int_a^b f(x)dx \le M(b-a)$

(B) $\int_a^b f(x)dx > m(b-a)$

(C) $\int_a^{-b} f(x)dx > \int_{-a}^{b} f(x)dx$

(D) None of the above

93. Let $f : [a,b] \to \mathbf{R}$ be a bounded map; P be a partition of $[a,b]$. Let $L(P, f)$ and $U(P, f)$ denote Riemann lower and upper sums respectively, then which of the following is necessarily true ?

(A) $U(P, f) = L(P, f)$

(B) $U(P, f) < L(P, f)$

(C) $U(P, f) \ne L(P, f)$

(D) $U(P, f) \ge L(P, f)$

94. Let :

$$f(x) = \begin{cases} \sin x, & x \in \left[0, \frac{\pi}{2}\right] \\ \cos x, & x \in \left(\frac{\pi}{2}, 4\right] \end{cases}$$

Then which of the following is true ?

(A) f is nowhere continuous

(B) f is Riemann Integrable

(C) f is not Riemann Integrable

(D) None of the above

95. Let :

$$f(x)=\begin{cases} x, & x\in[0,1) \\ x+1, & x\in[1,2) \\ x+3, & x\in[2,3) \end{cases}$$

and D be the set of discontinuity of f, then :

(A) $m^*(D)=0$

(B) $m^*(D)<0$

(C) $m^*(D)=3$

(D) $m^*(D)=\infty$

96. Let E be a measurable set and $1\le p\le\infty$. If the functions $f,g\in L^p(E)$ then :

(A) $f+g\in L^p(E)$

(B) $f+g\notin L^p(E)$

(C) Both (A) and (B) are true

(D) None of the above

97. Let E be a measurable set and $1\le p\le\infty$. If the functions $f,g\in L^p(E)$, then :

(A) $\|f+g\|p\le\|f\|_p-\|g\|_p$

(B) $\|f-g\|p>\|f\|_p+\|g\|_p$

(C) $\|f+g\|p>\|f\|_p+\|g\|_p$

(D) $\|f+g\|p\le\|f\|_p+\|g\|_p$

98. For $1<p<\infty; q$ is the conjugate of p $\left(i.e. \frac{1}{p}+\frac{1}{q}=1\right)$ and any *two* positive numbers a and b :

(A) $ab>\frac{a^p}{p}+\frac{b^q}{q}$

(B) $ab\ge\frac{a^p}{p}+\frac{b^q}{q}$

(C) $ab\le\frac{a^p}{p}+\frac{b^q}{q}$

(D) None of the above

99. If $f,g\in L^2(E)$, then which of the following is necessarily true ?

(A) $\int_E(\lambda f+g)^2=\lambda^2\int_E f^2+2\lambda\int_E f.g+\int_E g^2\,\forall\lambda\in\mathbf{R}$

(B) $\int_E(\lambda f+g)^2<0\,\forall\lambda\in\mathbf{R}$

(C) $\int_E(\lambda f+g)^2=\lambda\int_E f^2+\int_E g\,\forall\lambda\in\mathbf{R}$

(D) None of the above

100. If f is bounded functions on E and $f\in L^p(E)$, then :

(A) If $p_2>p_1$, then $f\notin L^{p_2}(E)$

(B) $\exists p_2>p_1$ such that $f\notin L^{p_2}(E)$

(C) $\forall p_2>p_1, f\in L^{p_2}(E)$

(D) None of the above

Roll No. ....

O. M. R. Serial No. | | | | | | | | |

Question Booklet Number
294242

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Advanced Topology)

Paper Code							
B	0	3	0	8	0	2	T

Questions Booklet Series
B

Time : 1:30 Hours]

[*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

(Remaining instructions on the last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. Every locally compact Hausdorff space is :

(A) regular

(B) completely regular

(C) normal

(D) None of the above

2. In a topological space (X, T) if every point in X has a nbd whose closure is compact, then the space is :

(A) Lindeloff

(B) Locally compact

(C) Normal

(D) None of the above

3. An indiscrete topological space $I = \{\phi, X\}$ is always :

(A) locally connected

(B) disconnected

(C) connected

(D) None of the above

4. Let (X, T) is a topological space and A is a non-empty subset of X. If A is the union of two non-empty separated sets, then :

(A) A is connected

(B) A is disconnected

(C) A is maximal connected

(D) None of the above

5. A topological space (X, T) is disconnected if and only if $\exists$ a non-empty proper subset of X which is :

(A) T-open in X.

(B) T-closed in X.

(C) Both T-open and T-closed in X.

(D) None of the above

6. The closure of a connected set is :

(A) Connected

(B) Maximal connected

(C) Separated

(D) None of the above

7. A continuous image of a connected space is :

(A) disconnected

(B) locally connected

(C) connected

(D) None of the above

8. If (X, T) be a product topological space of two topological spaces (X_1, T_1) and (X_2, T_2), then X is connected, if :

(A) X_1 is connected.

(B) X_2 is connected.

(C) X_1 and X_2 both are connected.

(D) None of the above

9. If $T = \{\phi, \{1\}, \{2, 3\}, X\}$ is a topology on $X = \{1, 2, 3\}$, then (X, T) is a :

(A) connected space

(B) maximal connected space

(C) disconnected space

(D) None of the above

10. Every discrete topological space (X, **D**) when X consists of more than one point is :

(A) connected

(B) disconnected

(C) maximal connected

(D) None of the above

11. If (X, T) is disconnected and T_0 is finer than T, then (X, T_0) is :

(A) locally connected

(B) connected

(C) disconnected

(D) None of the above

12. The range of a continuous real-valued function defined on a connected space is :

(A) an interval

(B) a set

(C) a space

(D) None of the above

13. If S be a lower limit topology of the set of real numbers R, then the space (R, S) is :

(A) maximal connected space

(B) connected space

(C) disconnected space

(D) None of the above

14. The usually topological space is :

(A) a locally connected space

(B) a connected space

(C) a disconnected space

(D) None of the above

15. If (X, T) is connected space and T^* is coarser than T, then (X, T^*) :

(A) is connected.

(B) is disconnected.

(C) may be connected or disconnected

(D) None of the above

16. If $X = \{p, q, r, s\}$ and $T = \{\phi, \{p\}, \{p, q\}\ \{p, q, r\}, X\}$, then (X, T) is :

(A) disconnected

(B) locally connected

(C) connected

(D) None of the above

17. If (X, T) is a connected space then it has :

(A) only open component X itself.

(B) only open component ϕ itself.

(C) many open components.

(D) None of the above

18. If (X, T) be a topological space and $A \subset X$. If A is a maximal connected subset of X, then A is said to be :

(A) a non-empty frontier.

(B) a component of the space X.

(C) a complement.

(D) None of the above

19. If (X, T) be an arbitrary topological space, then :

(A) each component of X is open.

(B) each component of X is closed.

(C) each component of X is disconnected.

(D) None of the above

20. If $T = \{\phi, \{1\}, \{2, 3\}, \{1, 2, 3\}, \{2, 3, 4, 5\}, X\}$ is a topology on $X = \{1, 2, 3, 4, 5\}$, then the components of X are :

(A) $\{1\}$ and $\{2, 3, 4, 5\}$.

(B) $\{2, 3\}$ and $\{1, 2, 3\}$.

(C) $\{1, 2, 3\}$ and X.

(D) All of the above

21. If {X, T} be an arbitrary topological space, then :

(A) each component of X is disconnected.

(B) each component of X is locally connected.

(C) the components of X form a partition of X.

(D) None of the above

22. The continuous image of an arcwise connected set is :

(A) connected

(B) arcwise connected

(C) disconnected

(D) None of the above

23. The components of a totally disconnected space (X, T) :

(A) are singleton sets

(B) are null sets

(C) are open sets

(D) None of the above

24. Every discrete topological space (X, D) is :

(A) connected

(B) arcwise connected

(C) totally disconnected

(D) None of the above

25. Every component of a locally connected space is :

(A) open

(B) closed

(C) disconnected

(D) None of the above

26. Any discrete space (X, **D**) containing a single point is :

(A) totally disconnected

(B) locally connected

(C) disconnected

(D) None of the above

27. The product X × Y of locally connected sets X and Y is :

(A) locally connected

(B) separated

(C) totally disconnected

(D) None of the above

28. Which one of the following is the weakest topology defined on a non-empty set X ?

(A) Product topology

(B) Discrete topology

(C) Indiscrete topology

(D) None of the above

29. The product of two second axiom (second countable) space is a :

(A) Hausdorff space

(B) Second axiom space

(C) Normal space

(D) None of the above

30. The product of two Hausdorff spaces is a :

(A) Hausdorff space

(B) Regular space

(C) Normal space

(D) None of the above

31. If X = X $\{X_n : n \in I\}$, then the function $\Pi_n : X \to X_n$ defined by $\Pi_n(x) = x_n \;\forall x \in X$ is said to be the :

(A) evaluation map

(B) projection map

(C) diagonal map

(D) None of the above

32. A map f : X → Y defining a homeomorphism of X onto Y is said to be :

(A) an embedding

(B) a diagonal map

(C) evaluation map

(D) a projection of a topological space X into another space Y.

33. The evaluation map of X into X $\{Y_n : n \in I\}$ is :

(A) constant

(B) unique

(C) not unique

(D) None of the above

34. If $\{(X_\alpha, T_\alpha) : d \in I\}$ be an arbitrary collection of topological spaces and T is a topology on $X = X\{X_\alpha : \alpha \in I\}$, then T is :

(A) the product topology for X

(B) the quotient topology for X

(C) the metric topology for X

(D) None of the above

35. Each projection mapping Π_α is :

(A) constant

(B) closed

(C) open

(D) None of the above

36. Let X be any set and $\tau = X, \phi$. Then τ is called :

(A) co-finite topology

(B) co-complement topology

(C) Indiscrete topology

(D) None of the above

37. The product of any non-empty class of Hausdorff spaces is :

(A) open

(B) closed

(C) a Hausdorff

(D) None of the above

38. The product space $X = X\{X_\alpha : \alpha \in I\}$ is regular if and only if each co-ordinate space X_α is :

(A) continuous

(B) normal

(C) open

(D) regular

39. Every Tychonoff space $X = X\{X_\alpha : \alpha \in I\}$ can be embedded as :

(A) a subspace of X

(B) a subspace of a cube

(C) a subspace of co-ordinate space

(D) None of the above

40. Projection maps are :

(A) always closed

(B) not always closed

(C) always open

(D) None of the above

41. If X is a T_1-space which is regular and also satisfies the second axiom of countability, then X is :

(A) metrizable and separable

(B) connected space

(C) quotient space

(D) None of the above

42. Which one of the following topologies is the smallest topology of which the projections are continuous ?

(A) Quotient topology

(B) Discrete topology

(C) Product topology

(D) None of the above

43. If (X, T) be a topological space, Y is a set and f is a mapping of X onto Y, then the largest topology say T* for Y such that $f : T \to T^*$ is continuous, is said to be the :

(A) Tychonoff topology

(B) Product topology

(C) Quotient topology

(D) Discrete topology for Y relative to f and T.

44. If X is a non-empty set and D a decomposition of X, then the mapping Π from X onto D, such that $\Pi(x)$ is the unique member of D to which x belongs, is said to be the :

(A) canonical map

(B) evaluation map

(C) diagonal map

(D) None of the above

45. If X be a topological space such that the quotient space X/R is Hausdorff, then :

(A) R is a closed subset of the space X.

(B) R is a closed subset of the product space X × X.

(C) R is an open subset of the product space X × X.

(D) R is an open subset of the space X.

46. A subset A of Y is open in the quotient topology relative to $f : X \to Y$, if and only if :

(A) f^{-1} [A] is open in Y.

(B) f^{-1} [A] is open in X.

(C) f[A] is open in Y.

(D) None of the above

47. If f be a continuous mapping of a topological space (X, T) onto another space (Y, T*) such that f is either open or closed, then T* must be the :

(A) Tychonoff topology for Y

(B) Tychonoff topology for X

(C) Quotient topology for Y

(D) Quotient topology for X

48. If X be a topological space, X/R be a quotient space such that R is closed in X × X and Π is an open quotient map, then X/R is :

(A) normal space

(B) regular space

(C) Hausdorff space

(D) None of the above

49. The usual topological space (R, U) is :

(A) Normal space

(B) Hausdorff space

(C) Regular space

(D) None of the above

50. The pair (A, ≥) consisting of a non-empty set A and a binary relation ≥ defined on A is called a :

(A) directed system

(B) cofinal subset

(C) residual subset

(D) None of the above

51. A sequence of natural numbers < N > is an example of a :

(A) residual subset

(B) net

(C) directed set

(D) None of the above

52. If (X, T) be an indiscrete topological space, then every net (f, X A, ≥) in X converges to :

(A) a unique point of X

(B) only two points of X

(C) every point of X

(D) None of the above

53. Let a net $\{f_a : a \in A\}$ be in a set X, if ∀ subset V of X, the net is eventually in V or eventually in V′, then the net is called :

(A) universal net

(B) subnet

(C) cofinal subnet

(D) None of the above

54. If (A, ≥) and (B, ≥*) be two directed sets, then a mapping Ψ : A → B defined as $a_1 \geq a_2 \Rightarrow \Psi(a_1) \geq^* \Psi(a_2),\ a_1, a_2 \in A$, is known as :

(A) projection mapping

(B) isotone mapping

(C) homomorphism

(D) None of the above

55. If (X, T) be a topological space and f be a net in X and x_0 be a point in X. If f is frequently in every T-nbd of x_0, then the point x_0 is said to be :

(A) cluster point of the net f.

(B) interior point of the net f.

(C) neighborhood point of the net f.

(D) All of the above

56. If each net in X converges to at most one point, then the topological space (X, T) is :

(A) Tychonoff space

(B) Lindelof space

(C) Hausdorff space

(D) None of the above

57. A subspace Y of a topological space (X, T) is closed if and only if no net in Y converges to :

(A) a point in X

(B) a point in Y

(C) a point in X ~ Y

(D) None of the above

58. If $\{f_a : a \in A\}$ be an ultranet in X and g a mapping of X into Y, then $\{g(f_a) : a \in A\}$ is :

(A) an ultranet in X

(B) an ultranet in Y

(C) an ultranet in X ~ Y

(D) None of the above

59. If (f, X, A, ≥) be a net and Ψ be an isotone map of a directed set (B, ≥) into the directed set (A, ≥) such that Ψ [B] is cofinal in A, then f o Ψ is :

(A) a subset of f

(B) a subset of Ψ

(C) an ultranet of f

(D) None of the above

60. A topological space (X, T) is compact if and only if each net in X has :

(A) an interior point

(B) an exterior point

(C) a cluster point

(D) None of the above

61. A point p in a topological space (X, T) is a cluster point of the net (f, X, A, ≥) if and only if :

(A) some subnet (g, X, B, ≥*) of f converges to p.

(B) some subnet (g, X, B, ≥*) of f converges except p.

(C) some ultranet (g, X, B, ≥*) of f converges except p.

(D) None of the above

62. If N be directed by $\geq$, then N – {1, 2} is a :

(A) closed subset of N

(B) residual subset of N

(C) cofinal subset of N

(D) None of the above

63. If the set of all natural numbers N be directed by $\geq$, then the subset S = {1, 3, 5, ...} is :

(A) cofinal subset of N

(B) residual subset of N

(C) closed subset of N

(D) None of the above

64. Let f be a net in N i. e. $f : N \to N$, defined by $f(x) = 2n - 1$, then the set of cluster points of f being :

(A) {1, 2, 1, 3, 1, 4, ...}

(B) {2, 3, 4, 3, 5, 3, ...}

(C) {1, 3, 5, ...}

(D) {2, 4, 6, ...}

65. If (X, D) be a discrete topological space, then a net (f, X A, $\geq$) converges to a point $p \in X$ if and only if :

(A) f is eventually in p.

(B) f is frequently in p.

(C) f is eventually in $\{p\}$.

(D) f is frequently in $\{p\}$.

66. In a topological space (X, T) if every convergent net in X has a unique cluster point and this is the unique limit point of the net then the space, is :

(A) Connected space

(B) Compact space

(C) Lindelof space

(D) Hausdorff space

67. If X be an infinite set, then the family F = {A : X ~ A is finite} defines a filter on X, known as :

(A) cofinite filter

(B) free filter

(C) fixed filter

(D) None of the above

68. If (X, T) be a topological space and N (x) be a collection of all T-nbds of a point $x \in X$, then N (x) defines a filter on X, is called :

(A) discrete filter

(B) indiscrete filter

(C) cofinite filter

(D) neighbourhood filter

69. A filter F on a non-empty set X is known as free filter if and only if :

(A) $\cap\{A : A \in F\} = \phi$

(B) $\cap\{A : A \in F\} \neq \phi$

(C) $\cap\{A : A \in X\} = \phi$

(D) None of the above

70. If X be a non-empty set, then {X} is always a filter on X and known as :

(A) fixed filter

(B) indiscrete filter

(C) discrete filter

(D) None of the above

71. A filter F on X is said to be an ultrafilter on X if and only if there exists :

(A) no filter on X strictly finer than F.

(B) no filter on X strictly coarser than F.

(C) no filter on X equal to F.

(D) None of the above

72. If (X, T) be a topological space and F be a filter on X, then F is said to converge to a point $p \in X$, if and only if F is eventually in each nbd of p. Here p is known as the :

(A) cluster point of F

(B) limit point of F

(C) interior point of F

(D) None of the above

73. Two filter bases B_1 and B_2 are equivalent if p is :

(A) a limit point of both B_1 and B_2.

(B) an interior point of both B_1 and B_2.

(C) an adherent point of both B_1 and B_2.

(D) None of the above

74. Every filter on a set X is contained in :

(A) a discrete filter

(B) a cofinite filter

(C) a neighbourhood filter

(D) None of the above

75. Every filter F on a set X is the intersection of :

(A) all the ultrafilters coarser than F.

(B) all the ultrafilters finer than F.

(C) all the cofinite filters coarser than F.

(D) None of the above

76. A topological space (X, T) is Hausdorff if and only if every convergent filter on X has :

(A) a limit point

(B) a cluster point

(C) a unique limit

(D) None of the above

77. If (X, T) be a topological space and every ultrafilter on X converges, then the space (X, T) is :

(A) a Hausdorff space

(B) a compact space

(C) a connected space

(D) None of the above

78. If (X, T) be a topological space and $A \subset X$, then a class $C^* = \{G_i : i \in I\}$ of subsets of X is said to be the :

(A) Cover

(B) Open cover

(C) Refinement

(D) T-open cover

of A if and only if $A \subset \bigcup_i \{G_i : i \in I\}$.

79. "Every open cover of a closed and bounded interval $A = [a, b]$ is reducible to a finite cover." This is the statement of :

(A) Bolzano theorem

(B) Tychonoff's theorem

(C) Heine-Borel theorem

(D) None of the above

80. A topological space in which every open cover has finite subcover is said to be a :

(A) Connected space

(B) Compact space

(C) Lindelof space

(D) Hausdorff space

81. A class of sets is said to be 'Fixed' if :

(A) it has non-empty intersection.

(B) its intersection is empty.

(C) its number of elements are fixed.

(D) None of the above

82. Any closed subspace of a compact space is :

(A) Hausdorff

(B) Not compact

(C) Compact

(D) Connected

83. A continuous image of a compact set is :

(A) closed

(B) compact

(C) not compact

(D) open

84. If A is a subset of a topological space (X, T) and A is compact with respect to T, then :

(A) A has finite intersection property.

(B) A is compact w. r. t. the relative topology T_A on A.

(C) A is not compact w. r. t. the relative topology T_A on A.

(D) None of the above

85. Every compact subset of a Hausdorff space is :

(A) Hausdorff

(B) Compact

(C) Closed

(D) All of the above

86. Every compact Hausdorff space is :

(A) normal

(B) regular

(C) Tychonoff

(D) All of the above

87. An infinite subset A of a discrete topological space (X, D) is :

(A) closed

(B) compact

(C) not compact

(D) None of the above

88. If (X, T) and (Y, T*) be two topological spaces, A is a compact subset of X and $f : X \to Y$ is a continuous function, then $f[A]$ is :

(A) compact

(B) not compact

(C) regular

(D) normal

89. The closed interval [0, 1] is :

(A) not compact

(B) compact

(C) separated

(D) None of the above

90. The Cantor's set Γ is :

(A) closed and bounded

(B) unbounded

(C) not compact

(D) None of the above

91. Let T = {ϕ, {1}, {1, 2,}, Y} be a topology defined on Y = {1, 2, 3}. Then (Y, T) is :

(A) Hausdorff space

(B) Normal space

(C) Compact space

(D) Not a compact space

92. If X be a compact space and Y be a Hausdorff space, then every bijective continuous mapping of X onto Y is :

(A) a homomorphism

(B) an automorphism

(C) an isomorphism

(D) None of the above

93. In a topological space, compactness is :

(A) a topological variant property

(B) a topological invariant property

(C) a hereditary property

(D) None of the above

94. The usual topological space (R, U) is :

(A) Hausdorff

(B) Normal

(C) Compact

(D) Not compact

95. In a topological space (X, T) if every open cover of X is reducible to a countable cover, then the space is called a :

(A) Countable compact space

(B) Sequentially compact space

(C) Lindelof space

(D) Locally compact space

96. 'Every bounded infinite set of real numbers has a limit point.' This is called :

(A) Heine-Borel Theorem

(B) Bolzano-Weierstrass Theorem

(C) Bolzano-Weierstrass property

(D) None of the above

97. A topological space with Bolzano-Weierstrass property is also known to be :

(A) Frechet compact

(B) Locally compact

(C) Sequentially compact

(D) None of the above

98. The set of real numbers in $[0, 1] \subset R$ is a :

(A) Countably compact set

(B) Sequentially compact set

(C) Locally compact set

(D) All of the above

99. A sequentially compact topological space (X, T) is :

(A) countably compact space

(B) locally compact space

(C) Lindelof space

(D) None of the above

100. Which one of the following statements is not true ?

(A) The compactness is a topological invariant.

(B) The Lindelofness is a topological invarianat.

(C) Both (A) and (B) are true.

(D) None of the above is true.

Roll No. ....

Question Booklet Number

297419

O. M. R. Serial No. | | | | | | | | |

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Operations Research)

Paper Code							
B	0	3	0	8	0	3	T

Questions Booklet Series

C

Time : 1:30 Hours] [*Maximum Marks : 75*

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(Remaining instructions on the last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. A necessary and sufficient condition for the existence of feasible solution of $m \times n$ transportation problem for $i = 1, 2, \ldots, m$ and $j = 1, 2, \ldots, h$ is that :

(A) $\Sigma a_i = \Sigma b_j$

(B) $\Sigma a_i < \Sigma b_j$

(C) $\Sigma a_i > \Sigma b_j$

(D) None of the above

2. The feasible solution of a transportation problem can be obtained by :

(A) north-west corner method

(B) lowest cost entry method

(C) Vogel's approximation method

(D) All of the above

3. In a B. F. S. of a $m \times n$ transportation problem, the total number of positive allocations is atmost :

(A) $m - n$

(B) $m + n$

(C) $m + n - 1$

(D) None of the above

4. In a $m \times n$ translation problem, degeneracy is said to occur when the number of allocations is :

(A) greater than $m + n - 1$

(B) less than $m + n - 1$

(C) equal to $m + n - 1$

(D) less than $m - n - 1$

5. A transportation problem is said to be unbalanced if :

(A) $\Sigma a_i = \Sigma b_j$

(B) $\Sigma a_i < \Sigma b_j$

(C) $\Sigma a_i > \Sigma b_j$

(D) Either (B) or (C)

6. In a 5×6 transportation problem, for a feasible solution to be non-degenerate, the total number of allocations is :

(A) 30

(B) 20

(C) 15

(D) None of the above

7. When total supply is equal to total demand in a transportation problem, the problem is said to be :

(A) balanced

(B) unbalanced

(C) degenerate

(D) None of the above

8. One disadvantage of using North-West corner method to find initial solution to the transportation problem is that :

(A) it is complicated to use

(B) it does take into account cost of transportation

(C) it leads to a degenerate initial solution

(D) All of the above

9. Profit maximization problem can be solved by Hungarian method by multiplying each element of payoff matrix by :

(A) -1

(B) 2

(C) -2

(D) None of the above

10. All costs in the dummy (fictitious) are or column added to convert an unbalanced assignment problem to balanced, assignment problem is taken equal to :

(A) 1

(B) -1

(C) 0

(D) None of the above

11. The total number of marked in the final reduced cost matrix of order n when an optimal assignment is obtained is :

(A) $n-1$

(B) n

(C) $n+1$

(D) None of the above

12. An assignment problem is called an unbalanced assignment problem when in its cost matrix :

(A) number of rows = number of columns

(B) number of rows < number of columns

(C) number of rows > number of columns

(D) Either (B) or (C)

13. If there were n workers and n jobs, there would be :

(A) $n!$ solutions

(B) $(n-1)!$ solutions

(C) $(n!)^n$ solutions

(D) n solutions

14. The assignment problem :

(A) requires that only one activity be assigned to each resource

(B) it a special case of transportation problem

(C) can be used to maximize resources

(D) All of the above

15. The Hungarian method for solving an assignment problem can also be used to solve :

(A) a transportation problem

(B) a travelling salesman problem

(C) Both (A) and (B)

(D) None of the above

16. An optimal solution of an assignment problem can be obtained only if :
(A) each row and column has only one zero element
(B) each row and column has at least one zero element
(C) the data are arranged in a square matrix
(D) None of the above

17. Two person zero-sum game means that the :
(A) sum of losses to one player is equal to the sum of gains to other
(B) sum of losses to one player is not equal to the sum of gains to other
(C) Both (A) and (B)
(D) None of the above

18. A game is said to be fair if :
(A) both upper and lower values of the game are same and zero
(B) upper and lower values of the game are not equal
(C) upper value is more than lower values of the game
(D) None of the above

19. What happens when maximin and minimax values of the game are same ?
(A) no solution exists
(B) solution is mixed
(C) saddle point exists
(D) None of the above

20. A mixed strategy game can be solved by :
(A) algebraic method
(B) matrix method
(C) graphical method
(D) All of the above

21. The size of the payoff matrix of a game can be reduced by using the principle of :
(A) game inversion
(B) rotation reduction
(C) dominance
(D) game transpose

22. Gomes which involve more than two players are called :
(A) conflicting games
(B) negotiable games
(C) N-person games
(D) All of the above

23. Linear programming method should be used to determine value of the game when size of pay off matrix is :
(A) 2×2
(B) 3×4
(C) $m \times 2$
(D) $2 \times n$

24. Gomes theory is the study of :
(A) selecting optimal strategies
(B) resolving conflict between players
(C) Both (A) and (B)
(D) None of the above

25. The technique of dynamic programming was developed by :

(A) Richard Bellman

(B) George Dantzig

(C) J. V. Neumann

(D) None of the above

26. A dynamic programming problem can be decomposed into a sequence of smaller sub-problems called :

(A) states

(B) stages

(C) Both (A) and (B)

(D) None of the above

27. The relationship between stages of dynamic programming problem is called :

(A) Random variable

(B) Note

(C) State

(D) Transformation

28. The technique of dynamic programming was developed in :

(A) 1900

(B) 1920

(C) 1950

(D) 1970

29. When classical method is used in solving a dynamic programming problem, the objective may be linear or non-linear but the constraints must be :

(A) Linear

(B) Non-linear

(C) Linear or non-linear

(D) None of the above

30. A spanning tree contains :

(A) at least one vertex

(B) at least two vertices

(C) all vertices

(D) None of the above

31. The total number of spanning trees of a graph with n vertices is :

(A) 2^{n-1}

(B) 2^{n-2}

(C) n^{n-2}

(D) None of the above

32. The number of different minimal spanning trees of a network with distinct labels on its branches is :

(A) one

(B) two

(C) three

(D) None of the above

33. A connected directed graph with no cycles is called a :

(A) tree

(B) spanning tree

(C) minimal spanning tree

(D) None of the above

34. The maximal flow model was first formulated by T.E. Harris and T. S. Ross in :

(A) 1950

(B) 1954

(C) 1960

(D) 1964

35. The objective of network analysis is to :

(A) minimize total project deviation

(B) minimize total project cost

(C) minimize production delays, interruption and conflicts

(D) All of the above

36. Network models have advantage in terms of :

(A) project planning

(B) project scheduling

(C) project controlling

(D) All of the above

37. In PERT, the span of time between the optimistic and pessimistic time estimates of an activity is :

(A) 3 σ

(B) 6 σ

(C) 12 σ

(D) None of the above

38. If an activity has zero slack, it implies that :

(A) it lies on the critical path

(B) it is a dummy activity

(C) the project is progressing well

(D) None of the above

39. The activity that can be delayed without affecting the execution of the immediate succeeding activity is determined by :

(A) total float

(B) free float

(C) independent float

(D) None of the above

40. Float or slack analysis is useful for :

(A) projects behind the schedule only

(B) projects ahead of the schedule only

(C) Both (A) and (B)

(D) None of the above

41. Which of the following methods can be used to solve non-linear programming problems ?

(A) Simplex method

(B) Dynamic programming

(C) Branch and bound method

(D) Gradient based methods

42. In non-linear programming, what is the objective function ?

(A) the set of constraints that must satisfied

(B) the variable to the optimized

(C) the feasible region of the problem

(D) the initial guess for the solution

43. Which of the following is true regarding the feasible region in non-linear programming ?

(A) it must be convex set.

(B) it can be a non-convex set.

(C) it is always a linear set.

(D) it does not impact the solution.

44. The objective function in quadratic programming is defined as :

(A) a linear function

(B) a non-linear function

(C) a quadratic function

(D) an exponential function

45. In quadratic programming, the feasible region is determined by :

(A) linear constraints only

(B) non-linear constraints only

(C) Both line and non-linear constraints

(D) None of the above

46. Which method is commonly used to solve quadratic programming problem ?

(A) Simplex method

(B) Branch and bound method

(C) Dynamic programming

(D) Interior point method

47. Which of the following is a characteristic of quadratic programming problems ?

(A) They always have a unique optimal solution.

(B) The feasible region forms a convex set.

(C) They can be solved using linear programming techniques.

(D) None of the above

48. Operations Research approach is :

(A) qualitative managerial skills

(B) operational managerial skills

(C) scientific approach to decision making

(D) quantitative managerial skills

49. Operations research practitioners do not :

(A) predict future operations

(B) build more than one model

(C) collect relevant data

(D) recommend decision and accept

50. OR was used initially in military by :

(A) British military

(B) USA military

(C) Japanese military

(D) Indian military

51. Operations research was developed :

(A) just before world war-I

(B) just before world war-II

(C) before the year 1900

(D) by around 1910

52. OR is said to be :

(A) only art

(B) only science

(C) art as well as science

(D) None of the above

53. OR approach is typically based on the use of :

(A) physical model

(B) mathematical model

(C) iconic model

(D) descriptive model

54. A model is :

(A) an essence of reality

(B) an approximation

(C) an idealization

(D) All of the above

55. A physical model is an example of :

(A) an iconic model

(B) an analogue model

(C) a verbal model

(D) a mathematical model

56. An optimization model :

(A) provides the best decision

(B) provides decision within its limited context

(C) helps in evaluating various alternatives

(D) All of the above

57. The process of modifying an OR model to observe the effect upon its output is called :

(A) sensitivity analysis

(B) cost/benefit analysis

(C) model validation

(D) input variation

58. The procedure for determining an optimal sequence of n-jobs on two machines was developed by :

(A) Newton

(B) Johnson

(C) Legendre

(D) J. V. Neumann

59. Johnson's method for sequencing of n-jobs on three machines is known as :

(A) Modified method

(B) Extended method

(C) Normal method

(D) None of the above

60. A sequencing problem involving 5 jobs and three machines requires evolution of :

(A) $\lfloor\underline{5} + \lfloor\underline{5} + \lfloor\underline{5}$ sequences

(B) $(\lfloor\underline{5})^3$ sequences

(C) $5 \times 5 \times 5$ sequences

(D) $5 + 5 + 5$ sequences

61. Which of the following best defines a convex set ?

(A) A set that contains only one point

(B) A set that contains all points on a straight line

(C) A set in which any line segment connecting two points in the set lies entirely within set

(D) A set that contains only integers

62. Which of the following statements about convex sets is true ?

(A) the intersection of two convex sets is also convex

(B) the union of two convex sets is always convex

(C) a convex set can be empty

(D) None of the above

63. The extreme points of the convex set of feasible solutions to an LPP are :

(A) finite

(B) infinite

(C) at most two

(D) None of the above

64. Which of the following is related to LPP ?

(A) Objective function

(B) Constraints

(C) Requirement vectors

(D) All of the above

65. A constraint that does not affect the feasible region is a :

(A) non-negative constraint

(B) redundant constraint

(C) standard constraint

(D) slack constraint

66. Infeasibility means that the number of solutions of the LP model that satisfies all the constraints is :

(A) at least 1

(B) zero

(C) infinite

(D) None of the above

67. In the degenerate basic solution of a system of equations :

(A) no basic variable is zero

(B) at least one basic variable is zero

(C) at least one basic variable is negative

(D) no basic variable is negative

68. The variables associated to B. F. S. are called :

(A) basic variables

(B) non-basic variables

(C) stack variables

(D) surplus variables

69. Constraints in LP model represent :

(A) limitations

(B) requirements

(C) balancing limitations and requirements

(D) All of the above

70. While solving LP problem, infeasibility may be removed by :

(A) adding another constraint

(B) adding another variable

(C) removing a constraint

(D) removing a variable

71. Simplex method was developed by :

(A) George Dantzig

(B) Hungarian

(C) John Von Neumann

(D) None of the above

72. To improve the solution in a simplex table of a maximization LPP, the vector α_k is selected as the incoming vector if $\Delta_h = C_k - Z_k$ is :

(A) Minimum

(B) Maximum and > 0

(C) Negative

(D) None of the above

73. In a maximization LPP, the coefficient of artificial variables in the objective function are taken as :

(A) zero

(B) M

(C) $-M$

(D) None of the above

74. The value of all the variables that do not appear in the basis variable column B of the last simplex table is :

(A) zero

(B) negative

(C) positive

(D) None of the above

75. To solve LPP, by simplex method, artificial variables are added to some constraints to :

(A) obtain an initial B. F. S.

(B) obtain F.S.

(C) obtain non-negative solution

(D) None of the above

76. In the optimal simpler table, $c_j - z_j = 0$ value indicates :

(A) unbounded solution

(B) cycling

(C) alternative solution

(D) infeasible solution

77. If any value in x_B-column of final simplex table is negative, then the solution is :

(A) unbounded

(B) infeasible

(C) optimal

(D) None of the above

78. For any primal problem and its dual :

(A) optimal value of objective function is same

(B) primal will have an optimal solution if dual does too

(C) both primal and dual cannot be infeasible

(D) All of the above

79. If dual has an unbounded solution, primal has :

(A) no feasible solution

(B) unbounded solution

(C) feasible solution

(D) None of the above

80. Dual constraints for the maximization LP problem can be written as :

(A) $\Sigma a_{ij} y_i \geq c_j$

(B) $\Sigma a_{ji} y_i \geq c_j$

(C) $\Sigma a_{ij} y_j \leq c_j$

(D) $\Sigma a_{ji} y_i \leq c_j$

81. If a primal LP problem has a finite solution, then the dual LP problem should have :

(A) finite solution

(B) infeasible solution

(C) unbounded solution

(D) None of the above

82. If the standard primal problem is of minimization, then all the constraints involve the sign :

(A) $\leq$

(B) $\geq$

(C) =

(D) None of the above

83. If the i^{th} slack variable of the primal is positive, then the i^{th} variable of the dual is :

(A) positive

(B) negative

(C) zero

(D) None of the above

84. The dual of the primal maximization LP problem having *m* constraints and *n* non-negative variables should :

(A) have *n* constraints and *m* non-negative variables

(B) be a minimization LP problem

(C) Both (A) and (B)

(D) None of the above

85. The right hand side constants of the constraints in a primal in standard form appears in its dual problem as :

(A) right hand constants

(B) the coefficients in the objective function

(C) the coefficients of an extra constraint

(D) None of the above

86. When an additional variable is added in the LP model, the existing optimal solution can be further improved if :

(A) $c_j - z_j \geq 0$

(B) $c_j - z_j \leq 0$

(C) Both (A) and (B)

(D) None of the above

87. Additional of an additional constraint in the existing constraints will cause a :

(A) change in objective function coefficients (c_j)

(B) change in coefficients a_{ij}

(C) Both (A) and (B)

(D) None of the above

88. The entering variable in the sensitivity analysis of objective function coefficients is always a :

(A) decision variable

(B) non-basic variable

(C) basic variable

(D) slack variable

89. A change in the objective function for a non-basic variable can affect :

(A) $c_j - z_j$ values of all non-basic variables

(B) $c_j - z_j$ values of all basic variables

(C) only the $c_j - z_j$ value of that variable

(D) None of the above

90. The right hand side range is often referred to as the range of :

(A) improvement

(B) feasibility

(C) infeasibility

(D) optimality

91. The maintain optimality of current optimal solution for a change Δc_k in the coefficients c_k of non-basic variable x_k we must have :

(A) $\Delta C_k = C_k - Z_k$

(B) $\Delta C_k = Z_k$

(C) $C_k + \Delta C_k = Z_k$

(D) $\Delta C_k \geq Z_k$

92. To ensure the best marginal increase in the objective function value, a resource value may be increased whose shadow price is comparatively :

(A) larger

(B) smaller

(C) Neither (A) or (B)

(D) Both (A) and (B)

93. In a mixed-integer programming problem :

(A) all of the decision variable require integer solutions

(B) few of the decision variables require integer solutions

(C) different objective functions are mixed together

(D) None of the above

94. The use of cutting plane method :

(A) reduces the number of constraints in the given problem

(B) yields better value of objective function

(C) requires the use of standard LP approach between each cutting plane application

(D) All of the above

95. Branch and Bound method divides the feasible solution space into smaller parts by :

(A) branching

(B) bounding

(C) enumerating

(D) All of the above

96. In a branch and bound minimization tree, the lower bounds on objective function value :

(A) do not decrease in value

(B) do not increase in value.

(C) remain constant

(D) None of the above

97. While applying the cutting-plane method, dual simplex method is used to maintain :

(A) optimality

(B) feasibility

(C) Both (A) and (B)

(D) None of the above

98. A non-integer variable is chosen in the optimal similar table of the integer LP problem to :

(A) leave the basis

(B) enter the basis

(C) construct a Gomory cut

(D) None of the above

99. The part of the feasible solution space eliminated by plotting a cut contains :

(A) only non-integer solutions

(B) only integer solutions

(C) Both (A) and (B)

(D) None of the above

100. While solving an IP problem any non-integer variable in the solution is picked up in order to :

(A) obtain the cut constraint

(B) enter the solution

(C) leave the solution

(D) None of the above

Roll No. ....

O. M. R. Serial No. | | | | | | | | |

Question Booklet Number
300565

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Mathematical Statistics) (Elective)

Paper Code							
B	0	3	0	8	0	4	T

Questions Booklet Series
A

Time : 1:30 Hours]

[*Maximum Marks : 75*

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2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. A point P is taken at random in a line AB of length $2a$, all positions of the point being equally likely. Then the probability of the area of the raetangle AP · FB exceeding $\frac{a^2}{2}$ is :

(A) $\frac{1}{\sqrt{2}}$

(B) $\frac{1}{2}$

(C) $\frac{\sqrt{3}}{2}$

(D) $\frac{1}{\sqrt{3}}$

2. If X is any random variable, then :

(A) $| E(X) | \geq E(| X |)$

(B) $| E(X) |^2 \geq E(| X |)$

(C) $| E(X) | \leq E(| X |)$

(D) None of the above

3. The first moment about mean is :

(A) 1

(B) 0

(C) 2

(D) 1.5

4. A chord is drawn at random in a given circle. What is probability that it is greater than the side of the equilateral triangle inscribed in that circle ?

(A) $\frac{1}{3}$

(B) $\frac{1}{4}$

(C) $\frac{1}{\sqrt{2}}$

(D) $\frac{1}{2}$

5. If $E(X) = \frac{1}{5}$ and $E(Y) = \frac{1}{6}$, then $E[2X + 5Y]$ is equal to :

(A) $\frac{37}{30}$

(B) $\frac{41}{30}$

(C) $\frac{38.5}{30}$

(D) $\frac{43}{30}$

6. If the probability distribution is given by :

x	$p(x)$
8	$\frac{1}{8}$
12	$\frac{1}{6}$
16	$\frac{3}{8}$
20	$\frac{1}{4}$
24	$\frac{1}{12}$

then $\frac{1}{4}E(X)$ is :

(A) 17

(B). 4

(C) 11

(D) 3

7. The expectation of the product of two independent discrete random variables is equal to :

(A) the product of their expectations

(B) the division of their expectations

(C) the product of their variables

(D) None of the above

8. A coin is tossed until the head appears. What is expectation of the number of tosses ?

(A) 3

(B) 5

(C) 2

(D) 4

9. If the density function is defined by

$f(x) = ce^{-x}, 0 \le x \le \infty,$

$= 0, \quad$ otherwise;

then the value of c is :

(A) 2

(B) 3

(C) 4

(D) 1

10. If x takes the values $x_n = (-1)^n 2^n n^{-1}$ for $n = 1, 2, 3, \ldots,$ with probabilities $p_n = 2^{-n}$, then E(x) is equal to :

(A) $\log\left(\frac{1}{2}\right)$

(B) $\log\left(\frac{1}{3}\right)$

(C) log 2

(D) log 3

11. If the probability of the variate X falling in the infinitesimal interval

$$\left(x - \frac{1}{2}dx, x + \frac{1}{2}dx\right)$$

be expressed in the form $f(x)dx$ where $f(x)$ is continuous function, then $f(x)$ is called :

(A) oscillatory function

(B) density function

(C) constant function

(D) None of the above

12. If $f(x) = 3x^2, 0 < x < 1$ is a probability density function, then $P\left(\frac{1}{3} < X < \frac{1}{2}\right)$ is :

(A) $\frac{17}{216}$

(B) $\frac{21}{216}$

(C) $\frac{19}{216}$

(D) $\frac{23}{216}$

13. A continuous random variable X has the probability density function $f(x) = 3x^2$, $0 \le x \le 1$, then for $P(X > b) = 0.05$, the value of b is :

(A) $(2.05)^{\frac{1}{3}}$

(B) $(3.05)^{\frac{1}{3}}$

(C) $(0.05)^{\frac{1}{3}}$

(D) $(1.05)^{\frac{1}{3}}$

14. If $F(x) = \int_{-\infty}^{x} f(x)dx = P(X \le x)$, then $F(x)$ is :

(A) a cumulative distribution function

(B) linear function

(C) an oscillatory function

(D) None of the above

15. The distribution function of a random variable X is given by

$$F(x) = \begin{cases} 1-(1+x)e^{-x}, & \text{for } x \ge 0 \\ 0, & \text{for } x < 0 \end{cases}$$

then corresponding density function of random variable X is :

(A) $\begin{cases} x^2e^{-x}, & \text{for } x \ge 0 \\ 0, & \text{for } x < 0 \end{cases}$

(B) $\begin{cases} x^{-1}e^{-x}, & \text{for } x \ge 0 \\ 0, & \text{for } x < 0 \end{cases}$

(C) $\begin{cases} xe^{-x}, & \text{for } x \ge 0 \\ 0, & \text{for } x < 0 \end{cases}$

(D) None of the above

16. If $P(a \le X \le b, c \le Y \le d)$,

$$= \int_a^b \{\int_c^d f(x,y)dy\}dx,$$

then :

(A) $\int_a^b \int_c^d f(x,y)dydx = 1$

(B) $\int_a^b \int_c^d f(x,y)dydx = 0$

(C) $\int_a^b \int_c^d f(x,y)dydx \to \infty$

(D) None of the above

17. If the joint probability density function of X and Y is $f(x,y) = 2,\ 0 < x < y < 1$, then the marginal probability density function of X, $g(x)$ is :

(A) $2+3x, 0 < x < 1$

(B) $2-2x, 0 < x < 1$

(C) $3+2x, 0 < x < 1$

(D) $2+2x, 0 < x < 1$

18. If the joint probability density function of X and Y is given in the question 17, then the marginal probability density function of Y, $h(y)$ is :

(A) $3y, 0 < y < 1$

(B) $4y, 0 < y < 1$

(C) $2y, 0 < y < 1$

(D) $\frac{3}{2}y, 0 < y < 1$

19. The conditional probability density function of Y for given X, $h\left(\frac{y}{x}\right)$ is :

(A) $\frac{1}{1-x}, 0 < x < 1$

(B) $\frac{1}{1-2x}, 0 < x < 1$

(C) $\frac{1}{1-3x}, 0 < x < 1$

(D) $\frac{2}{1-x}, 0 < x < 1$

20. The conditional probability density function of X for given Y, $g\left(\frac{x}{y}\right)$ is :

(A) $\frac{1}{y}, 0 < y < 1$

(B) $\frac{1}{2y}, 0 < y < 1$

(C) $\frac{1}{3y}, 0 < y < 1$

(D) $\frac{1}{4y}, 0 < y < 1$

21. If the density function

$$f(x) = \begin{cases} \frac{(x-1)^3}{4}, & 1 \le x \le 3 \\ 0, & \text{otherwise} \end{cases}$$

then, the mean E(X) is :

(A) 3.6

(B) 5.6

(C) 2.6

(D) 3.7

22. For the continuous distribution

$dF = y_0(x - x^2)dx, 0 \le x \le 1,$

y_0 being a constant, then y_0 is :

(A) 6

(B) 7

(C) 8

(D) 9

23. For the continuous distribution function given in question 22, the arithmetic mean is :

(A) $\frac{1}{3}$

(B) $\frac{1}{2}$

(C) $\frac{1}{5}$

(D) $\frac{1}{4}$

24. For the continuous distribution function given in question 22, the harmonic mean is :

(A) $\frac{1}{2}$

(B) $\frac{1}{4}$

(C) $\frac{1}{3}$

(D) $\frac{1}{6}$

25. For the continuous distribution function given in the question 22, the median is :

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{1}{5}$

(D) $\frac{1}{6}$

26. For the continuous distribution function given the question 22, the mode is :

(A) $\frac{1}{3}$

(B) $\frac{1}{2}$

(C) $\frac{1}{6}$

(D) $\frac{1}{4}$

27. For the distribution

$$df = y_0 e^{-\frac{x}{\sigma}} dx, 0 \le x \le \infty;$$

the μ_2' is :

(A) 2σ

(B) $\frac{2}{\sigma}$

(C) σ

(D) σ^{-1}

28. For the distribution given in the question 27, μ_2 is :

(A) σ^2

(B) σ^{-2}

(C) $2\sigma^2$

(D) $2e^{-2}$

29. For the distribution given in the question 27, the β_1 is :

(A) 5

(B) 6

(C) 4

(D) 9

30. If X and Y are two random variables, having joint probability distribution

$$f(x, y) = \begin{cases} x + y, & 0 < x < 1, \quad 0 < y < 1; \\ 0, & \text{elswehre} \end{cases}$$

then Var (X) is :

(A) $\frac{11}{144}$

(B) $\frac{13}{144}$

(C) $\frac{15}{144}$

(D) $\frac{11}{145}$

31. If:

$$f(x,y)=\begin{cases}3x^2y+3y^2x, & 0\le x\le 1, \quad 0\le y\le 1;\\ 0 & , \text{ elsewhere}\end{cases}$$

then the marginal density function $g(x)$ is :

(A) $\frac{5}{2}x^2+2x$

(B) $\frac{5}{2}x^2+3x$

(C) $\frac{3}{2}x^2+x$

(D) $\frac{3}{2}x^2+2x$

32. If the function $f(x, y)$ is given in the question 31, then the marginal density function $h(y)$ is :

(A) $y+\frac{5}{2}y^2$

(B) $y+\frac{3}{2}y^2$

(C) $2y+\frac{3}{2}y^2$

(D) $3y+\frac{5}{2}y^2$

33. If $f(x, y), g(x)$ and $h(y)$ are given in the questions 31, 32 and 33 respectively, then :

(A) X and Y are independent.

(B) X and Y are dependent.

(C) X and Y are equal.

(D) None of the above

34. If X be a random variable, then the moment generating function is :

(A) $E(e^{tX})$

(B) $E(e^{Xt^{-1}})$

(C) $E(e^{Xt^2})$

(D) None of the above

35. The moment generating function of sum of two independent random variables is :

(A) sum of their m. g. fs.

(B) division of their m. g. fs.

(C) product of their m. g. fs.

(D) None of the above

36. If $f(x)=\begin{cases}x & , \ 0\le x\le 1\\ 2-x, & 1\le x\le 2\\ 0 & , \text{ otherwise}\end{cases}$

Then $M_X(t)$ is :

(A) $(e^t+1)t^{-2}$

(B) $(e^t+1)^2t^{-3}$

(C) $(e^t-1)t^{-2}$

(D) $(e^t-1)^2t^{-2}$

37. If $f(x)$ is given in the question 36, then μ_1' is :

(A) 1

(B) 2

(C) 3

(D) 4

38. If $f(x)$ is given in the question 37, then μ_2' is :

(A) 2

(B) $\frac{3}{4}$

(C) $\frac{7}{6}$

(D) $\frac{1}{6}$

39. Logarithm of the m. g. f. of a distribution is :

(A) cumulant generating functions

(B) sum of generating functions

(C) product of generating functions

(D) None of the above

40. The cumulant generating function of the sum of two independent random variables is :

(A) product of their cumulant generating functions

(B) division of their cumulant generating functions

(C) sum of their cumulant generating functions

(D) None of the above

41. If the probability of success is p and the probability of the failure is q, then for n trials the mean of the binomial distribution is :

(A) np

(B) n^2p

(C) $n^{-1}p$

(D) np^2

42. If all the assumptions of the question 41 are followed, then μ_1 is :

(A) 2

(B) 1

(C) 0

(D) $\frac{1}{2}$

43. If all assumptions and the conditions of the question 41 are followed, then the second moment about mean is :

(A) n^2pq^{-1}

(B) npq

(C) $n^{-1}pq$

(D) npq^{-1}

44. If K(t) is the cumulative function about the origin of the binomial distribution of size n, then for $z = \log \frac{p}{q}$:

(A) $\frac{dK}{dt} = n\left[1 + e^{-(t+z)}\right]^{-1}$

(B) $\frac{dK}{dt} = n^2\left[1 + e^{-(t+z)}\right]^{-1}$

(C) $\frac{dK}{dt} = ne^{-zt} + 1$

(D) $\frac{dK}{dt} = n\left[1 + e^{-zt}\right]^{-1}$

45. Under the assumptions and the conditions given in equation 41, the moment generating function is found by :

(A) $(q + pe^t)^n$

(B) $(q^{-1} + pe^t)^n$

(C) $(q + pe^{-t})^n$

(D) $(q^{-1} + p^{-1}e^t)^n$

46. For the binomial distribution, there exists a relation :

(A) $k_{r+1}^2 = pq\left(\frac{dk_r}{dp}\right), r > 1$

(B) $k_{r+1} = pq\left(\frac{dk_r}{dp}\right), r > 1$

(C) $k_{r+1} = pq\left(\frac{dk_r}{dp}\right)^2, r > 1$

(D) None of the above

47. For the binomial distribution, the probability of at most r successes is :

(A) $\sum_{i=0}^{r} {}^nC_i \, p^{2i}q^{n-2i}$

(B) $\sum_{i=0}^{r} {}^nC_i \, p^{3i}q^{n-3i}$

(C) $\sum_{i=0}^{r} {}^nC_i \, p^{i}q^{n-i}$

(D) None of the above

48. A variate assumes values 0, 1, 2, ..., n whose frequencies are proportional to the binomial coefficients given by :

$\binom{n}{0}, \binom{n}{1}, \binom{n}{2}, \ldots\ldots, \binom{n}{n}$.

Then the mean is :

(A) $\frac{n^2}{2}$

(B) $\frac{n}{3}$

(C) $\frac{n}{4}$

(D) $\frac{n}{2}$

49. If all conditions and assumptions of the question 48 are followed, then the variance is :

(A) $\frac{n^2}{4}$

(B) $\frac{n^2}{3}$

(C) $\frac{n}{4}$

(D) $\frac{n^2}{2}$

50. "For any binomial distribution, the mean is 5 and the standard deviation is 3", then this statement is :

(A) correct

(B) incorrect

(C) semi-correct

(D) None of the above

51. The Poisson distribution is a limiting form of the binomial distribution when p(or q) is very small and n is large enough so that np or nq is :

(A) ∞

(B) changing

(C) a finite constant

(D) None of the above

52. The first moment of the Poisson distribution about origin is :

(A) m^{-1}

(B) m^{-2}

(C) m^2

(D) m

53. For the Poisson distribution, the second moment about origin is :

(A) $m^2 + m$

(B) $m^2 + 3m$

(C) $2m^2 + m$

(D) $m^2 + 2m$

54. For the Poisson distribution the standard deviation is :

(A) $\sqrt{m^3}$

(B) $\sqrt{m^5}$

(C) $\sqrt{m}$

(D) None of the above

55. If the mean of a Poisson distribution is 7 while the standard deviation is 6, then :

(A) the statement is correct.

(B) the statement is incorrect.

(C) the statement is semi-correct.

(D) None of the above

56. If $P(X = 0) = P(X = 1) = \lambda$ in Poisson distribution, then λ is :

(A) e^2

(B) e

(C) $e^{\frac{1}{2}}$

(D) e^{-1}

57. A Poisson distribution has a double mode at $x = 3$ and $x = 4$, then the probability that x will have one or the other of these two values, is found as :

(A) $\frac{64}{3}e^{-4}$

(B) $\frac{65}{3}e^{-4}$

(C) $\frac{61}{3}e^{-4}$

(D) $\frac{61}{4}e^{-4}$

58. If X_1 and X_2 be two independent random variables having Poisson distribution with parameters m_1 and m_2 respectively, then the Poisson distribution of $X_1 + X_2$ has the parameters :

(A) $m_1 m_2$

(B) $m_1 + m_2$

(C) $\frac{m_1}{m_2}$

(D) $\frac{m_2}{m_1}$

59. If x and y are two independent Poisson variates, where P(X = 1) = P(X = 2) and P(Y = 2) = P(Y = 3), then mean of X + Y is :

(A) 6

(B) 7

(C) 4

(D) 5

60. In a book of 300 pages, a proofreader finds no error in 200 pages, in 75 pages one error on each page, in 20 pages two errors on each page and in 5 page 3 errors on each page. Use Poisson distribution to these data and then the theoretical frequency for x error is ($e^{-.43} = 0.6505$) :

(A) $\frac{195.15(.43)x}{x!}$

(B) $\frac{200.15(.43)x}{x!}$

(C) $\frac{195.15(.86)x}{x!}$

(D) $\frac{200.15(.86)x}{x!}$

61. For the distribution

$$f(x) = y_0 e^{-\frac{1}{2}}\left(\frac{x-\mu}{\sigma}\right), -\infty \le x \le \infty,$$

where μ and σ > 0, one the parameters of the distribution, then y_0 is :

(A) $\frac{1}{\sqrt{2\pi\sigma}}$

(B) $\frac{1}{2\sqrt{2\pi\sigma}}$

(C) $\frac{1}{\sqrt{2\pi\sigma^2}}$

(D) $\frac{1}{2\sqrt{2\pi\sigma^2}}$

62. For the normal distribution, the ratio of the mean deviation from mean and the standard deviation is :

(A) 4 : 5

(B) 5 : 3

(C) 3 : 5

(D) 3 : 7

63. For the normal distribution at the origin the mean, median and mode are being :

(A) unequal

(B) different

(C) coincide

(D) None of the above

64. For the normal distribution, the moment generating function about origin is :

(A) $e^{\mu^2 t+\frac{1}{2}t^2\sigma^2}$

(B) $e^{\mu t+\frac{1}{2}t^2\sigma^2}$

(C) $e^{\mu^2 t^2+\frac{1}{3}t^3\sigma^2}$

(D) $e^{2\mu^2 t^2+\frac{1}{3}t^3\sigma^2}$

65. The income tax, X, of an employee has an distribution

$$f(x)=\begin{cases}\frac{1}{4}e^{-\frac{x}{4}}, & x\geq 0\\ 0, & x<0\end{cases}$$

If tax is levied at the rate of 5%, then the probability, that his income exceed ₹ 10,000 is :

(A) e^{-140}

(B) e^{-145}

(C) e^{-125}

(D) e^{-149}

66. Given $x=4y+5, y=kx+4$ are two regression lines of x on y and y on x respectively. Then :

(A) $0\leq 4k\leq 1$

(B) $0\leq k\leq \frac{1}{5}$

(C) $0\leq 4k\leq 3$

(D) None of the above

67. If the regression lines are given in the question 66 and $k=\frac{1}{16}$, then the coefficient of correlation is :

(A) $\frac{1}{3}$

(B) $\frac{1}{4}$

(C) $\frac{1}{5}$

(D) $\frac{1}{2}$

68. For the random variables x and y with the same mean the two regression equations are $y=ax+b$ and $x=\alpha y+\beta$, then :

(A) $b(1-\alpha)=\beta(1-a)$

(B) $(1-\alpha)=b\beta(1-a)$

(C) $b\beta(1-\alpha)=(1-a)$

(D) None of the above

69. Two independent variables x and y have means 5 and 10 and variances 4 and 9 respectively. If $u=3x+4y$ and $v=3x-y$, then the coefficient of correlation between u and v is :

(A) 0

(B) $\frac{1}{3}$

(C) $\frac{1}{4}$

(D) $\frac{1}{5}$

70. If $R_{1.23} = 1$, then there exists :

(A) $R_{2.13} = 1$ and $R_{3.13} = 1$

(B) $R_{2.23} = 1$ and $R_{3.13} = 1$

(C) $R_{2.13} = 1$ and $R_{3.12} = 1$

(D) None of the above

71. The Pearson's coefficient of correlation r lies between :

(A) -1 and $+1$

(B) $-\frac{1}{2}$ and $+\frac{1}{2}$

(C) $-\frac{1}{3}$ and $+\frac{1}{3}$

(D) None of the above

72. If the data are given by :

x	y
–3	9
–2	4
–1	1
1	1
2	4
3	9

then $\text{Cov}(x, y)$ is :

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) 0

(D) $\frac{1}{5}$

73. For the data given in the question 72, there exists :

(A) $\text{var}(x) = \frac{28}{6}, \text{var}(y) = \frac{392}{36}$

(B) $\text{var}(x) = \frac{25}{6}, \text{var}(y) = \frac{392}{37}$

(C) $\text{var}(x) = \frac{29}{6}, \text{var}(y) = \frac{393}{37}$

(D) None of the above

74. For the data given in the question 72, there exists :

(A) $y = x^2$

(B) x and y are independent

(C) $y^2 = x$

(D) None of the above

75. If $r_{12} = k$ and $r_{23} = -k$, then r_{13} lies between :

(A) 1 and $1 - 2k^2$

(B) -1 and $-1 - 2k^2$

(C) -1 and $1 - 2k^2$

(D) 1 and $-1 - 2k^2$

76. A random variable X follows an exponential distribution

$$f(x, \theta) = \frac{1}{\theta} e^{-\frac{x}{\theta}}, 0 \leq x \leq \infty, \theta > 0.$$

The null hypothesis $H_0 : \theta = 5$ is rejected and alternative hypothesis $H_1 : \theta = 10$ is accepted, if an observation selected at random takes the value 15 or more, then the critical region is :

(A) $x \geq 15$

(B) $x \leq 15$

(C) $x \leq 10$

(D) None of the above

77. If all assumptions and the conditions of the question 76 are followed, then the acceptance region is :

(A) $x > 15$

(B) $x < 15$

(C) $x < 5$

(D) $x < 10$

78. If all assumptions and the conditions of the question 76 are followed, then the size of the Type I error is :

(A) e^{-5}

(B) e^{-10}

(C) e^{-3}

(D) None of the above

79. If all assumptions and the conditions of the question 76 are followed, then the size of the type II error is :

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

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

(C) $1 - e^{-3}$

(D) $1 + e^{-3}$

80. A hypothesis which is tested for possible rejection under the assumption that it is true is known as :

(A) hypothetical region

(B) critical region

(C) null hypothesis

(D) None of the above

81. A coin is tossed 400 times and it turns up head 216 times. Then the test statistic is :

(A) > 3

(B) > 5

(C) < 3

(D) None of the above

82. Five dice were thrown 192 times and the number of times 4, 5 or 6 were as follows :

No. of dice throwing 4, 5, 6	f
5	6
4	46
3	70
2	48
1	20
0	2

Then χ^2 is :

(A) 18.03

(B) 10.03

(C) 11.03

(D) 12.03

83. For the following variable values in a sample of eight

$-4, -2, -2, 0, 2, 2, 3, 3$

and the mean of the universe to be zero. Then the Student's t is :

(A) 5.0

(B) 3.0

(C) 0.27

(D) None of the above

84. Two independent samples of sizes 8 and 7 respectively were taken and the following values were obtained :

Sample I	Sample II
9	10
11	12
13	10
11	14
15	9
9	8
12	10
14	

Then s is :

(A) 2.1

(B) 5.1

(C) 3.1

(D) 1.1

85. If all assumptions and the conditions of the question 84 are followed, then t is :

(A) 3.21

(B) 1.21

(C) 5.21

(D) None of the above

86. If all assumptions and the conditions of the question 84 are followed, then the degree of freedom is :

(A) 15

(B) 17

(C) 12

(D) 13

87. Two samples of size 9 and 8 give the sum of squares of deviations from their respective means equal to 160 squares and 91 squares respectively. Also given that $F_{0.05}$ for 8 and 7 d.f. is 3.73. Then :

(A) F is not at all significant

(B) F is significant

(C) F is greater than significant

(D) None of the above

88. If X and Y are independent gamma variates with parameters m and n respectively, then there exists :

(A) $X \cdot Y = U$ and $\frac{X}{Y} = V$ are independent.

(B) $X + Y = U$ and $\frac{X}{Y} = V$ are independent.

(C) $X \cdot Y^2 = U$ and $\frac{X^2}{Y} = V$ are independent.

(D) None of the above

89. If X and Y are independent gamma variates with parameters m and n respectively, then there exists :

(A) $X+Y=U$ is $\overline{|(m+n)}$ variates and $\frac{X}{Y}=V$ is $B(m,n)$ variates.

(B) $X+Y=U$ is $B(m,n)$ variates and $\frac{X}{Y}=V$ is $\overline{|(m,n)}$ variates.

(C) $X+Y=U$ is $\overline{|(m.n)}$ variates and $\frac{X}{Y}=V$ is $B(m\cdot n)$ variates.

(D) None of the above

90. If $X_1, X_2, \ldots\ldots, X_n$ be n independent random variables all of which have the same distribution. Let the common expectation and variance be μ and σ^2 respectively. Then for $\bar{X}=\sum_{i=1}^{n}\frac{X_i}{n}$, the distribution of $\bar{X}$ approaches to :

(A) the gamma distribution with mean μ and variance $\frac{\sigma^2}{n}$ as $n\to\infty$

(B) the beta distribution with mean μ and variance $\frac{\sigma^2}{n}$ and $n\to\infty$

(C) the normal distribution with mean μ and variance $\frac{\sigma^2}{n}$ as $n\to\infty$

(D) None of the above

91. A function $\phi(t)$ be a characteristic function if :

(A) $\phi(0)=t, |\phi(t)|\le 1$, and $\phi(t)$ and $\phi(-t)$ are conjugate functions.

(B) $\phi(0)=t, |\phi|\ge 1$, and $\phi(t)$ and $\phi(-t)$ are conjugate functions.

(C) $\phi(0)=0, |\phi(t)|\le 1$, and $\phi(t)$ and $\phi(-t)$ are conjugate functions.

(D) $\phi(0)=0, |\phi(t)|\ge 1,$, and $\phi(t)$ and $\phi(-t)$ are conjugate functions.

92. If $\phi(t)=e^{-\frac{t^2}{2}}$, then the density of the variate is :

(A) $e^{-\frac{x}{2}}$

(B) $e^{\frac{x}{2}}$

(C) $\frac{1}{\sqrt{2\pi}}e^{\frac{x^2}{2}}$

(D) $\frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}}$

93. In a random choice of a value of a variate whose standard deviation is σ, then :

(A) $P(|x-\bar{x}|\le\lambda\sigma)\le\frac{1}{\lambda^2}$

(B) $P(|x-\bar{x}|\ge\lambda\sigma)\ge\frac{1}{\lambda^2}$

(C) $P(|x-\bar{x}|\ge\lambda\sigma)\le\frac{1}{\lambda^2}$

(D) None of the above

94. A symmetric die is thrown 600 times. Then the lower bound for the probability of getting 80 to 120 sixes is :

(A) $\frac{19}{24}$

(B) $\frac{23}{24}$

(C) $\frac{7}{24}$

(D) $\frac{9}{24}$

95. If the distribution is $y = y_0 e^{-\frac{\chi^2}{2}} (\chi^2)^{\left(\frac{n}{2}-1\right)}$, $\chi^2 \geq 0$ and $y_0 = \frac{1}{2^{\frac{v}{2}} \left|\left(\frac{v}{2}\right)\right.}$, then its mean is :

(A) v

(B) v^2

(C) $\frac{v}{2}$

(D) $-\frac{v}{2}$

96. What is not an use of t-distribution ?

(A) the mean of the sample

(B) the difference between two means

(C) coefficient of correlation

(D) not to compare two samples

97. If X_1 and X_2 are standard normal variables with correlation coefficient ρ between them, then the correlation coefficient between X_1^2 and X_2^2 is :

(A) ρ^2

(B) ρ^{-2}

(C) ρ^{-1}

(D) ρ

98. Which is not the criteria for the best estimator ?

(A) Consistency

(B) Unbiasedness

(C) Efficiency

(D) Analysis

99. If t_n is a sufficient estimator for θ, then $\frac{\partial}{\partial\theta}\log L$ is a :

(A) function of t_n only

(B) function of θ only

(C) function of t_n and θ only

(D) None of the above

100. If t is an unbiased estimator of θ, then :

(A) t^2 is a biased estimator of θ^2.

(B) t^{-1} is a biased estimator of θ^{-2}.

(C) t^2 is a biased estimator of θ^{-2}.

(D) None of the above

Roll No. ....

Question Booklet Number

O. M. R. Serial No. | | | | | | | | |

303202

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(History and Development of Indian Mathematics) (Elective)

Paper Code							
B	0	3	0	8	0	5	T

Questions Booklet Series

B

Time : 1:30 Hours]

[*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page)

(शेष निर्देश अन्तिम पृष्ठ पर)

1. "An equation has no meaning for me unless it expresses a thought of God." Who is the speaker ?

(A) Gritsmad

(B) Harischandra

(C) Ramanujan

(D) Pingla

2. Prasanta Chandra Mahalanobis known for :

(A) Mahalanobis distance

(B) Feldman-Mahalanobis Model

(C) (A) and (B) both

(D) None of the above

3. The birth place of Shankaracharya Jagadguru Bharatikrishna Tirthaji Maharaj is :

(A) Telangana

(B) Kerala

(C) Tamil Nadu

(D) Bihar

4. At what the age of Shankaracharya Jagadguru Bharatikrishna Tirthaji Maharaj studied advanced Vedanta philosophy for eight years from 1911 to 1919 ?

(A) 28

(B) 12

(C) 21

(D) 27

5. Who named, Swami Bharati Krishna Tirtha ?

(A) H. H. Jagadguru Shankaracharya Shri Trivikrama Tirthaji Maharaja

(B) Jagadguru Shankaracharya

(C) Harischandra

(D) Pingla

6. Harish-Chandra was considered for the Filed medal :

(A) in 1958

(B) in 1962

(C) in 1975

(D) in 1984

7. Date of birth of Shankaracharya Jagadguru Bharatikrishna Tirthaji Maharaj is :

(A) 14th March, 1884

(B) 14th April, 1884

(C) 16th March, 1884

(D) 16th April, 1884

8. Harish-Chandra Mehrotra was born in :

(A) Lucknow

(B) Pryagraj

(C) Kanpur

(D) Varanasi

9. "On Some properties of Bernoulli numbers" is a paper by Ramanujan published in the Journal of the Indian Mathematical Society. What is its significance ?

(A) It is Ramanujan's last published paper.

(B) It is Ramanujan's first published paper.

(C) It is Ramanujan's Hardy last published paper.

(D) None of the above

10. Harish-Chandra won Cole Prize of American Mathematical Society :

(A) in 1954

(B) in 1966

(C) in 1976

(D) in 1955

11. "National Statistics Day" is :

(A) 29 June

(B) 24 December

(C) 29 May

(D) 29 December

12. In 2006 Govt. of India announced the birthday of which scientist to be celebrated as "National Statistics Day" :

(A) Harischandra

(B) Prasanta Chandra Mahalanobis

(C) Ramanujan

(D) Brahmgupt

13. In which year the postage stamp on "Prasanta Chandra Mahalanobis" was issued :

(A) 1994

(B) 1995

(C) 1996

(D) 1993

14. Mahalanobis distance is one of the most widely used metrics to find how much a point diverges from a distribution, based :

(A) on measurements in multiple dimensions

(B) on measurements in dimensions

(C) on measurements in single dimensions

(D) on measurements in two dimensions

15. Harish-Chandra Mehrotra is known for :

(A) Harish-Chandra character function

(B) Harish- Chandra character formula

(C) Harish-Chandra module

(D) All of the above

16. The whole work of Prof. Harish-Chandra is distributed in his .... research papers.

(A) 100

(B) 200

(C) 85

(D) 95

17. Harish-Chandra Research institute of Mathematics and Mathematical physics (H.R.I.) is situated :

(A) in Pryagraj

(B) in Pune

(C) in Varanasi

(D) in Hyderabad

18. What is the actual number of "Sutras" of Vedic mathematics ?

(A) 10

(B) 12

(C) 13

(D) 16

19. Sridharachrya was written in three hundred shlokas thus his major work Pātī gaita ṇ sāra was named :

(A) Triśatika

(B) Anna Sayeed

(C) Kanak

(D) None of the above

20. According to Dharma-Shastra what was the rate and revenue ?

(A) 1/4

(B) 1/6

(C) 1/8

(D) 1/9

21. Mahaviracharya discovered algebraic identities like :

(A) $a^3 = (a + b)(a - b) + b^2 (a - b) + b^3$

(B) $a^3 = a(a + b)(a - b) + b^2 (a - b) + b^3$

(C) $a^3 = a(a + b) + b^2 (a - b) + b^3$

(D) $a^3 = a(a + b)(a - b) + b^2 (a - b) + b^3$

22. In total number, how many Upanishad in India ?

(A) 104

(B) 106

(C) 108

(D) 109

23. Who asserted that the square root of a negative number does not exist ?

(A) Mahaviracharya

(B) Sridharachrya

(C) Aryabhatt

(D) None of the above

24. Sridharachrya was the first person to give an algorithm for solving :

(A) Binary equation

(B) Quadratic equation

(C) Cubic

(D) Infinite series

25. "Veda" has been derived from the word of "Vid". What is the meaning of "Vid" ?

(A) God

(B) Knowledge

(C) Holy

(D) Religious

26. Which is the oldest Veda ?

(A) Yajur

(B) Rig

(C) Atharva

(D) Sama

27. Mahaviracharya highly respected among Indian mathematicians, because of his establishment of terminology for concepts such as :

(A) equilateral, and isosceles triangle

(B) rhombus

(C) circle and semicircle

(D) All of the above

28. The birth place of the Sridharachrya is :

(A) Hugh in West Bengal

(B) BHU in Varanasi

(C) Patna in Bihar

(D) Chennai in Tamil Nadu

29. Who wrote, "If zero is added to any number, the sum is the same number; if zero is subtracted from any number, the number remains unchanged; if zero is multiplied by any number, the product is zero" ?

(A) Harischandra

(B) Prasanta Chandra Mahalanobis

(C) Ramanujan

(D) Sridharacharya

30. Who separated Algebra from Arithmetic ?

(A) Sridharachrya

(B) Ramanujan

(C) Pingla

(D) Aryabhatt

31. Mahaviracharya authored :

(A) Ganita Sara Sangraha

(B) Ganita Sangraha

(C) Ganita Sara

(D) None of the above

32. Mahāvīra's *Ganita-sāra-saṅgraha* gave systematic rules for expressing a fraction as the :

(A) division of unit fractions

(B) sum of unit fraction

(C) multiplication of unit fraction

(D) subtraction of unit fraction

33. Sripati's father was :

(A) Namadeva

(B) Pingla

(C) Bashkara

(D) None of the above

34. Dhikotidakarana written by :

(A) Sripati's

(B) Nilkantha

(C) Aryabhata II

(D) Bhaskaracharya II

35. Siddhantasekhara a major work on :

(A) Trigonometry

(B) geometry

(C) algebra

(D) astronomy

36. Aryabhata II is the author of :

(A) Maha-Siddhanta

(B) Siddhanta

(C) Sutra

(D) None of the above

37. Jaina theorists derived the value of *pi* as root of :

(A) 20

(B) 30

(C) 10

(D) 15

38. Aryabhata II wrote Maha-Siddhanta, also known as :

(A) Arya-siddhanta

(B) Arya

(C) Siddanta

(D) Sutra

39. The dot symbol came to be called the :

(A) shunya-bindu

(B) bindu

(C) Shunya

(D) None of the above

40. Aryabhata II gives elaborate rules to solve the indeterminate equation :

(A) $y = ax + c$

(B) $by = ax + c$

(C) $by = x + c$

(D) $y = ax - c$

41. The highest enumerable number (ie, N) of the Jainas corresponds to another concept developed by Cantor, aleph-null, also called :

(A) the first transfinite number

(B) the transfinite number

(C) the last transfinite number

(D) the second transfinite number

42. Bhaskarachaiya II Authored :

(A) Siddhānta Shiromani

(B) Arya-siddhanta

(C) Siddanta

(D) Sutra

43. Bhaskaracharya II birth palce :

(A) Odisha

(B) Kerala

(C) Uftar Pradesh

(D) Maharashtra

44. Bhaskara II was the leader of a cosmic observatory at .... the main mathematical centre of ancient India.

(A) Bhopal

(B) Ujjain

(C) Varanasi

(D) Mathura

45. Bhāskara II works represent a significant contribution to :

(A) mathematical and astronomical knowledge

(B) mathematical knowledge

(C) astronomical knowledge

(D) None of the above

46. His main work Siddhāṇnta-Śiromaṇi, is divided into four parts called

(A) Līlāvatī, Bījagaṇita, Grahagaṇita and Golādhyāya

(B) Līlāvatī, Sutra, Grahagaṇita and Golādhyāya

(C) Līlāvatī, Bījaganita, Grahaganita and Matntra

(D) None of the above

47. Complete name of Nilkhnata :

(A) Kelallur Somayaji

(B) Kelallur Nilakantha Somayaji

(C) Nilakantha Somayaji

(D) Nilakanta

48. Nilkhanta had also composed an elaborate commentary on Aryabhatiya called the :

(A) Aryabhatiya Bhasya

(B) Aryabhatiya Bhasya II

(C) Aryabhatiya II

(D) Bhasya II

49. The Jainas could conceive of such huge units of time as $756 \times 10^{11} \times 8{,}400{,}000^{28}$ days, which was termed ?

(A) Sirsaprahelika

(B) Tantrasangraha

(C) Sutra

(D) Bhasya

50. Nilakantha was bom in :

(A) Odisha

(B) Tamil Nadu

(C) Andhra Pradesh

(D) Kerala

51. The Bakhshali manuscript uses numerals with a place-value system, using a dot as a place holder for :

(A) Zero

(B) One

(C) Three

(D) Two

52. The name of book in which book Nilkhantha revised Arybhata's model for the planet Mercury and Venus :

(A) Tantrasangraha

(B) Līlāvatī

(C) Bījagaṇita

(D) Golādhyāya

53. Surya Prajnapti, important Jain works on mathematics included the :

(A) Sthananga Sutra

(B) SthanangaRoop

(C) Sthananga geranit

(D) None of the above

54. The Anuyogadwara Sutra (c. 200 BCE – 100 CE), which includes the earliest known description of .... in Indian mathematics.

(A) division

(B) addition

(C) multiplication

(D) factorial

55. The Chandahśāstra authored by :

(A) Pingla

(B) Līlāvatī

(C) Aryabhatiya II

(D) Nilakantha

56. The term *rajju* was used in different senses by the Jaina theorists. In cosmology it was frequently used as a measure of length of about :

(A) 6.4×10^{21}

(B) 5.4×10^{21}

(C) 2.4×10^{21}

(D) 3.4×10^{21}

57. Pingala was the brother of :

(A) Pānini

(B) Lilavati

(C) Nilakanta

(D) Golādhyāya

58. The Chandaḥśāstra presents the first known description of a

(A) Number system

(B) Binary Number System

(C) Fraction

(D) Factorial

59. The birthplace of the Bakhshali is :

(A) Pakistan

(B) Iran

(C) Nepal

(D) Bhutan

60. The Bakhshali manuscript is an ancient mathematical text written on :

(A) Sthananga Ganit

(B) Brich bark

(C) Tantrasangraha

(D) Arya-siddhanta

61. Aryabhata I is the student of :

(A) Nalanda University

(B) Patilputra University

(C) Takshsila University

(D) None of the above

62. Authoured of Arya-siddhanta is :

(A) Aryabhata I

(B) Aryabhata II

(C) Pingla

(D) Sridharacharya

63. The Aryabhatiya is also remarkable for its description of :

(A) Speed of light

(B) Gravity

(C) Friction

(D) Relativity of motion

64. In Aryabhatiya, Aryabbata I provided elegant results for the summation of series of squares

(A) $1^2 + 2^2 + ... + n^2 = \frac{n(n+1)(n+2)}{6}$

(B) $1^2 + 2^2 + ... + n^2 = \frac{n(n+1)(2n+1)}{6}$

(C) $1^2 + 2^2 + ... + n^2 = \frac{n(n+1)(2n+2)}{6}$

(D) $1^2 + 2^2 + ... + n^2 = \frac{n(n+1)(n+3)}{6}$

65. Aryabhata I described model of the Solar System is known as :

(A) Geocentric

(B) Magnetic

(C) Scalar

(D) Vector

66. Varāhamihirad's commentator Utpala calls him :

(A) Magadha

(B) Magadha-dvija

(C) Dvija

(D) None of the above

67. Name of the father of Varāhamihiras is :

(A) Aditya-dasa

(B) Aditya

(C) Panini

(D) Sridharacharya

68. Birthplace of Brahmagupta is :

(A) Gujarat

(B) Haryana

(C) Uttar Pradesh

(D) Rajasthan

69. Brahmagupta gave the solution of the general :

(A) Linear equation

(B) Quadratic equation

(C) Cubic equation

(D) Differential equation

70. Brahmagupta went on to give a recurrence relation for generating solutions to certain instances of Diophantine equations of the second degree such as $Nx^2 + 1 = y^2$ (call Pell's Equation) by using the :

(A) Quadratic formula

(B) Euclidean algorithm

(C) Linear formula

(D) All of the above

71. The author of Brahmasphutasiddhānta is :

(A) Brahmagupta

(B) Varāhamihira

(C) Aryabhata I

(D) Bhaskara I

72. Sulbasutras contain the geometry necessary for construction of the .... and the .... for the obligatory and votive rites.

(A) Vedi and Sutra

(B) Agni and Sutra

(C) Vedi and Agni

(D) Mantra and Sutra

73. The Baudhayana Shulba sutra gives the construction of geometric shapes such as :

(A) squares and rectangles

(B) square and cubic

(C) cubic and rectangle

(D) All of the above

74. Excavations at Harappa, Mohenjo-daro and other sites of the Indus Valley civilisation have uncovered evidence of the use of :

(A) Practical Mathematics

(B) Linear Mathematics

(C) Arrow signed

(D) Cubic Mathematics

75. The Kerala school of Astronomy and Mathematics was founded by :

(A) Madhava of Sangamagrama

(B) Bharati Krishna Tirthaji

(C) Shripati

(D) Sridharacharya

76. Which one of the following Indian Mathematician invented decimal place value ?
(A) Bhaskar
(B) Varahmihira
(C) Brahmagupta
(D) Aryabhatta

77. Who of the following is especially known for his contribution in the field of Algebra ?
(A) Aryabhatta
(B) Brahmagupta
(C) Bhaskar
(D) Lall

78. Aryabhatta was :
(A) Indian Politician
(B) Indian Mathematician and Astronomer
(C) Indian Sanskrit Scholar and Poet
(D) None of the above

79. What lie did the British mathematician Hardy give to the Scotland Yard once in order to save Ramanujan from an arrest ?
(A) That he was a fellow of the Royal Society when in fact he was not at that time.
(B) That he was a fellow of the French Society when in fact he was not at that time.
(C) That he was a fellow of the Royal Society when in fact he was at that time.
(D) That he was a fellow of the French Society when in fact he was at that time.

80. Lilavathi, a treatise on Mathematics, was written by :
(A) Ramanuj
(B) Kautilya
(C) Amartya Sen
(D) Bhaskaracharya

81. Who invented numbers ?
(A) Brahmagupta
(B) Aryabhata
(C) Euclid
(D) Both (A) and (B)

82. Main Branch of Mathematics is :
(A) Arthmatics
(B) Algebra
(C) Geometry
(D) Accountancy

83. Which is the base of Scientific development ?
(A) Physics
(B) Chemistry
(C) Mathematics
(D) None of the above

84. The Birthplace of Aryabhata is :
(A) Kusumpur
(B) Raipur
(C) Ujjain
(D) Deemapur

85. If Janaki Ammal is Ramanujan's wife then who is Kommalatammal ?

(A) His Aunty

(B) His Mother

(C) His Class Teacher

(D) None of the above

86. The arithmetic was scientific was scientific developed during :

(A) 500-1000 A. D.

(B) 1000-1500 A. D.

(C) 100-500 A. D.

(D) None of the above

87. Hardy gave personal rating to various mathematicians, to himself he gave 25, to Littlewood a 35, to Archimedes an_80, but how much did he give Ramanujan ?

(A) 75

(B) 81

(C) 85

(D) 100

88. Who is created as a discover of decimal system ?

(A) Pingla

(B) Aryabhatta

(C) Nagarujn

(D) None of the above

89. Which book by Robert Kanigal depicting the life of Ramanujan is slated to be made into a Hollywood movie ?

(A) The Man Who Knew Infinity-A Life of the Genius Ramanujan

(B) The Man Who Knew Finite-A Life of the Genius Ramanujan

(C) The Man Who Knew Infinity

(D) The Man Who Knew Finite

90. Beejganit (Algebra) is also known as :

(A) Unknownganit

(B) Known ganit

(C) Vernankganit

(D) None of the above

91. Zero was invented 1st by what country ?

(A) Arab

(B) India

(C) Japan

(D) China

92. Zero was invented by what Vedic sage ?

(A) Gritsmad

(B) Panini

(C) Pingal

(D) None of the above

93. Pierre Deligne won the 1974 Fields Medal, the highest honor in mathematics for proving what ?

(A) Ramanujan's Tau Conjecture.

(B) Ramanujan's Numbers

(C) Ramanujan Phi Conjecture.

(D) None of the above

94. Value of Pie (π) is discovered in which book ?

(A) Leelavati

(B) Siddhant Shromany

(C) Ganitadhyay

(D) Goladhyay

95. The descriptions of arithmetic, area, cube, root interest etc. are given in which book ?

(A) Sidhant Shromani

(B) Leelavati

(C) Brahrnsphut

(D) All of the above

96. From what book the Arabians got knowledge of Indian Mathematics and astrology ?

(A) Written by Brahmgupt

(B) Written by Varahmahir

(C) Written by Aryabatt

(D) Written by Bhaskaracharya

97. In Arithmetic Brahmgupt wrote principaisby which method ?

(A) Infinite

(B) Ratio

(C) Zero

(D) All of the above

98. How where the "Hindu number system" reached to Arab ?

(A) By Varabmahir

(B) By Kanak

(C) By Anna Sayeed

(D) By Brahmgupt

99. If the letter of the word RAMANUJAN are put in a box and one letter is drawn at random. The probability that the letter is A is :

(A) 3/5

(B) 1/2

(C) 3/7

(D) 1/3

100. Which seminal paper of Ramanujan was published in the Quarterly Journal of Mathematics, Oxford in 1914 which has paved the way for modem day computer algorithms ?

(A) Modular Equations and Approximations of Pi.

(B) Modular Equations and Approximations of Theta

(C) Modular Equations and Approximations of gamma

(D) Modular Equations and Approximations of beta

Roll No. ....

O. M. R. Serial No. | | | | | | | | |

Question Booklet Number

306790

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Fuzzy Set Theory) (Elective)

Paper Code							
B	0	3	0	8	0	6	T

Questions Booklet Series

B

Time : 1:30 Hours]

[*Maximum Marks : 75*

Instructions to the Examinee :

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(Remaining instructions on the last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. Let $f : X \to Y$ be an arbitrary crisp function. Then for any $A \in f(X)$ and all $\alpha \in [0,1]$, which of the following is true ?

(A) $f[{}^{\alpha}A] = {}^{\alpha}[f(A)]$

(B) $f[{}^{\alpha}A] \subseteq {}^{\alpha}[f(A)]$

(C) $f[{}^{\alpha}A] \supseteq {}^{\alpha}[f(A)]$

(D) None of the above

2. Let C : $[0,1] \to [0,1]$ be a fuzzy complement of fuzzy set A and denoted by CA. Then, which is NOT true for fuzzy complement ?

(A) $C(0) = 1$

(B) $C(1) = 0$

(C) For all $a, b \in [0,1]$, if $a \leq b$, then $c(a) \leq c(b)$

(D) c is a continuous function

3. Every fuzzy complement has at most :

(A) One equilibrium

(B) Two equilibrium

(C) Three equilibrium

(D) Four equilibrium

4. Which of the following is NOT t-norm ?

(A) $i(a,b) = \min(a,b) \forall a,b \in [0,1]$

(B) $i(a,b) = ab \forall a,b \in [0,1]$

(C) $i(a,b) = a + b \forall a,b \in [0,1]$

(D) $i(a,b) = \begin{cases} a & \text{when } b = 1 \\ b & \text{when } a = 1 \\ 0 & \text{otherwise} \end{cases}$

5. Which is the only idempotent t-conorm ?

(A) Algebraic sum

(B) Bounded sum

(C) Standard union

(D) Drastic union

6. Which of the following is fuzzy number ?

(A) $A = \left\{\frac{0.2}{1}, \frac{0.5}{2}, \frac{0.9}{3}, \frac{1}{4}\right\}$

(B) $B = \left\{\frac{0.1}{1}, \frac{0.2}{2}, \frac{0.5}{3}, \frac{0.6}{4}\right\}$

(C) $C = \left\{\frac{0.2}{1}, \frac{0.3}{2}, \frac{0.5}{3}, \frac{0.9}{4}\right\}$

(D) $D = \left\{\frac{0.3}{1}, \frac{0.1}{2}, \frac{0.2}{3}, \frac{0.4}{4}\right\}$

7. The α-cuts of fuzzy number are :

(A) open intervals of real number

(B) closed intervals of real number

(C) Empty set

(D) None of the above

8. The α-cuts of fuzzy sets A and B are given as $\alpha_A = [3\alpha - 2, 4 - 3\alpha]$ and $\alpha_B = [3\alpha + 2, 8 - 3\alpha]$. Then sum $\alpha_{(A+B)}$ is :

(A) $[6\alpha, 12 - 6\alpha]$

(B) $[6\alpha - 10, 2 - 6\alpha]$

(C) $[-4, -4]$

(D) $[9\alpha, 32\alpha]$

9. If $A \subseteq E$ and $B \subseteq F$, where A, B, E, F are fuzzy sets, then which is true ?

(A) $A \oplus B \supseteq E \oplus F$

(B) $A \ominus B \supseteq E \ominus F$

(C) $A \oplus B \subseteq E \oplus F$

(D) $A \ominus B = E \ominus F$

10. Let MIN and MAX be binary operations on **R**. Then for any A, B, $\in \mathbf{R}$, which in true ?

(A) MIN (A, B) = MAX (B, A)

(B) MIN (A, B) = MIN (B, A)

(C) MAX (A, B) = MIN (B, A)

(D) MIN [A, MAX (A, B)] = B

11. Which of the following fuzzy sets is/are fuzzy numbers ?

(A) $A(x) = \begin{cases} \sin x & \text{for } 0 \le x \le \pi \\ 0 & \text{otherwise} \end{cases}$

(B) $B(x) = \begin{cases} 1 & \text{for } x = 5 \\ 0 & \text{otherwise} \end{cases}$

(C) Both the above mentioned

(D) None of the above

12. Which of the following fuzzy sets is/are fuzzy numbers :

(A) $A(x) = \begin{cases} \min(1, x) & \text{for } x \ge 0 \\ 0 & \text{otherwise} \end{cases}$

(B) $B(x) = \begin{cases} 0.5 & \text{for } x = 5 \\ 0 & \text{otherwise} \end{cases}$

(C) Both the above mentioned

(D) None of the above

13. The value of $[-5, 4] - [3, 7]$ is given as :

(A) $[-8, -3]$

(B) $[8, 3]$

(C) $[-12, -16]$

(D) $[-12, 1]$

14. The value of $[-3, 4] + [-3, 4]$ is given as :

(A) $[-9, 16]$

(B) $[-6, 8]$

(C) $[6, -8]$

(D) $[6, 8]$

15. A fuzzy number A is called a convex normalized fuzzy set if :

(A) There exists exactly one $x_0 \in \mathbf{R}$ such that A $(x_0)=1$

(B) $A(x)$ is piecewise continuous

(C) Both (A) and (B)

(D) None of the above

16. Which axiom does not hold good for t-norm ?

(A) Monotonicity

(B) Commutativity

(C) Continuity

(D) Superidempotency

17. Which is true for t-norm ?

(A) $i(a,1)=a$

(B) $i(a,1)=1$

(C) $i(a,0)=a$

(D) $i(a,0)=0$

18. Which axiom does not hold good for t-conorm ?

(A) Monotonicity

(B) Commutativity

(C) Continuity

(D) Subidempotency

19. Which of the following is true for t-conorms ?

(A) $u(a,0)=0$

(B) $u(a,0)=a$

(C) $u(a,0)=1$

(D) $u(a,1)=a$

20. For any t-norm $i(a,b)$, which of the following is true for all $a,b \in [0,1]$:

(A) $i_{\min}(a,b) \leq i_{(a,b)} \leq \min(a,b)$

(B) $i_{\min}(a,b) \geq i_{(a,b)} \geq \min(a,b)$

(C) $i_{\min}(a,b) = \min(a,b)$

(D) None of the above

21. For all $a,b[0,1]$ and for any t-conorm $u(a,b)$, which of the following is true ?

(A) $u_{\max}(a,b) \leq u(a,b) \leq \max(a,b)$

(B) $u_{\max}(a,b) \geq u(a,b) \geq \max(a,b)$

(C) $u_{\max}(a,b) = \max(a,b)$

(D) None of the above

22. The subtraction of two intervals $[a,b]-[c,d]$ is given by :

(A) $[a-c,b-d]$

(B) $\min\{a-c,b-d\}$

(C) $[a-d,b-c]$

(D) $\max\{a-c,b-d\}$

23. The value of $[3,5]-[2,4]$ is equal to :

(A) $[1,1]$

(B) $[-1,3]$

(C) $[-1,-1]$

(D) $[0,0]$

24. Let A and B fuzzy numbers and let * be any of the four basic arithmetic operations then α-cut $\alpha_{(A*B)}$ is given by :

(A) A * B

(B) B * A

(C) $\alpha_A * \alpha_B$

(D) None of the above

25. Let R_1 and R_2 be two fuzzy relations defined on $X \times Y$. Then $(R_1 \cup R_2)(x,y)$ is defined as :

(A) $\min\{R_1(x,y), R_2(x,y)\}$

(B) $\max\{R_1(x,y), R_2(x,y)\}$

(C) $R_1(x,y)$

(D) $R_2(x,y)$

26. Let R_1 and R_2 be two fuzzy relations defined on $X \times Y$. Then $(R_1 \cap R_2)(x,y)$ defined as :

(A) $\min\{R_1(x,y), R_2(x,y)\}$

(B) $\max\{R_1(x,y), R_2(x,y)\}$

(C) $R_1(x,y)$

(D) $R_2(x,y)$

27. Let :

$X = \{x_1, x_2, x_3\}$ and $Y = \{y_1, y_2, y_3\}$

Consider two fuzzy relations R_1 and R_2 defined on X × Y such that R_1 = "x considerably smaller than y and R_2 = "x is very for from y". Then the union of R_1 and R_2 be :

(A) x considerably greater or very far from y

(B) x considerably smaller or very far from y

(C) x considerably smaller and very far from y

(D) x considerably greater and very far from y

28. Let $R(X, Y)$ be a binary relation of X and Y, then membership function of domain of R is defined as dom R (x) =

(A) $\max_{x\in X} R(x,y)$ for all $y \in Y$

(B) $\min_{x\in X} R(x,y)$ for all $y \in Y$

(C) $\max_{y\in Y} R(x,y)$ for all $x \in X$

(D) $\min_{y\in Y} R(x,y)$ for all $x \in X$

29. Let $R(x, y)$ be a binary fuzzy relation on X and Y, then its range is denoted by ran R and membership function is defined as ran R (y) =

(A) $\max_{x\in X} R(x,y)$ for all $y \in Y$

(B) $\min_{x\in X} R(x,y)$ for all $y \in Y$

(C) $\max_{y\in Y} R(x,y)$ for all $x \in X$

(D) $\min_{y\in Y} R(x,y)$ for all $x \in X$

30. The height of the fuzzy relation R (X, Y) is given by $h(R)$ = :

(A) $\min_{x\in X} \min_{y\in Y} R(x,y)$

(B) $\min_{x\in X} \max_{y\in Y} R(x,y)$

(C) $\max_{y\in Y} \min_{x\in X} R(x,y)$

(D) $\max_{y\in Y} \max_{x\in X} R(x,y)$

31. The membership matrix $[\gamma_{xy}]$ for R (X, Y) is given an, where $X = \{x_1, x_2\}$ and $Y = \{y_1, y_2, y_3\}$ and $R(x,y)$ =

$$\left\{\frac{1}{(x_1,y_1)}, \frac{0}{(x_1,y_2)}, \frac{0.6}{(x_1,y_3)}, \frac{0.9}{(x_2,y_1)}, \frac{0.5}{(x_2,y_2)}, \frac{0.3}{(x_2,y_3)}\right\}.$$

(A) $\begin{matrix} & y_1 & y_2 & y_3 \\ x_1 & 1 & 0 & 0.6 \\ x_2 & 0.9 & 0.5 & 0.3 \end{matrix}$

(B) $\begin{matrix} & y_1 & y_2 & y_3 \\ x_1 & 0.9 & 0.5 & 0.3 \\ x_2 & 1 & 0 & 0.6 \end{matrix}$

(C) $\begin{matrix} & y_1 & y_2 & y_3 \\ x_1 & 0.3 & 0.5 & 0.9 \\ x_2 & 1 & 0 & 0.6 \end{matrix}$

(D) $\begin{matrix} & y_1 & y_2 & y_3 \\ x_1 & 0.6 & 0 & 1 \\ x_2 & 0.9 & 1 & 0 \end{matrix}$

32. Let P (X,Y) and Q = (Y, Z) be fuzzy relations then their relational join is denoted by P * Q and is defined by [P * Q] (x, y, z)] =

(A) $\max[P(x,y), Q(y,z)]$

(B) $\max[P(x,x), Q(y,y)]$

(C) $\min[P(x,x), Q(y,y)]$

(D) $\min[P(x,y), Q(y,z)]$

33. The max-min composition of two fuzzy relations P (X, Y) and Q (Y, Z) is denoted by [P o Q] (x,z) and defined by :

(A) $\min_{y\in Y}[P*Q](x,y,z)$

(B) $\max_{y\in Y}[P*Q](x,y,z)$

(C) $\min_{x\in X}[P*Q](x,y,z)$

(D) $\max_{x\in X}[P*Q](x,y,z)$

34. Let R be fuzzy relation on X × X. Then R is said to be reflexive if :

(A) $R(x,x)=1\ \forall x\in X$

(B) $R(x,x)=0\forall x\in X$

(C) $R(x,x)=R(x,y)\forall x y\in X$

(D) None of the above

35. Let R o R denotes the max-min composition of R and if R is reflexive relation, then :

(A) $R\,o\,R=R$

(B) $R\,o\,R\subset o\,R$

(C) $R\subset R\,o\,R$

(D) None of the above

36. If R is symmetric fuzzy relation, then each power of R is :

(A) Reflexive

(B) Symmetric

(C) Antisymmetric

(D) None of the above

37. If R_1 and R_2 are symmetric fuzzy relations, then R_1 o R_2 is symmetric if :

(A) $R_1 o R_2 = R_2 o R_1$

(B) $R_1 o R_2^{-1} = R_1^{-1} o R_2$

(C) $R_1^{-1} o R_2 = R_2 o R_1^{-1}$

(D) None of the above

38. A fuzzy relation R (X, Z) is called transitive if :

(A) $R(x,z)\le\max_{y\in Y}\min[R(x,y)R(y,z)]$

(B) $R(x,z)\ge\max_{y\in Y}\min[R(x,y)R(y,z)]$

(C) $R(x,z)=\max_{y\in Y}\min[R(x,y)R(y,z)]$

(D) $R(x,z)=\max_{y\in Y}\min[R(x,x)R(z,z)]$

39. A fuzzy relation R is called max-min transitive if :

(A) $R o R\supseteq R$

(B) $R o R=R$

(C) $R o R\subseteq R$

(D) None of the above

40. If R is symmetric and transitive fuzzy relation, then :

(A) $R(x,x)\subseteq R(y,y)$ for all $x,y\in X$

(B) $R(x,y)\subseteq R(x,y)$ for all $x,y\in X$

(C) $R(x,x)=R(x,y)$ for all $x,y\in X$

(D) $R(x,x)\subseteq R(x,y)$ for all $x,y\in X$

41. If R is reflexive and transitive then :

(A) $R \circ R \subseteq R$

(B) $R \circ R \supseteq R$

(C) $R \circ R = R$

(D) None of the above

42. A relation R (X, Y) is called anti-transitive if :

(A) $R(x,z) < \max_{y \in Y} \min[R(x,y), R(y,z)]$

(B) $R(x,z) > \max_{y \in Y} \min[R(x,y), R(y,z)]$

(C) $R(x,z) = \min_{y \in Y} \max[R(x,y), R(y,z)]$

(D) $R(x,z) < \max_{y \in Y} \max[R(x,y), R(y,z)]$

43. The quasi-equivalence relations on fuzzy sets are :

(A) reflexive and symmetric but not transitive

(B) reflexive and transitive but not symmetric

(C) symmetric and transitive but not reflexive

(D) only transitive

44. The fuzzy relation R (x, y) is given by membership matrix

$$R(x,y) = \begin{matrix} & a & b & c \\ a & 1 & 0.8 & 0 \\ b & 0.8 & 1 & 0 \\ c & 0 & 0 & 1 \end{matrix},$$

then it is :

(A) Reflexive

(B) Symmetric

(C) Reflexive symmetric but not transitive

(D) Equivalence relation

45. The fuzzy relation matrix given by :

$$R = \begin{matrix} & a & b & c & d \\ a & 0.4 & 0 & 0.1 & 0.8 \\ b & 0.8 & 1 & 0 & 0 \\ c & 0 & 0.6 & 0.7 & 0 \\ d & 0 & 0.2 & 0 & 0 \end{matrix}$$

is :

(A) Reflexive

(B) Symmetric

(C) Antisymmetric

(D) None of the above

46. The fuzzy relation matrix given by :

$$R = \begin{matrix} & a & b & c & d \\ a & 0.4 & 0 & 0.7 & 0 \\ b & 0 & 1 & 0.9 & 0.6 \\ c & 0.8 & 0.4 & 0.7 & 0.4 \\ d & 0 & 0.1 & 0 & 0 \end{matrix}$$

is :

(A) Reflexive

(B) Symmetric

(C) Antisymmetric

(D) None of the above

47. The fuzzy relation R defined by the membership matrix :

$$R = \begin{matrix} & x_1 & x_2 & x_3 \\ x_1 & 1 & 0.7 & 0.3 \\ x_2 & 0.4 & 1 & 0.8 \\ x_3 & 0.7 & 0.5 & 1 \end{matrix}$$

is :

(A) Reflexive

(B) Symmetric

(C) Transitive

(D) None of the above

48. The fuzzy relation R given by :

$$R = \begin{bmatrix} 0.2 & 1 & 0.4 \\ 0 & 0.6 & 0.3 \\ 0 & 1 & 0.3 \end{bmatrix}$$

is :

(A) Reflexive

(B) Symmetric

(C) antisymmetric

(D) max-min transitive

49. Compatibility relations are also called :

(A) Reflexive directed graphs

(B) Reflexive undirected graphs

(C) Symmetric directed graphs

(D) None of the above

50. An element $x \in X$ is undominated if :

(A) $R(x,y) = 1 \forall y \in X$

(B) $R(x,x) = 1 \forall y \in X$

(C) $R(x,y) = 0 \ \forall y \in X$ and $x \neq y$

(D) None of the above

51. A fuzzy relation is called fuzzy order relation if :

(A) Reflexive, symmetric and transitive

(B) Reflexive, antisymmetric and transitive

(C) Reflexive, antisymmetric but not transitive

(D) Reflexive antisymmetric and max-min transitive

52. A fuzzy weak ordering with $R(x, y) > 0$, is a fuzzy relation, in which R is :

(A) Reflexive and transitive

(B) Reflexive and symmetric

(C) Reflexive and antisymmetric

(D) Reflexive, symmetric but not transitive

53. Let X be a universal set and M be the family of subsets of X, then fuzzy measure $g : M \to [0,1]$ satisfies :

(A) $g(\phi) = 1$

(B) $g(x) = 0$

(C) $g(\phi) = 0$

(D) $g(x) = 0.5$

54. The fuzzy measures is :

(A) monotoanically decreasing

(B) monotonically increasing

(C) not montotonic

(D) None of the above

55. Let $g : M \to [0,1]$ be a fuzzy measure. For any increasing sequence $A_1 \subset A_2 \subset A_3$.......... in M if $\bigcup_{i=1}^{\infty} A_i \in M$, then :

(A) $\lim_{i \to \infty} g(A_i) = g\left(\bigcup_{i=1}^{\infty} A_i\right)$

(B) $\lim_{i \to \infty} g(A_i) > g\left(\bigcup_{i=1}^{\infty} A_i\right)$

(C) $\lim_{i \to \infty} g(A_i) < g\left(\bigcup_{i=1}^{\infty} A_i\right)$

(D) $\lim_{i \to \infty} g(A_i) \neq g\left(\bigcup_{i=1}^{\infty} A_i\right)$

56. Every fuzzy measure of satisfies the in equality :

(A) $g(A \cap B) \geq \min[g(A), g(B)]$

(B) $g(A \cap B) \geq \max[g(A), g(B)]$

(C) $g(A \cap B) \leq \min[g(A), g(B)]$

(D) $g(A \cap B) \leq \max[g(A), g(B)]$

57. Semi-continuous fuzzy measures are :

(A) continuous from above

(B) continuous from below

(C) Either (A) or (B)

(D) None of the above

58. Which of the following is true for Belief measure (Bel (A)) and Plausibility measures (pl (A)) ?

(A) Bel (A) + Bel (A^c) $\geq$ 1 $\forall A \in P(X)$, where P (X) is powerset A^c is complement of A

(B) Bel $(A) + \text{Bel}(A^c) \leq 1 \forall A \in P(X)$

(C) $pl(A) + pl(A^c) \leq 1 \forall A \in P(X)$

(D) $pl(A) + pl(A^c) = 1 \forall A \in P(X)$

59. The basic probability assignment $M : P(X) \rightarrow [0,1]$ satisifies the condition :

(A) $M(\phi) = 1$

(B) $M(X) = 0$

(C) $\sum_{A \in P(X)} M(A) = 0$

(D) $\sum_{A \in P(X)} M(A) = 1$

60. Let M be the basic probability assignment and Bel (A) be the belief measure on A, then which is true ?

(A) Bel $(A) = \sum_{B \subseteq A} M(B)$

(B) Bel $(A) \leq \sum_{B \subseteq A} M(B)$

(C) Bel $(A) \geq \sum_{B \subseteq A} M(B)$

(D) Bel $(A) = \sum_{B \cap A \neq \phi} M(B)$

61. Which of the following is NOT true for basic probability assignment ?

(A) $M(\phi) = 0$

(B) $M(A) = 1$

(C) $\sum_{A \in P(X)} M(A) = 1$

(D) None of the above

62. A fuzzy measure 'Nec' on (X, ρ) is called necessity measure if :

(A) $\text{Nec}\left(\bigcap_{k\in K} A_k\right) = \inf_{k\in K} \text{Nec}\,(A_k)$

(B) $\text{Nec}\left(\bigcap_{k\in K} A_k\right) \le \inf_{k\in K} \text{Nec}\,(A_k)$

(C) $\text{Nec}\left(\bigcup_{k\in K} A_k\right) = \inf_{k\in K} \text{Nec}\,(A_k)$

(D) $\text{Nec}\left(\bigcup_{k\in K} A_k\right) \ge \sup_{k\in K} \text{Nec}\,(A_k)$

63. Which of the following is true for necessity and possibility measures ?

(A) Nec (A) = Pos (A)

(B) Nec (A) + Pos (A) = 0.5

(C) Nec (A) = 1 − Pos (A)

(D) Nec (A) + Pos (A) = 0

64. For any necessary measure Nec (A) and possibility measure Pos (A), which of the following is NOT true ?

(A) Nec (A) > 0 ⇒ Pos (A) = 1

(B) Pos (A) < 1 ⇒ Nec (A) = 0

(C) Nec (A) + Pos (A) = 1

(D) Nec (A) − Pos (A) = 1

65. Let

$$r : X \to [0,1]$$

be a possibility distribution function, then :

(A) $\text{Pos}\,(A) = \min_{x\in A} r(x)\ \forall A \in P(X)$

(B) $\text{Pos}\,(A) \le \min_{x\in A} r(x)\ \forall A \in P(X)$

(C) $\text{Pos}\,(A) = \max_{x\in A} r(x)\ \forall A \in P(X)$

(D) $\text{Pos}\,(A) \ge \max_{x\in A} r(x)\ \forall A \in P(X)$

66. Let Pro (A) denotes the probability measure, then which of the following is true ?

(A) Pro $(A\cup B) = \text{Pro}\ (A) + \text{Pro}\ (B)$ such that $A\cap B = \phi$

(B) Pro $(A \cup B) = \text{Pro}\ (A) + \text{Pro}\ (B)$

(C) Pro $(A\cap B) = \text{Pro}\ (A) + \text{Pro}\ (B)$

(D) Pro $(A\cap B) = \text{Pro}\ (A) - \text{Pro}\ (B)$

67. Let $A_i \in F(X)$ for all $i \in I$, where I is an index set, F (X) is collection of all fuzzy sets on X, then which of the following is true ?

(A) $\bigcup_{i\in I} \alpha^{+}_{A_i} \supseteq {}^{\alpha^+}\left[\bigcup_{i\in I} A_i\right]$

(B) $\bigcup_{i\in I} \alpha^{+}_{A_i} = {}^{\alpha^+}\left[\bigcup_{i\in I} A_i\right]$

(C) $\bigcap_{i\in I} \alpha^{+}A_i \supseteq {}^{\alpha+}\left[\bigcap_{i\in I} A_i\right]$

(D) $\bigcap_{i\in I} \alpha^{+}A_i = {}^{\alpha+}\left[\bigcap_{i\in I} A_i\right]$

68. "Let A be a fuzzy set defined on X. Then $A = A = \bigcup_{\alpha\in[0,1]} \alpha^{+A}$ where α^{+A} denotes a special fuzzy set defined by $\alpha^{+A(x)} = \alpha.\alpha^{+}_{A(x)}$." This is the statement of :

(A) First decomposition theorem

(B) Second decomposition theorem

(C) Law of contradiction

(D) None of the above

69. The fuzzy set A is given by :

$$A = \left\{\frac{0.4}{1}, \frac{0.2}{2}, \frac{0.5}{3}, \frac{0.4}{4}, \frac{1}{5}\right\},$$

then, cardinality of A is :

(A) 0

(B) 1

(C) 2.5

(D) 0.5

70. The strong α-cut for fuzzy set

$$A = \left\{\frac{0.1}{1}, \frac{0.2}{2}, \frac{0.5}{3}, \frac{0.6}{4}, \frac{1}{5}\right\},$$

for $\alpha = 0.2$ is :

(A) {1, 2, 3}

(B) {2}

(C) {2, 3, 4, 5}

(D) {3, 4, 5}

71. A fuzzy A on **R** is convex for $\forall x, y \in \mathbf{R}$ and $\lambda \in [0,1]$ if :

(A) $A[\lambda x + (1-\lambda)y] \leq \min[A(x), A(y)]$

(B) $A[\lambda x + (1-\lambda)y] \geq \min[A(x), A(y)]$

(C) $A[\lambda x + (1-\lambda)y] = \max[A(x), A(y)]$

(D) $A[\lambda x + (1-\lambda)y] \geq \max[A(x), A(y)]$

72. Let :

$X = \{a, b, c, d\}$ and $A = \left\{\frac{0.4}{a}, \frac{1}{b}, \frac{0.9}{c}, \frac{0.1}{d}\right\}$,

then core (A) is given by :

(A) $\{a, c, d\}$

(B) $\{b\}$

(C) $\{b, c, d\}$

(D) $\{a, b, c, d\}$

73. Let A, B $\in F(X)$ where F (X) is the collection of all fuzzy sets on X, then for all $\alpha \in [0,1]$ which is true ?

(A) ${}^{\alpha}(A \cap B) = \alpha_A \cap \alpha_B$

(B) ${}^{\alpha}(A \cap B) \subseteq \alpha_A \cap \alpha_B$

(C) ${}^{\alpha}(A \cap B) \supseteq \alpha_A \cap \alpha_B$

(D) ${}^{\alpha}(A \cup B) \supseteq \alpha_A \cup \alpha_B$

74. The range of the fuzzy set is :

(A) set of real numbers

(B) set of natural numbers

(C) {0, 1}

(D) [0, 1]

75. The truth values of fuzzy set are :

(A) Between 0 and 1 both exclusive

(B) any of 0 or 1

(C) 0.5

(D) Between 0 and 1 both inclusive

76. Let α_A denotes the α-cut of a fuzzy set A and β_A denotes the β-cut of a fuzzy set A, Then $\alpha \leq \beta$:

(A) $\alpha_A \supseteq \beta_A$

(B) $\alpha_A \supset \beta_A$

(C) $\alpha_A \subseteq \beta_A$

(D) $\alpha_A \subset \beta_A$

77. Let :

$$A = \left\{\frac{0.7}{x_1}, \frac{0.3}{x_2}, \frac{0.4}{x_3}, \frac{0.8}{x_4}, \frac{0.1}{x_5}\right\}$$

be a fuzzy set on universal set

$$X = \{x_1, x_2, x_3, x_4, x_5\},$$

Then the strong α-cut is given by c where $\alpha = 0.4$:

(A) $\{x_1, x_2, x_4\}$

(B) $\{x_1, x_4\}$

(C) $\{x_1, x_3, x_4\}$

(D) $\{x_2, x_3, x_5\}$

78. The height of a fuzzy set A is denoted by $h(\mathrm{A})$ and is defined as

$$h(\mathrm{A}) = \sup_{x \in \mathrm{X}} \mathrm{A}(x)$$

where $\mathrm{A}(x)$ is the membership grade. Then the fuzzy set A is called normal when :

(A) $h(\mathrm{A})=0$

(B) $h(\mathrm{A})<0$

(C) $h(\mathrm{A})=1$

(D) $h(\mathrm{A})<1$

79. Which is/are the way/s to represent uncertainty ?

(A) Fuzzy logic

(B) Probability

(C) Entropy

(D) All of the above mentioned

80. Consider a fuzzy set :

A = {(20, 0), (30, 0.2), (40, 0.4), (50, 0.6), (60, 0.8), (70, 1), (80, 1)}.

Then the α-cut for $\alpha = 0.8$ will be :

(A) {(40, 0.4)}

(B) {50, 60, 70, 80}

(C) {(20, 0.1), (30, 0.2)}

(D) {60, 70, 80}

81. If A and B are two fuzzy sets with membership functions :

A (x) = {0.6, 0.5, 0.1, 0.7, 0.8} and

B (x) = {0.9, 0.2, 0.6, 0.8, 0.5}.

Then the value of complement of (A ∪ B) (x) that is $(\mathrm{A} \cup \mathrm{B})^c(x)$ will be :

(A) {0.9, 0.5, 0.6, 0.8, 0.8}

(B) {0.6, 0.5, 0.6, 0.7, 0.5}

(C) {0.1, 0.5, 0.4, 0.2, 0.2}

(D) {0.1, 0.5, 0.4, 0.2, 0.3}

82. If A and B are two fuzzy sets with membership functions A (x) = {0.2, 0.5, 0.6, 0.1, 0.9} and B (x) = {0.1, 0.5, 0.2, 0.7, 0.8}, then the value of $(\mathrm{A} \cap \mathrm{B})(x)$ will be :

(A) {0.2, 0.5, 0.6, 0.7, 0.9}

(B) {0.2, 0.5, 0.2, 0.1, 0.8}

(C) {0.1, 0.5, 0.6, 0.1, 0.8}

(D) {0.1, 0.5, 0.2, 0.1, 0.8}

83. The statement "when someone says the temperature is 45°C, the viewer converts the crisp input value into linguistic variable like favourable temperature for human body, hot or cold" indicates which process ?

(A) Fuzzification

(B) Defuzzification

(C) Both (A) and (B)

(D) None of the above

84. A fuzzy set where no membership function has its value equal to 1 is called :

(A) Normal fuzzy set

(B) Subnormal fuzzy set

(C) Convex fuzzy set

(D) Cancave fuzzy set

85. Let :

$X = \{a, b, c, d\}$ and

$$A = \left\{\frac{0.2}{a}, \frac{0.5}{b}, \frac{0.7}{c}, \frac{0.9}{d}\right\}$$

be the fuzzy set. Then the level set denoted by ΔA is given by :

(A) {0.2, 0.5, 0.7, 0.9}

(B) {0.2, 0.5, 0.7}

(C) $\{a, b, c, d\}$

(D) $\{a\}$

86. Let :

$X = \{a, b, c, d\}$ and $A = \left\{\frac{0.1}{a}, \frac{0.2}{b}, \frac{0}{c}, \frac{0.3}{d}\right\}$

be the fuzzy set. Then the support of fuzzy set A i. e. supp (A) is given by :

(A) $\{c\}$

(B) $\{a, b, c\}$

(C) $\{a, b, c, d\}$

(D) $\{a, b, d\}$

87. Let :

$X = \{a, b, c, d\}$ and

$$A = \left\{\frac{0.2}{a}, \frac{0.5}{b}, \frac{0.9}{c}, \frac{0.7}{d}\right\}$$

be a fuzzy set. Then the height of A denoted by $h(A)$ and given by :

(A) 0.2

(B) 0.5

(C) 1

(D) 0.9

88. Let :

$X = \{a, b, c, d\}$ and

$$A = \left\{\frac{0.2}{a}, \frac{0.3}{b}, \frac{0.5}{c}, \frac{0.7}{d}\right\}$$

be a fuzzy set. Then the cardinality of fuzzy set A is given by :

(A) 0

(B) 1

(C) 1.7

(D) 4

89. The membership function for fuzzy set B is given by :

$$B(x) = \left(1 - \frac{x}{10}\right) \forall \in \{0, 1, 2, \ldots\ldots\ldots, 9\}.$$

The relative cardinality of fuzzy set B is :

(A) 0

(B) 1

(C) 10

(D) 0.55

90. Let $X = \{a,b,c,d\}$ and let us consider the fuzzy sets :

$$A = \left\{\frac{0.3}{a}, \frac{0.2}{b}, \frac{0.5}{c}, \frac{0.8}{c}\right\};$$

$$B = \left\{\frac{0.5}{a}, \frac{0.3}{b}, \frac{0.6}{c}, \frac{0.8}{d}\right\}$$

$$C = \left\{\frac{0.4}{a}, \frac{0.1}{b}, \frac{0.4}{c}, \frac{0.9}{d}\right\}.$$

Then the following is true :

(A) $A \subseteq B$

(B) $A \subseteq C$

(C) $A = C$

(D) $B = C$

91. Let A and B be two fuzzy sets defined on universal set X. Then the degree of subsethood S (A, B) is defined by

S (A, B) =

$$\frac{1}{|A|}\left[|A| - \sum_{x \in X} \max\{0, A(x) - B(x)\}\right].$$

Give $X = \{a,b,c,d\}$,

$$A = \left\{\frac{0.2}{a}, \frac{0.8}{b}, \frac{0.6}{c}, \frac{0.5}{d}\right\}$$

and $\left\{\frac{0.4}{a}, \frac{0.7}{b}, \frac{0.5}{c}, \frac{0.9}{c}\right\}$.

Then S (A, B) is given by :

(A) 0.1

(B) 0.2

(C) 0.9

(D) 1

92. The membership function for fuzzy set A is given by :

$$A(x) = \begin{cases} x-5 & \text{if } 5 \le x \le 6 \\ -x+7 & \text{if } 6 < x \le 7 \\ 0 & \text{otherwise} \end{cases},$$

$$X = \{1, 2, 3, \ldots\ldots\ldots, 10\}.$$

Then the height of a given by :

(A) 0

(B) 1

(C) 0.5

(D) 10

93. The hamming distance is given by $d(A, B) = \sum_{x \in X} |A(x) - B(x)|$,

where A and B are the fuzzy sets.

Give A = $\left\{\frac{0.2}{a}, \frac{0.5}{b}, \frac{0.8}{c}, \frac{0.4}{d}\right\}$ and

B = $\left\{\frac{0.1}{a}, \frac{0.7}{b}, \frac{0.3}{c}, \frac{0.9}{d}\right\}$, then d (A, B) is given by :

(A) 0

(B) 1

(C) 1.3

(D) 0.5

94. If a fuzzy set is convex then its all α-level sets are :

(A) convex

(B) concave

(C) empty set

(D) None of the above

95. For the fuzzy sets, which law/s hold/s good :

(A) Law of contradiction

(B) Law of excluded middle

(C) Both do not hold

(D) Both holds good

96. Let $A_i \in F(x)$ for all $i \in I$, where $F(x)$ is the collection of all fuzzy sets of X and I is the index set, then which is true ?

(A) $\bigcup_{i \in I} \alpha A_i \subseteq {}^{\alpha}\left[\bigcup_{i \in I} A_i\right]$

(B) $\bigcup_{i \in I} \alpha A_i \supseteq {}^{\alpha}\left[\bigcup_{i \in I} A_i\right]$

(C) $\bigcup_{i \in I} \alpha A_i = {}^{\alpha}\left[\bigcup_{i \in I} A_i\right]$

(D) None of the above

97. Let $A_i \in F(X)$ for all $i \in I$, where $F(X)$ is the collection of all fuzzy sets of X and I be the index set, then which is true ?

(A) $\bigcap_{i \in I} {}^{\alpha}A_i \subseteq {}^{\alpha}\left[\bigcap_{i \in I} A_i\right]$

(B) $\bigcap_{i \in I} {}^{\alpha}A_i = {}^{\alpha}\left[\bigcap_{i \in I} A_i\right]$

(C) $\bigcap_{i \in I} {}^{\alpha}A_i \supseteq {}^{\alpha}\left[\bigcap_{i \in I} A_i\right]$

(D) None of the above

98. Let A, B $\in F(X)$, where $F(X)$ be the collection of all fuzzy sets on X, then for all $\alpha \in [0,1]$, which is true ?

(A) $A \subseteq B \Rightarrow \alpha_A \subseteq \alpha_B$

(B) $A \subseteq B \Rightarrow \alpha_A^+ \subseteq \alpha_B^+$

(C) Both (A) and (B)

(D) None of the above

99. "For every A $\in F(X)$, $A = \bigcup_{\alpha \in [0,1]} \alpha^A$, where α^A is special fuzzy set and F (X) is the collection of all fuzzy sets on X." This is the statement of :

(A) First Decomposition Theorem

(B) Second Decomposition Theorem

(C) Principle of Excluded Middle

(D) None of the above

100. Let $f: X \rightarrow Y$ be an arbitrary crisp function. Then for any $A_i \in F(X)$ and $B_i \in F(Y)$, $i \in I$, which of the following is true ?

(A) $f\left(\bigcup_{i \in I} A_i\right) \supseteq \bigcup_{i \in I} f(A_i)$

(B) $f^{-1}\left(\bigcap_{i \in I} B_i\right) = \bigcap_{i \in I} f^{-1}(B_i)$

(C) $A \supseteq f^{-1}(f(A))$

(D) None of the above

Roll No. ....

O. M. R. Serial No. | | | | | | | | |

Question Booklet Number
308161

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Programming in C) (Elective)

Paper Code							
B	0	3	0	8	0	7	T

Questions Booklet Series
A

Time : 1:30 Hours]

[*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

(Remaining instructions on the last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. C language was developed by ....

(A) Dennis Rechard

(B) Dennis M. Ritchie

(C) Bjarne Stroustrup

(D) Anders Hejlsberg

2. In which year was C language developed ?

(A) 1962

(B) 1978

(C) 1979

(D) 1972

3. C language is a successor to which language ?

(A) Basic

(B) Cobol

(C) C++

(D) B

4. C is a ....

(A) Low level language

(B) High level language

(C) Medium level language

(D) None of the above

5. How many keywords are there in C language ?

(A) 32

(B) 33

(C) 64

(D) 18

6. C language is a ....

(A) Procedural oriented programming language

(B) General purpose programming language

(C) Structured programming

(D) All of the above

7. Which is not a valid keyword in C language ?

(A) for

(B) while

(C) do-while

(D) switch

8. The C source file is processed by the ....

(A) Interpreter

(B) Compiler

(C) Both Interpreter and Compiler

(D) Assembler

9. What is the extension of a C language source file ?

(A) .c

(B) .cpp

(C) .c99

(D) .h

10. What is the extension of a C language header file ?

(A) .c

(B) .cpp

(C) .c99

(D) .h

11. To develop which operating, C language was invented ?

(A) Linux

(B) Unix

(C) Android

(D) Mac

12. Which is/are the disadvantage(s) of C language ?

(A) No Garbage Collection

(B) Inefficient Memory Management

(C) Lack of Object Orientation

(D) All of the above

13. Which are the fundamental data types in C ?

(A) char

(B) int

(C) float

(D) All of the above

14. How many byte(s) does a char type take in C ?

(A) 1

(B) 2

(C) 3

(D) 4

15. What is the difference between float and double in C ?

(A) Both are used for the same purpose

(B) Double can store just double value as compare to float value

(C) Double is an enhanced version of float and was introduced in C99

(D) Double is more precise than float and can store 64 bits

16. What is the correct syntax to declare a variable in C ?

(A) data_type variable_name;

(B) data_type as variable_name;

(C) variable_name data_type;

(D) variable_name as data_type;

17. Which is correct with respect to the size of the data types in C ?

(A) char > int > float

(B) char < int < float

(C) int < char < float

(D) int < chat > float

18. Which operator is used to find the remainder of two numbers in C ?

(A) /

(B) \

(C) %

(D) //

19. Which of the following is not an arithmetic expression ?

(A) x = 10

(B) x / = 10

(C) x % = 10

(D) x ! = 10

20. What will be the output of the following C code ?

```
#include <stdio.h>
int main()
{
    int x = 20;
    x %= 3;
    printf (“%d”,x);
    return 0;
}
```

(A) 2

(B) 2.5

(C) Error

(D) Warning

21. What will be the output of the following C code ?

```
#include <stdio.h>
void main()
{
    int x = 10;
    int y = x++ + 20;
    printf(“%d,%d”,x,y);
    return 0;
}
```

(A) 11, 30

(B) 11, 31

(C) 10, 30

(D) 10, 31

22. Increment (++) and decrement (- -) are the .... operators in C.

(A) Unary

(B) Binary

(C) Ternary

(D) None of the above

23. What is the name of "&" operator in C ?

(A) Ampersand

(B) And

(C) Address of

(D) None of the above

24. Which of the following are valid decision-making statements in C ?

(A) if

(B) switch

(C) nested if

(D) All of the above

25. Ternary operator in C programming is ....

(A) if-else-if

(B) ?:

(C) ?;?

(D) None of the above

26. What will be the result of the following condition ?

```
#include <stdio.h>
int main()
{
Printf((43>43)  ? "value 1 is greater" :
        "value 1 is not greater ")
Return 0;
}
```

(A) value 1 is not greater

(B) value 1 is greater

(C) Error

(D) None of the above

27. What will be the result of the following condition ?

(!(25 > 25))

(A) True

(B) False

(C) Error

(D) None of the above

28. Which statement is required to execute a block of code when the condition is false ?

(A) for

(B) if

(C) else

(D) All of the above

29. The if-elseif-else statement in C programming is used :

(A) Create multiple conditional statements

(B) Return values

(C) Loop in if-else block

(D) All of the above

30. When all cases are unmatched which case is matched in a switch statement ?

(A) Default case

(B) First case

(C) No case

(D) None of the above

31. Loops in C programming are used to ....

(A) Execute a statement based on a condition

(B) Execute a block of code repeatedly

(C) Create a variable

(D) None of the above

32. Which of these is an exit-controlled loop ?

(A) for

(B) if

(C) do...while

(D) while

33. Which loop executes the block a specific number of times ?

(A) while loop

(B) for loop

(C) do...while loop

(D) All of the above

34. A string is terminated by ....

(A) Newline ('\n')

(B) Null ('\0')

(C) Whitespace

(D) None of the above

35. Which format specifier is used to read and print the string using printf() and scanf() in C ?

(A) %c

(B) %str

(C) %p

(D) %s

36. Which format specifier is used to read and print the string using printf() and scanf() in C ?

(A) %c

(B) %str

(C) %p

(D) %s

37. Which function is used to concatenate two strings in C ?

(A) concat()

(B) cat()

(C) stringcat()

(D) strcat()

38. Which function is used to compare two strings in C ?

(A) strcmp()

(B) strcmpi()

(C) compare()

(D) cmpi()

39. Which function is used to compare two strings with ignoring case in C ?

(A) strcmp()

(B) strcmpi()

(C) compare()

(D) cmpi()

40. You can access elements of an array by ....

(A) values

(B) indices

(C) memory addresses

(D) All of the above

41. Array elements are always stored in .... memory locations.

(A) Random

(B) Sequential

(C) Both (A) and (B)

(D) None of the above

42. Which of the following is the collection of different data types ?

(A) structure

(B) string

(C) array

(D) All of the above

43. Which operator is used to access the member of a structure ?

(A) -

(B) >

(C) *

(D) .

44. Which of these is a user-defined data type in C ?

(A) int

(B) union

(C) char

(D) All of the above

45. The size of a union is ....

(A) Sum of sizes of all members

(B) Predefined by the compiler

(C) Equal to size of largest data type

(D) None of the above

46. Which keyword is used to define a union ?

(A) un

(B) union

(C) Union

(D) None of the above

47. All members of union ....

(A) Stored in consecutive memory location

(B) Share same memory location

(C) Store at different location

(D) All of the above

48. The members of union can be accessed using ....

(A) Dot Operator (.)

(B) And Operator (&)

(C) Asterisk Operator (*)

(D) Right Shift Operator (>)

49. What is a function in C ?

(A) User defined data type

(B) Block of code which can be reused

(C) Declaration syntax

(D) None of the above

50. Which keyword is used to return values from function ?

(A) Return

(B) Value

(C) Return type

(D) All of the above

51. Which of these is not a valid parameter passing method in C ?

(A) Call by value

(B) Call by reference

(C) Call by pointer

(D) All of the above

52. A C program contains ....

(A) At least one function

(B) No function

(C) No value from command line

(D) All of the above

53. A recursive function in C ....

(A) Call itself again and again

(B) Loop over a parameter

(C) Return multiple values

(D) None of the above

54. The sqrt() function is used to calculate which value ?

(A) Square

(B) Square of reverse bits

(C) Square root

(D) None of the above

55. Before using a pointer variable, it should be ....

(A) Declared

(B) Initialized

(C) Both (A) and (B)

(D) None of the above

56. Which function is used to open a file in C ?

(A) open()

(B) fopen()

(C) file_open()

(D) fileopen()

57. Who is the father of C language ?

(A) Steve Jobs

(B) James Gosling

(C) Dennis Ritchie

(D) Rasmus Lerdorf

58. Which function is used to close an opened file in C ?

(A) close()

(B) fclose()

(C) file_close()

(D) fileclose()

59. What is the value of EOF in C ?

(A) – 1

(B) 0

(C) 1

(D) Null

60. Which function checks the end-of-file indicator for the given stream in C ?

(A) eof()

(B) EOF

(C) feof()

(D) None of the above

61. Which function is used to seek the file pointer position in C ?

(A) seek()

(B) fseek()

(C) fileseek()

(D) fmove()

62. Which function is used to delete an existing file in C ?

(A) delete()

(B) fremove()

(C) frem()

(D) remove()

63. Which symbol is used to begin a preprocessor ?

(A) @

(B) !

(C) #

(D) All of the above

64. Which of these is a valid preprocessor in C ?

(A) #include

(B) #if

(C) #error

(D) All of the above

65. Header files ....

(A) Contain function declarations

(B) Can be included to a program

(C) End with .h extension

(D) All of the above

66. What will the result of num variable after execution of the following statements ?

```
int num = 58;
num %= 11;
```

(A) 3

(B) 5

(C) 8

(D) 11

67. Array is a .... data structure.

(A) Non-linear

(B) Primary

(C) Linear

(D) Data type

68. Which of the following statements is correct about the array ?

(A) In the array, users can only allocate the memory at the run time.

(B) In the array, users can only allocate the memory at the compile time.

(C) The array is a primitive and non-linear data structure that only stores a similar data type.

(D) All of the above

69. A global variable is declared ....

(A) Outside of the function

(B) Inside of the function

(C) With the function

(D) Anywhere in the program

70. A Which of the following operations cannot be performed in file handling ?

(A) Open the file

(B) Read the file

(C) To write a file

(D) None of the above

71. In which of the following modes, the user can read and write the file ?

(A) r

(B) w

(C) r+

(D) b+

72. The enum keyword is used to assign names to the .... constants.

(A) Integer

(B) String

(C) Character

(D) All of the above

73. Which of the following operators precedence order is correct (from highest to lowest) ?

(A) %, *, /, +, -

(B) %, +, /, *, -

(C) +, -, %, *, /

(D) %, +, -, *, /

74. Which of the following is not an arithmetic operation ?

(A) x * = 65;

(B) x / = 42;

(C) x % = 2;

(D) x ! = 56;

75. Which of the following keyword is used for union in c language ?

(A) un

(B) unt

(C) ion

(D) union

76. Which of the following variable name is correct in c language ?

(A) For

(B) for

(C) Basic salary

(D) hello.

77. Which of the following header files is not used in C language ?

(A) <assert.h>

(B) <ctype.h>

(C) <iostream.h>

(D) <locale.h>

78. Which of the following declaration is incorrect in C language ?

(A) scanf("%d%d", a, b);

(B) scanf("%d%d", a b);

(C) scanf("First %d Second %d", &a, &b);

(D) scanf("%d%d", &x,&y);

79. Which of the following is the variable that can be used for all functions ?

(A) Static variable

(B) Global variable

(C) Local variable

(D) Dynamic variable

80. Which symbol is used to declare a pointer ?

(A) *

(B) #

(C) &

(D) &&

81. When was C programming developed ?

(A) The 1950s

(B) The 1960s

(C) The 1980s

(D) The 1970s

82. Which of the following is not a variable type in c programming ?

(A) Float

(B) Int

(C) While loop

(D) All of the above

83. What are strings in C programming ?

(A) Individual variables

(B) Group of function

(C) Group of character type variables in array form

(D) All of the above

84. What does a do-while loop do ?

(A) Repeats the process infinitely

(B) Processes the code at least once and then repeats

(C) Repeats only once

(D) All of the above

85. What of the following is true ?

(A) Variables are functions

(B) Variable is a type of output command

(C) Variables are used to store values

(D) All of the above

86. What is a function ?

(A) Looping code

(B) Code that operates when called

(C) Unknown variable

(D) All of the above

87. How many variables can the following string contain bat(45] ?

(A) 20

(B) 40

(C) 44

(D) 45

88. What is function overloading ?

(A) Process of multiple functions

(B) Multiple functions with the same name

(C) Looping functions

(D) All of the above

89. Which header file uses gets() ?

(A) Studio. h

(B) Stdlib.h

(C) Conio.h

(D) All of the above

90. What are const data types used for ?

(A) Unknown values

(B) Static or constant values

(C) Dynamic variable values

(D) All of the above

91. Which of the following is not related to c programming ?

(A) conio.h

(B) getch()

(C) console.log

(D) All of the above

92. What is scanf() in c programming ?

(A) The layout of an input string

(B) Array

(C) Output function

(D) All of the above

93. What is the size of the int data type (in bytes) in C ?

(A) 4

(B) 8

(C) 2

(D) 1

94. If p is an integer pointer with a value 1000, then what will the value of p + 5 be ?

(A) 1020

(B) 1005

(C) 1004

(D) 1010

95. Which of the following are not standard header files in C ?

(A) Stdio.h

(B) Stdlib.h

(C) Conio.h

(D) None of the above

96. In which of the following languages is function overloading not possible ?

(A) C

(B) C++

(C) Java

(D) Python

97. What is the return type of the fopen() function in C ?

(A) Pointer to a FILE object

(B) Pointer to an integer

(C) An integer

(D) None of the above

98. How to find the length of an array in C ?

(A) sizeof(a)

(B) sizeof(a[0])

(C) sizeof(a)/sizeof(a[0])

(D) sizeof(a)*sizeof(a[0])

99. Which of the following is not a storage class specifier in C ?

(A) volatile

(B) extern

(C) typedef

(D) static

100. Which data structure is used to handle recursion in C ?

(A) Stack

(B) Queue

(C) Deque

(D) Trees

Roll No. ....

O. M. R. Serial No. | | | | | | | | |

Question Booklet Number
310680

M. A./M. Sc. (Second Semester) (NEP) EXAMINATION, 2022-23

MATHEMATICS

(Introductory Statistical Methods)

Paper Code							
B	0	3	0	8	0	9	T

Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks :*

SE

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

(Remaining instructions on the last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. The first four moments of a distribution about the value 4 of the variable are –1.5, 17, –30 and 108, then third moment about mean i.e. μ_3 is :

(A) 0

(B) 14.75

(C) 39.75

(D) None of the above

2. A bag contains 5 red, 7 black and 8 white balls. Two balls are drawn from it at random. What is the probability that they are of the same colour ?

(A) $\frac{16}{81}$

(B) $\frac{61}{190}$

(C) $\frac{57}{190}$

(D) None of the above

3. If A and B are two events with P (A) = 0.38, P (B) = 0.62 and $P(A \cup B) = 0.75$, then P (B/A) = :

(A) $\frac{19}{62}$

(B) $\frac{21}{62}$

(C) $\frac{23}{38}$

(D) $\frac{25}{38}$

4. If the A. M. of a set of two observations is 9 and its G. M. is 6, then H. M. of the set of observations is :

(A) 3

(B) $3\sqrt{6}$

(C) 4

(D) None of the above

5. All values in a sample are same. Then their variance is :

(A) One

(B) Zero

(C) Not calculable

(D) All of the above

6. The probability of success of an event is 5 time that of its failure. Then the probability of success is :

(A) $\frac{5}{6}$

(B) $\frac{1}{6}$

(C) $\frac{1}{5}$

(D) None of the above

7. Which one of the following is a one-dimensional diagram ?

(A) Bar diagram

(B) Pie chart

(C) Cylinder

(D) None of the above

8. In a bar diagram, the base line is :

(A) Horizontal

(B) Vertical

(C) False base line

(D) None of the above

9. Pie chart represent the component of a factor by :

(A) Percentage

(B) Angles

(C) Sectors

(D) Circles

10. Pictogram are shown by :

(A) dots

(B) circles

(C) lines

(D) pictures

11. Histogram can be used only when :

(A) Class intervals are equal or unequal

(B) Class intervals are unequal

(C) Frequencies in class interval are equal

(D) Class intervals are all equal

12. Mode is that value in frequency distribution which possesses :

(A) Frequency one

(B) Minimum frequency

(C) Maximum frequency

(D) None of the above

13. The mode of the distribution of values :

5, 7, 9, 9, 8, 5, 6, 8, 7, 7, 5, 7, 9, 2, 7

(A) 8

(B) 7

(C) 6

(D) 5

14. The distribution having two modes is called :

(A) Bimodel

(B) Unimodel

(C) Trimodel

(D) Without mode

15. To find the median (mode) it is necessary to arrange the data in :

(A) Ascending order

(B) Descending order

(C) Ascending or Descending order

(D) Any of the above

16. The percentage of data of a set which is to the right of 90th percentile is :

(A) 90 percent

(B) 10 percent

(C) 20 percent

(D) None of the above

17. If measure of skewness is zero then which of the following is correct ?

(A) Frequency curve is symmetrical

(B) $Q_3 + Q_1 = 2Q_2$

(C) Mean = Median = Mode

(D) All of the above

18. Which of the following is not correct ?

(A) If $\beta_2 > 3$ the curve is Platykurtic

(B) If $\beta_2 < 3$ the curve is Leptokurtic

(C) If $\beta_2 = 3$ the curve is Mesokurtic

(D) None of the above

19. The defination, "Dispersion is the measure of the variation of the items" was given by :

(A) Raigleman

(B) A. L. Bowley

(C) Speigel

(D) None of the above

20. For a leptokurtic curve, the relation between μ_4 and μ_2 is :

(A) $\mu_4 = 3\mu_2^2$

(B) $\mu_4 < 3\mu_2^2$

(C) $\mu_4 > 3\mu_2^2$

(D) None of the above

21. If $B \subset A$, the probability $P(A\bar{B})$ is :

(A) $P(A) - P(B)$ or $P(A - B)$

(B) $P(A) - P(B)$

(C) $P(A - B)$

(D) None of the above

22. For any two events $P(A) = P_1$, $P(B) = P_2$ and $P(A \cap B) = P_3$ then $P(\bar{A} \cup \bar{B})$ is :

(A) $P_1 + P_2$

(B) $1 - P_1 + P_2$

(C) P_1P_2

(D) $1 - P_3$

23. If two events A and B are mutually exclusive and $P(A) = \frac{1}{3}, P(B) = \frac{1}{2}$ then :

(A) $\frac{1}{6}$

(B) $\frac{2}{3}$

(C) $\frac{5}{6}$

(D) None of the above

24. Probability can take values :

(A) -1 to $+1$

(B) 0 to 1

(C) $-\infty$ to 1

(D) 1 to ∞

25. For testing that a bivariate random sample has come from an uncorrelated population, the appropriate test is :

(A) t-test

(B) χ^2-test

(C) F-test

(D) None of the above

26. Student's t-test based on two samples of size n_1 and n_2 for testing the equality of two normal population means when the population have same variances has degree of freedom equal to :

(A) $n_1 + n_2$

(B) $n_1 - n_2$

(C) $n_1 + n_2 + 2$

(D) None of the above

27. For the mid values given below :

25, 34, 43, 53, 61, 70

The first class of distribution is :

(A) 24.5-34.5

(B) 25-34

(C) 20-30

(D) 20.5-29.5

28. If the number of students in a school is 200 and max. and min. marks earned are 90 and 10 respectively, for the distribution of marks, the class interval rounded is :

(A) 10

(B) 9

(C) 12

(D) None of the above

29. Frequency of a variable is always :

(A) In percentage

(B) A fraction

(C) An integer

(D) None of the above

30. The data given as, 5, 7, 12, 17, 79, 84, 91 will be called as :

(A) A continuous series

(B) A discrete series

(C) An individual series

(D) Time series

31. Classification is applicable in case of :

(A) quantitative characters

(B) qualitative characters

(C) Both (A) and (B)

(D) None of the above

32. Which of the following is a measure of central value ?

(A) Median

(B) Standard deviation

(C) Mean deviation

(D) Quartile deviation

33. If a constant value 50 is subtracted from each observation of a set, the mean of set is :

(A) decreased by 50

(B) increased by 50

(C) not affected

(D) zero

34. What would be the weighted mean of n natural numbers if weights are corresponding numbers ?

(A) $\frac{2n+1}{4}$

(B) $\frac{2n+1}{5}$

(C) $\frac{2n-1}{3}$

(D) None of the above

35. The sum of $2n$ natural numbers from 1 to $2n$ is :

(A) $(n+1)/2$

(B) $n(2n+1)/2$

(C) $(2n+1)/2$

(D) $n(n+1)/2$

36. If for a discrete series, the assumed mean $A = 50$, $\Sigma fdx = 45$, for $dx = x - A$ $\Sigma f = 12$, then the mean of the series is :

(A) 46.25

(B) 7.92

(C) 49.17

(D) 53.75

37. The average of n observations $x_1, x_2, ..., x_n$ is M. If x_1 is replaced by x^1, then the new average is :

(A) $(nm - x_1 + x^1)/n$

(B) $(M - x_1 + x^1)/n$

(C) $M - x_1 + x^1$

(D) $\frac{(n-1)M - x_1 + x^1}{n}$

38. A train covered the first 5 km of its journey at a speed of 30 km/h and next 15 km at a speed of 45 km/h. The average speed of the train is :

(A) 35 km/h

(B) 40 km/h

(C) 32 km/h

(D) 42 km/h

39. A fair coin is tossed repeatedly unless a head is obtained. The probability that the coin has to be tossed at least four times is :

(A) $\frac{1}{2}$

(B) $\frac{1}{4}$

(C) $\frac{1}{6}$

(D) $\frac{1}{8}$

40. From the probabilities given as $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$, $P(A/B) = \frac{1}{6}$, the probability $P(B/\bar{A})$ is equal to :

(A) 1/16

(B) 15/16

(C) 15/24

(D) 5/16

41. A number is selected randomly from each of two sets :

1, 2, 3, 4, 5, 6, 7, 8

2, 3, 4, 5, 6, 7, 8, 9

The probability that the sum of numbers is equal to 9, is :

(A) 7/64

(B) 8/91

(C) 7/72

(D) 5/64

42. An urn contains four tickets marked with 112, 121, 211, 222 and one ticket is drawn at random. Let A_i (i = 1, 2, 3) be the event that ith digit of the number of the ticket drawn is 1. The events A_1, A_2 and A_3 are :

(A) mutually exclusive

(B) dependent

(C) pairwise dependent

(D) independent

43. A machine produces 10 percent defective items. Ten items are selected at random. What is the probability of not more than one item being defective ?

(A) $\left(\frac{9}{10}\right)^8\left(\frac{19}{10}\right)$

(B) $\left(\frac{9}{10}\right)^7\left(\frac{19}{10}\right)$

(C) $\left(\frac{9}{10}\right)^9\left(\frac{19}{10}\right)$

(D) None of the above

44. If n trials be conducted with probability 'p' of a success and 'q' of a failure, the standard deviation of binomial distribution is :

(A) np

(B) nq

(C) pq

(D) None of the above

45. Which is wrong about Poisson distribution ?

(A) First three moments are not equal

(B) Poisson distribution is positively skewed

(C) Poisson distribution is leptokurtic

(D) None of the above

46. If a Poisson variate x is such that $P(x=1) = P(x=2)$, then mean μ is :

(A) 1

(B) 2

(C) 0

(D) None of the above

47. If $X \sim N(5,1)$ the probability density function for normal variate X is :

(A) $\frac{1}{5\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{X-1}{5}\right)^2}$

(B) $\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{X-1}{5}\right)^2}$

(C) $\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}X^2}$

(D) $\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(X-5)^2}$

48. If $X - N(8, 64)$, the standard normal deviate Z will be :

(A) $Z = \frac{X-64}{8}$

(B) $Z = \frac{X-8}{8}$

(C) $Z = \frac{X-8}{64}$

(D) None of the above

49. If for a binomial distribution mean = 4, variance = $\frac{4}{3}$, the probability $P(X \geq 5)$ is equal to :

(A) $4\left(\frac{2}{3}\right)^6$

(B) $\left(\frac{1}{3}\right)^5$

(C) $\left(\frac{2}{3}\right)^6$

(D) None of the above

50. If binomial random variable has mean = 4 and variance = 3, then its third central moment μ_3 is :

(A) $\frac{1}{2}$

(B) $\frac{5}{2}$

(C) $\frac{3}{2}$

(D) $\frac{7}{4}$

51. Coefficient of quartile deviation is given by :

(A) $\frac{Q_3+Q_1}{Q_3-Q_1}$

(B) $\frac{Q_3+Q_1}{Q_1-Q_3}$

(C) $\frac{Q_3-Q_1}{Q_3+Q_1}$

(D) None of the above

52. Sum of squares of the deviation is minimum when deviation are taken from :

(A) mean

(B) median

(C) mode

(D) zero

53. If the standard deviation of a distribution is 15, the quartile deviation of distribution is :

(A) 15

(B) 12.5

(C) 10

(D) None of the above

54. Which of the following formula for standard deviation of a frequency distribution is not correct ?

(A) $\sigma = \sqrt{\frac{1}{N}\sum_i f_i(x_i - \bar{x})^2}$

(B) $\sigma = \sqrt{\frac{1}{N}\sum_i f_i x_i^2 - \bar{x}^2}$

(C) $\sigma = \sqrt{\frac{1}{N}\sum_i f_i x_i^2 - \left(\frac{\sum_i f_i x_i}{N}\right)^2}$

(D) $\sigma = \sqrt{\frac{1}{N}\left(\sum_i f_i x_i\right)^2 - \frac{\sum f_i x_i}{N}}$

55. Which measure of dispersion ensures highest degree of reliability ?

(A) Range

(B) Mean deviation

(C) Quartile deviation

(D) Standard deviation

56. For positive skewed distribution the correct inequality is :

(A) Median > Mode

(B) Mean > Mode

(C) Mode > Mean

(D) Mode > Median

57. If the minimum value in a set is 9 and its range is 57, the maximum value of the set is :

(A) 66

(B) 33

(C) 48

(D) None of the above

58. Variance of the following frequency distribution is :

Class	Frequency
2—4	2
4—6	5
6—8	4
8—10	1

(A) 2.5

(B) 5.0

(C) 2.9

(D) None of the above

59. The variance of first n natural numbers is :

(A) $\frac{(n^2-1)}{12}$

(B) $\frac{(n^2+1)}{12}$

(C) $\frac{(2n^2-1)}{8}$

(D) None of the above

60. If the coefficient of kurtosis β_2 of a distribution is zero, the frequency curve is :

(A) Leptokurtic

(B) Platykurtic

(C) Mesokurtic

(D) None of the above

61. Suppose (x_i, y_i), where $i = 1, 2, ..., n$ are data points. If we want to fit $y = f(x)$ containing m unknown parameters $a_1, a_2, ..., a_m$ and $d_i = y_i - y'_i$, then y'_i is known as :

(A) Observed value

(B) Expected value

(C) Residual value

(D) None of the above

62. The curve for which the sum of squares of residual is minimum is called ?

(A) Least fitting curve

(B) Minimal fitting curve

(C) Maximal fitting curve

(D) None of the above

63. The normal equations to fit a straight line $y = a + bx$ to the given data with n observations are :

(A) $\Sigma y = na + b\Sigma x$ and $\Sigma xy = a\Sigma x - b\Sigma x^2$

(B) $\Sigma y = na + b\Sigma x$ and $\Sigma xy = a\Sigma x + b\Sigma x^2$

(C) $\Sigma y = na - b\Sigma x$ and $\Sigma xy = a\Sigma x + b\Sigma x^2$

(D) $\Sigma y = na - b\Sigma x$ and $\Sigma xy = a\Sigma x - b\Sigma x^2$

64. The number of normal equations to fit $y = a + bx + cx^2$ is :

(A) 1

(B) 2

(C) 3

(D) 4

65. To find the constant a and b the model $y = ae^{bx}$ to fit $(x_i, y_i), i = 1, 2, ..., n$ The sum of residuals that is minimized is :

(A) $\sum (y_i - ae^{bx_i})^2$

(B) $\sum (\log(y_i) - \log a - bx_i)^2$

(C) $\sum (y_i - \log a - bx_i)^2$

(D) $\sum (\log y_i - \log a - b \log x_i)^2$

66. For the given data below, the value of $\sum x_i^2 y_i$ is :

x	y
0	1
1	0
2	3
3	10
4	21

(A) 435

(B) 436

(C) 437

(D) 438

67. Fit the curve $y = ae^{bx}$ if their normal equations are $13.1991 = 4a + 10b$ and $30.7134 = 10a + 30b$:

(A) $y = 4.4419\, e^{-0.4569x}$

(B) $y = -0.4569\, e^{4.4419x}$

(C) $y = -4.419\, e^{0.4569x}$

(D) None of the above

68. In the least squares method we use .... to find the value of unknowns.

(A) Regression equations

(B) Normal equations

(C) General equations

(D) Auxillary equations

69. The best fitting line $y = a + bx$ for the values $(x_i, y_i), i = 1, 2, 3, ..., n$ always passes through the point :

(A) $(0, 0)$

(B) $(\bar{x}, 0)$

(C) $(\bar{x}, \bar{y})$

(D) $(0, \bar{y})$

70. The difference between the observed and expected value of given data in curve fitting is known as :

(A) margin

(B) gap

(C) step-size

(D) None of the above

71. The formula for the estimate b in the regression equation $y = a + bx$ is :

(A) $\text{cov}(x, y)/\sigma_x$

(B) $\Sigma \sigma_x/\sigma_y$

(C) $\Sigma (x_i - \bar{x})(y_i - \bar{y})/\Sigma (x_i - \bar{x})^2$

(D) All of the above

72. If x are independent the value of regression coefficient b_{yx} is equal to :

(A) 0

(B) 1

(C) ∞

(D) None of the above

73. The lines of regression intersect at the point :

(A) $(\bar{x}, \bar{y})$

(B) (x, y)

(C) $(0, 0)$

(D) None of the above

74. The idea of product moment correlation was given by :

(A) R. A. Fisher

(B) Sir Francis Galton

(C) Karl Pearson

(D) Spearman

75. Formula for coefficient of correlation by making use of the variance of the difference $(x - y)$ of the variable $x2y$ is :

(A) $\rho = \frac{\sigma_x^2 + \sigma_y^2 + \sigma_{x-y}^2}{2\sigma_x\sigma_y}$

(B) $\rho = \frac{\sigma_x^2 + \sigma_y^2 + \sigma_{x-y}^2}{\sigma_x\sigma_y}$

(C) $\rho = \frac{\sigma_x^2 + \sigma_y^2 - \sigma_{x-y}^2}{2\sigma_x\sigma_y}$

(D) $\rho = \frac{\sigma_x^2 + \sigma_y^2 - \sigma_{x-y}^2}{\sigma_x\sigma_y}$

76. Which of the following is correct formula ?

(A) $r = \sqrt{b_{yx} + b_{xy}}$

(B) $r = \sqrt{b_{yx} - b_{xy}}$

(C) Both (A) and (B)

(D) None of the above

77. If ρ is simple correlation, the quantity $(1 - \rho^2)$ is called :

(A) Coefficient of determination

(B) Coefficient of non-determination

(C) Coefficient of alienation

(D) None of the above

78. The coefficient of correlation between two variables x and y is 0.32. Their covariance is 7.86. The variance of x is 10. Then standard deviation in y is :

(A) 7.767

(B) 6.767

(C) 5.767

(D) None of the above

79. With usual notation, the coefficient of rank correlation ρ is given by :

(A) $\rho = 1 - \frac{6\Sigma d_i^2}{n(n^2 - 1)}$

(B) $\rho = 1 + \frac{6\Sigma d_i^2}{n(n^2 + 1)}$

(C) $\rho = 1 + \frac{6\Sigma d_i^2}{n(n^2 - 1)}$

(D) $\rho = 1 - \frac{6\Sigma d_i^2}{n(n^2 + 1)}$

80. The property that b_{yx} and b_{xy} and ρ have same sign, it called :

(A) Fundamental property

(B) Magnitude property

(C) Signature property

(D) Mean property

81. Regression analysis can be used :

(A) For reducing the length of confidence interval

(B) For prediction of dependent variate value

(C) To know the true effect of certain treatment

(D) All of the above

82. If the correlation coefficient between the variables x and y is ρ, the correlation coefficient between x^2 and y^2 is :

(A) ρ

(B) ρ^2

(C) 0

(D) 1

83. The maximum number of regression lines is :

(A) ∞

(B) 2

(C) 100

(D) None of the above

84. The coefficient of regression of y on x is b_{xy} =

(A) $r\frac{\sigma_x}{\sigma_y}$

(B) $\frac{1}{r}\frac{\sigma_y}{\sigma_x}$

(C) $\frac{1}{r}\frac{\sigma_x}{\sigma_y}$

(D) $r\frac{\sigma_y}{\sigma_x}$

85. If lines of regression are given by the equations $8x - 10y + 66 = 0$ and $40x - 18y = 214$. Then coefficient of correlation between x and y is :

(A) $r = \pm 0.2$

(B) $r = \pm 0.4$

(C) $r = \pm 0.6$

(D) None of the above

86. If $x + 4y + 5$ and $y = ax + 4$ are the regression lines of x on y and y on x respectively, then which is correct ?

(A) $0.25 < a \le 0.5$

(B) $-1 \le a < 0$

(C) $-\frac{1}{4} \le a \le -\frac{1}{2}$

(D) None of the above

87. The whole Chi-square distribution curve lies in which quadrant ?

(A) Fourth quadrant

(B) Third quadrant

(C) Second quadrant

(D) First quadrant

88. On which hypothesis it is depend that test is one sided or two sided ?

(A) Composite hypothesis

(B) Alternative hypothesis

(C) Null hypothesis

(D) Simple hypothesis

89. Which test will be used to test $H_0 : \mu = \mu_0$ *vs.* $H_1 : \mu > \mu_0$ when population S. D. is known ?

(A) *z*-test

(B) *t*-test

(C) Chi-test

(D) None of the above

90. Testing $H_0 : \mu = a$ *vs.* $H_1 : \mu \neq a$ leads to, where a is any constant :

(A) one-sided upper tailed test

(B) one-sided lower tailed test

(C) two-tailed test

(D) None of the above

91. A population is distributed as $N = (\mu, 10.24)$. A sample of 576 items has a mean 4.7. The value of the statistic z to test $H_0 : \mu = 5.2$ is :

(A) 3.75

(B) –3.75

(C) 8.125

(D) None of the above

92. The degree of freedom for statistic-*t*, for paired *t*-test based on n pairs of observations is :

(A) $2(n-1)$

(B) $(n-1)/2$

(C) $(n-1)$

(D) None of the above

93. The value of static χ^2 is zero if and only if :

(A) $O_i = E_i \forall_i$

(B) $\Sigma O_i = \Sigma E_i$

(C) E_i is large

(D) All of the above

94. A coin is tossed 400 times and it turns up head 216 times. The hypothesis that the coin is unbiased can be tested by :

(A) χ^2-test

(B) Z-test

(C) Neither (A) nor (B)

(D) Both (A) and (B)

95. Degree of freedom is related to-:

(A) No. of observations in a set

(B) Hypothesis under test

(C) No. of independent observations in a set

(D) None of the above

96. To test an hypothesis about proportion of items in a class, the usual test is :

(A) t-test

(B) Z-test

(C) F-test

(D) None of the above

97. The range of statistic χ^2 is :

(A) –1 to +1

(B) $-\infty$ to $+\infty$

(C) 0 to 1

(D) 0 to ∞

98. The mean and S. D. of a set are 15 and 5 respectively. Then values of Student t is calculated to test $H_0 : \mu = 10$. If each sample value is increased by 2, the value of t will be :

(A) increased

(B) decreased

(C) same

(D) None of the above

99. Which of the following with usual notation is not a statistical hypothesis ?

(A) H : People suffering from T. B. bèlongs to the poor section of society

(B) $H : \sigma^2 = \sigma_0^2$

(C) $H : \sigma_1^2 > \sigma_1^2$

(D) $H : \rho_1 = \rho_2$

100. Statistic $Z = \dfrac{\bar{x} - \bar{y}}{\sigma\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$ is used to test the null hypothesis :

(A) $H_0 : \mu_1 + \mu_2 = 0$

(B) $H_0 : \mu_1 - \mu_2 = 0$

(C) $H_0 : \mu = \mu_0$ (a constant)

(D) None of the above