M/P ENT - 122

Total No. of Pages : 12

Seat No.	

M. Phil./Ph. D. Entrance Examination, October - 2021

STATISTICS

Day and Date : Wednesday, 27 - 10 - 2021 **Total Marks : 100**

Time : 1.00 p.m. to 3.00 p.m.

Instructions :

1) **All questions are compulsory.**
2) **Each question carries 2 marks.**
3) **Answers should be marked in the given OMR answer sheet by darkening the appropriate option.**
4) **Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.**
5) **Follow the instructions given on OMR Sheet.**
6) **Rough work shall be done on the sheet provided at the end of question paper.**
7) **Only non-programmable calculators are allowed.**

1) Research is
   A) Searching again and again
   B) Finding solution to any problem
   C) Working in a scientific way to search for truth of any problem
   D) None of the above

2) Action research means
   A) A longitudinal research
   B) An applied research
   C) A research with socioeconomic objective
   D) A research initiated to solve an immediate problem

3) In the process of conducting research 'Formulation of Hypothesis' is followed by
   A) Selection of Research Tools
   B) Statement of Objectives
   C) Analysis of Data
   D) Collection of Data

4) An appropriate source to find out descriptive information is _____ .

A) Bibliography
B) Encyclopedia
C) Dictionary
D) Directory

5) Questionnaire is a

A) Research method
B) Measurement technique
C) Data analysis technique
D) Tool for data collection

6) Empirical research is characterized by

A) Observation - Questionnaire - Conclusions
B) Data - Analysis - Inference
C) Observation - Objective - Measurement
D) Data - Observation - Interference

7) A set of rules that govern overall data communications system is popularly known as _____ .

A) Protocol
B) Agreement
C) Memorandum
D) Pact

8) A researcher is generally expected to:

A) Study the existing literature in a field
B) Generate new principles and theories
C) Synthesize the ideas given by others
D) Evaluate finding of the studies

9) Of the following statements, there are two statements both of which can not be true but both can be false. Which are these two statements?

I. All machines make noise
II. Some machines are noisy
III. No machine make noise
IV. Some machines are not noisy

A) (I) and (II)
B) (III) and (IV)
C) (I) and (III)
D) (II) and (IV)

10) It is important that academics produce research that can be widely used and valued by academic community around the word. This termed as

A) Ethics impact
B) Citation impact
C) Research impact
D) None of the above

11) In the organization, 40% of the employees are non-graduates, 50% of the remaining employees are graduates, and the remaining 180 are postgraduates. How many employees are graduates?

A) 360
B) 240
C) 600
D) 180

12) A person travelled a distance of 610 km. in 9 hours. He travelled the first phase at a speed of 40 kmph and the rest at 90 kmph. The distance travelled during the first phase is

A) 140 km
B) 150 km
C) 160 km
D) 170 km

13) Which of the following word is different from the others?

A) aorta
B) heart
C) liver
D) stomach

14) Which of the following sequences is convergent?

A) $(-1)^n \sin nx$
B) $(-1)^n n \sin x$
C) $(-1)^n \sin\left(\frac{x}{n}\right)$
D) $(-1)^n \cos\left(\frac{x}{n}\right)$

15) In how many ways can 8 Indians, 4 Americans, and 4 Englishmen can be seated in a row so that all persons of the same nationality sit together?

A) 3! 4! 8! 4!
B) 4! 8! 4! 3!
C) 4! 4! 3!
D) 8! 4! 4!

16) The problem is to infer about the parameter $p \in (0, 1)$ of a discrete distribution. Beta distribution of first kind is the conjugate prior when the parent distribution is _____ .

A) Binomial
B) Negative Binomial
C) Geometric
D) All the three above

17) Which of the following tests in not based on empirical DF?

A) Anderson - Darling test
B) χ^2 - goodness of fit test
C) Kolmogorov - Smirnov test
D) Watson test

18) Let $M = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 2 \\ 0 & 1 & 1 \end{bmatrix}$ and the vector space V is defined by, $V = Mx^T,\ x \in \mathbb{R}^3$.

Then which of the following is not true?

A) V coincides with the row-space of the matrix M
B) Dimension of V is 2
C) V coincides with the column-space of the matrix M
D) The vector space V is orthogonal to the space $V_D = \{(0, C, -C), C, \in \mathbb{R}\}$

19) $\lim_{x \to 1} \frac{x^2 - 1}{x^2 + 3x - 4}$ equals.

A) $\frac{1}{5}$
B) $\frac{2}{5}$
C) $\frac{1}{3}$
D) $\frac{2}{3}$

20) Which of the following in NOT true?

A) The numbers generated by a pseudo random number generator shall have the same sequence if we use the same seed
B) The numbers generated by pseudo random number generator are truly random
C) The numbers generated by pseudo generator are not actually random, those just appear to be random
D) The Lehmer's algorithm is used to generate a sequence of random numbers.

21) Algorithm does not have _____ .

A) logic
B) English words
C) looping
D) a specific syntax

22) For _____ data analysis, the data collection is not followed by a model imposition; rather it is followed immediately by analysis with a goal of inferring what model would be appropriate.

A) Exploratory
B) Classical
C) Bayesian
D) None of A, B, C

23) _____technique/method allows estimation of the sampling distribution of almost any statistic using random sampling methods.

A) Bootstrap
B) EDA
C) Delta
D) Classical

24) Let X has chi-square distribution with 3 degrees of freedom. EXCEL function '=CHIDIST (5, 3)' will return the value of _____ .

A) f (5), where f (.) is probability density function
B) P ($X \leq 5$)
C) P ($X > 5$)
D) P ($X > 3$)

25) Consider the following statements.

i) RAND (10, 20) function in EXCEL returns a random number from U (10, 20) distribution

ii) RANDBETWEEN (10, 20) function in EXCEL returns a random number from U (10, 20) distribution

Which of the following is correct?

A) Both statements (i) and (ii) are true
B) Only statement (i) is true
C) Only statement (ii) is true
D) Both statements (i) and (ii) are false

26) In SRSWOR for 10 units from a population of 100 units, the probability that a specified pair of distinct units will be included in the sample is _____

A) $\frac{1}{100}$ B) $\frac{1}{110}$

C) $\frac{1}{90}$ D) $\frac{9}{10}$

27) From a population of 40 units a sample of 5 units is selected by linear systematic sampling. Then which of the following statement is true.

A) If 7^{th} unit is in the sample then 17^{th} will be in the sample

B) If 7^{th} unit is in the sample then 37^{th} will be in the sample

C) If 7^{th} unit is in the sample then 27^{th} will be in the sample

D) If 7^{th} unit is in the sample then 16^{th} will not be in the sample

28) Which of the following is not true,

The rank of an idempotent matrix of order *n* is equal to _____

A) Number of its non zero characteristic roots

B) *n* always

C) The trace

D) The sum of the characteristic roots

29) The vectors (1, 2, 3), (0, 1, 3) and (1, 3, X) are linearly dependent if X is

A) 6 B) 3

C) 0 D) None of A, B, C

30) For testing H_0: $\theta = 1$ against H_1: $\theta \neq 1$ based on a random sample from $N(\theta, 1)$

A) MP test exists
B) UMP test does not exits
C) UMP test exits
D) None of the above

31) If the distribution function under H_0 is P_0 under H_1 is P_1 and they are equal, then the MP level α test with power β satisfies.

A) $\alpha \neq \beta$
B) $\alpha > \beta$
C) $\beta > \alpha$
D) $\alpha = \beta$

32) Which of the following statement(s) is (are) true:

I) If a statistic is sufficient for a class of distributions, it is sufficient for any subclass of those distributions

II) If a family of distributions is complete, its sub family is also complete

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

33) Let X and Y be two independent random variables such that XY is degenerate at $c \neq 0$. Which of the following statement is true?

A) Only X is degenerate
B) Only Y is degenerate
C) Both X and Y are degenerate
D) Neither X nor Y is degenerate

34) Which of the following statements are true?

I) Let X and Y be independent random variables. If X + Y is normally distributed then X and Y both are normal.

II) If X and Y are continuous independent random variable such that X + Y and X – Y are independent, then X, Y, X + Y and X – Y are all normal.

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

35) The eigne vector corresponding to largest eigne value of the covariance matrix of the data gives the direction of

A) Maximum scatter of the data

B) Minimum scatter of the data

C) No such information can be interpreted

D) Second largest Eigen vector which is in the same direction

36) Let X_1 and X_2 be independent random variables each assuming values + 1 and –1 with probability ½. Let $X_3 = X_1 X_2$. Which of the following statements is true?

A) X_1 and X_3 are dependent

B) X_2 and X_3 are dependent

C) X_i and X_3 are independent for $i = 1, 2$

D) X_1, X_2 and X_3 are independent

37) Suppose the sequences {Xn} and {Yn} of random variables are such that $Xn \xrightarrow{p} X, Yn \xrightarrow{d} Y$, where X and Y are random variables and P[Y = 3] = 1. Which of the following is not correct?

A) $X_n + Y_n \xrightarrow{p} X + 3$

B) $X_n Y_n \xrightarrow{p} 3X$

C) $Y_n \cos(X_n) \xrightarrow{a.s.} 3\cos(X)$

D) $Y_n X_n^2 \xrightarrow{p} 3X^2$

38) The purpose of confounding is :

A) To reduce block size to attain more with-in block homogeneity

B) To attain more intra-block homogeneity

C) To attain more intra-block heterogeneity

D) None of these

39) With respect to a 2^2 factorial experiment involving two factors A and B, the factor A has significant main effect means that the mean response at

A) The two levels of A are significantly different

B) Different levels of A differ significantly at different levels of B

C) All level combinations are significantly different

D) The two levels of B may not be significantly different

40) Under which of the following designs, quadratic effects among factors are not estimable?

A) 3^n factorial design

B) 2^n factorial design

C) Central composite design

D) Box-Behnken designs

41) In a general linear model, the normal equations _____

A) have unique solution

B) can have one or more solutions

C) can have no solution

D) contain p linearly independent equations, where p is the number of parameters.

42) The dimensions of estimation space and error space of the model $y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$, $i = 1, 2, \ldots k$, $j = 1, 2, \ldots$ m are respectively, _____

A) $k - 1$ and $m - k + 1$

B) k and $m - k$

C) k and $k(m - 1)$

D) $k - 1$ and $km - 1$

43) If line segment joining any two points in a set belongs to that set then such set is called _____ set.

A) bounded

B) concave

C) convex

D) closed

44) What is not a solution to the following LPP?

Max Z = $x_1 + x_2$, subject to $x_1 + 2x_2 \leq 4$, $3x_1 + 2x_2 \leq 10$, $x_1 \geq 0$, $x_2 \geq 0$.

A) $x_1 = 0, x_2 = 2$ B) $x_1 = 2, x_2 = 0$

C) $x_1 = 2, x_2 = 1$ D) $x_1 = 2, x_2 = 2$

45) The output of the R statements: $x = diag\ (4)$; $mean(x[x < = 0])$ is _____

A) 0 B) 1

C) 0.25 D) None of the above

46) If X ~ U (0, 10), then the distribution of the integer part of X is _____ .

A) Geometric (0.5) B) Binomial (10, 0.5)

C) Discrete uniform {0, 1, ..., 10} D) None of the above

47) Let $X_1, X_2, ..., X_n$ be random sample from U (0, θ), then which of the following is not true?

A) $2\bar{X}$ is unbiased estimator as well as consistent estimator for θ

B) $X_{(n)}$ is consistent but not CAN estimator for θ

C) $X_{(n)}$ is superior to $2\bar{X}$

D) $2\bar{X}$ is BAN estimator for θ

48) Let $X_1, X_2, ..., X_n$ be random sample from Poisson (θ). Consider the statements

i. $\bar{X}$ is consistent estimator for θ

ii. $\bar{X}e^{-\bar{X}}$ is consistent estimator for P (X = 0).

A) Only (i) is correct B) Only (ii) is correct

C) Both (i) and (ii) are correct D) Neither (i) nor (ii) correct

49) Let $\{X_n, n \geq 0\}$ be a Markov chain with state space $\{0, 1, 2, 3, 4\}$ and t.p.m

	0	1	2	3	4
0	0.3	0	0	0	0.7
1	0	0.5	0	0.5	0
2	0.1	0.1	0.1	0.1	0.6
3	0	0.4	0	0.6	0
4	1	0	0	0	0

Which of the following statement is not true?

A) Markov chain is reducible

B) State 1 is recurrent

C) State 4 is aperiodic

D) State 0 is transient

50) Let $\{X_n, n = 0, 1, 2, ...\}$ be BGW branching process with $X_0 = 1$, $E(X_1) = 1$ and $V(X_1) = \sigma^2$. Then the mean and variance of X_n are _____ respectively.

A) $1, n\sigma^2$ B) $n, n\sigma^2$

C) n, σ^2 D) $1, \sigma^2$

Rough Work