

Seat No.	
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P.G. Entrance Examination, May - 2023
M.Sc. STATISTICS/APPLIED STATISTICS & INFORMATICS
Sub. Code : 58715

Day and Date : Tuesday, 09 - 05 - 2023

Total Marks : 100

Time : 03.30 p.m. to 05.00 p.m.

- Instructions :**
- 1) All questions are compulsory.
 - 2) Each question carries 1 mark.
 - 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
 - 4) Follow the instructions given on OMR sheet.
 - 5) Rough work shall be done on the sheet provided at the end of question paper.

Questions : Choose most correct alternatives.

- 1) For any two positive observations, which of the following is true?
A) $A.M. \geq G.M. \geq H.M.$ B) $A.M. \leq G.M. \leq H.M.$
C) $A.M. > H.M. > G.M.$ D) $A.M. < H.M. < G.M.$

- 2) Mean square deviation is minimum when calculated from _____
A) Mode B) Median
C) Mean D) GM

- 3) For negatively skewed distribution, the correct relation between mean, median and mode is
A) $Mode < Median < Mean$ B) $Mean < Median < Mode$
C) $Median < Mean < Mode$ D) $Median > Mean > mode$

- 4) In a random experiment _____
- A) All possible outcomes are known in advance
 - B) All possible outcomes are not known in advance
 - C) Some possible outcomes can be known in advance
 - D) Outcome of a particular trial is known in advance
- 5) The probability that a leap year will have 53 Sunday is _____
- A) $1/7$
 - B) $2/7$
 - C) $2/53$
 - D) $1/53$
- 6) If $r_{xy} = 0.9$ and if $u = 2x + 1$, $v = 3 - y$, then $r_{uv} =$ _____.
- A) 0.9
 - B) -0.9
 - C) 0.18
 - D) -0.18
- 7) If $X + 3Y = 0$ holds for all values of random variables X and Y, then the coefficient of correlation (r) between X and Y is _____
- A) -0.8
 - B) 0.64
 - C) -1
 - D) 0.8
- 8) In Paasche's quantity index number _____ are used as weights.
- A) current year quantities
 - B) base year quantities
 - C) base year prices
 - D) current year prices
- 9) The distribution function of a discrete random variable is _____.
- A) logarithmic function
 - B) step function
 - C) exponential function
 - D) constant function

16) Which of the following distribution does not have equal mean and variance?

A) $U(0,6)$

B) $\text{Exp}(1)$

C) $N(1,1)$

D) $\beta_1(1,2)$

17) The maximum height of the density curve of normal distribution with mean 2 and variance 4 is _____

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

B) $\frac{1}{\sqrt{8\pi}}$

C) $\frac{1}{\sqrt{4\pi}}$

D) None of these

18) Control chart in statistical quality control is not meant for checking the _____.

A) pattern of variation

B) variability in the product is within the tolerance limit or not

C) variability in the product is due to assignable causes or not

D) linear trend

19) Which of the following is true?

A) F-test is used for testing goodness of fit.

B) F-test is used for testing independence of two attributes.

C) F-test is used for testing significance of single population variance.

D) F-test is used for testing equality of two population variances.

- 20)** The relation between t and f distribution is _____.
- A) $t_n^2 = F(1,1)$ B) $t_n^2 = F(1,n)$
 C) $t_n^2 = F(n,1)$ D) None of these
- 21)** If X follows Laplace distribution with parameter (μ, λ) then its interquartile range is _____.
- A) $(2/\lambda)\log 2$ B) $2/\lambda^2$
 C) $(2/\mu)\log 2$ D) $2/\mu^2$
- 22)** If $X \sim \text{LN}(25,5)$, then $\text{Var}(\log X) =$ _____
- A) 5 B) $e^{52.5}$
 C) e^{30} D) 25
- 23)** If $X \sim C(\mu, \lambda)$ then fourth order central moment is _____.
- A) exist and equal to μ B) exist and equal to 2μ
 C) 0 D) do not exists
- 24)** If X follows Weibull distribution with shape parameter 1 then the distribution of X is _____.
- A) Exponential B) Double Exponential
 C) Normal D) Cauchy
- 25)** If X follows logistic distribution with parameter (μ, σ) then the mode of X is _____.
- A) σ B) μ
 C) $\mu + \sigma$ D) none of these

26) If X has Pareto distribution with parameters α and β then variance of X is _____.

A) $\frac{\alpha\beta^2}{(\alpha-1)(\alpha-2)^2}$

B) $\frac{\alpha\beta^2}{(\alpha-2)(\alpha-1)^2}$

C) $\frac{\alpha\beta}{(\beta-1)^2}$

D) none of these

27) Multinomial distribution is generalization of _____ distribution.

A) Binomial

B) Poisson

C) Geometric

D) Normal

28) If X is truncated normal variate, truncated left at $X=a$ and truncated to the right at $X=b$ then _____.

A) $P(X < a) = 0$

B) $P(X \leq b) = 0$

C) $P(X > a) = 0.5$

D) $P(X > a, X > b) = 1$

29) If X is truncated Exponential variate with mean $\frac{1}{\theta}$ truncated to the left at 3 then $E(X)$ is _____.

A) $\frac{1}{\theta} + 3$

B) $\frac{1}{\theta}$

C) $\frac{1}{\theta^2}$

D) 3

- 30) If $(X, Y) \sim BN(0, 0, 1, 1, 0)$ then distribution of $\frac{X}{Y}$ is _____.
- A) Normal
 B) Bivariate Normal
 C) Cauchy
 D) Uniform
- 31) If 4, 1, 3, 2, 5 are observations on X where X has a geometric distribution with parameter θ then the moment estimator of θ is
- A) $1/3$
 B) $2/3$
 C) $1/2$
 D) $1/4$
- 32) If X_1, X_2, \dots, X_n is random sample from $B(1, p)$ then the statistic $T(x) = \sum_i X_i$ is
- A) unbiased
 B) sufficient
 C) consistent
 D) none of these
- 33) If X_1, X_2, \dots, X_n s a random sample from $U(\theta, \theta + 2)$ then the unbiased estimator of θ is
- A) $(\bar{X}-1)/2$
 B) $\bar{X}/2$
 C) $(\bar{X}+1)/2$
 D) \bar{X}
- 34) T_n is a consistent estimator of $\psi(\theta)$ if
- A) T_n converges to θ with probability one
 B) $\lim_{n \rightarrow \infty} P(|T_n - \psi(\theta)| < \epsilon) \rightarrow 0$
 C) $\lim_{n \rightarrow \infty} P(|T_n - \psi(\theta)| > \epsilon) \rightarrow 1$
 D) None of the above

- 35) If s^2 is sample variance then an unbiased estimator of population variance σ^2 is
- A) $(n - 1)s^2 / n$
 - B) ns^2 / n
 - C) $ns^2/(n - 1)$
 - D) None of the above
- 36) Cramer-Rao inequality with regard to the variance of an estimator provides
- A) Upper bound of the variance
 - B) Lower bound of the variance
 - C) Asymptotic variance of an estimator
 - D) None of these.
- 37) If a statistic T is unbiased estimator of parameter θ then unbiased estimator of $4\theta - 7$ is
- A) $4T$
 - B) $4T + 7$
 - C) $4T - 7$
 - D) $T + 7$
- 38) If T_n is a sufficient statistic of θ then $\frac{d \log L}{d\theta}$ is function of only
- A) T_n
 - B) T_n and θ
 - C) θ
 - D) Neither T_n nor θ
- 39) A one-dimensional statistic that best estimates the parameter is known as
- A) Point Estimator
 - B) Interval Estimator
 - C) Interval Estimate
 - D) Point Estimate

- 40) Estimator T_1 is said to be more efficient than estimator T_2 if
- A) $V(T_1) > V(T_2)$
 - B) Bias of $T_1 >$ Bias of T_2
 - C) Bias of $T_1 <$ Bias of T_2
 - D) $V(T_1) < V(T_2)$
- 41) A completely randomized design is also known as _____.
- A) systematic design
 - B) restrictional design
 - C) single block design
 - D) None of the above
- 42) In one-way ANOVA with total number of observations 15 and 5 treatments, the error degrees of freedom is _____.
- A) 56
 - B) 4
 - C) 10
 - D) 14
- 43) A randomized block design has _____.
- A) one way classification
 - B) two way classification
 - C) three way classification
 - D) no classification
- 44) While analyzing the data of a $k \times k$ latin-square design, the error d.f. in analysis of variance is equal to _____.
- A) $(k-1)(k-2)$
 - B) $k(k-1)(k-2)$
 - C) k^2-2
 - D) $k^2 - k - 2$

- 45) In 2^3 factorial experiment the arrangement of replicate with two blocks each of four plots is shown below. Which interaction effect is confounded in given replicate?

Block	(1)	c	ab	abc
1				
Block	ac	bc	b	a
2				

- | | |
|---------------------|----------------------|
| A) AB is confounded | B) BC is confounded |
| C) AC is confounded | D) ABC is confounded |
- 46) Local control helps to
- | | |
|------------------------------------|---------------------------------|
| A) reduce the number of treatments | B) increase the number of plots |
| C) reduce the error variance | D) increase the error d.f. |
- 47) If different effects are confounded in different blocks, it is said to be _____
- | | |
|-------------------------|------------------------|
| A) complete confounding | B) partial confounding |
| C) balanced confounding | D) none of the above |

- 48) In one-way ANOVA, if,

$$SS \text{ due to Treatment} = 2400,$$

$$SS \text{ due to error} = 1600,$$

$$\text{Number of treatments} = 4,$$

$$\text{Total number of observations} = 20$$

then the value of F is _____.

- | | |
|------|-------|
| A) 7 | B) 8 |
| C) 9 | D) 19 |

- 49) Two linear combinations $\sum c_i t_i$ and $\sum d_i t_i$ of treatment means are called as orthogonal contrasts if _____.
- A) $\sum c_i = 0$ and $\sum d_i = 0$
 B) $\sum c_i = 1$ and $\sum d_i = 1$
 C) $\sum c_i = \sum d_i$
 D) $\sum c_i = 0, \sum d_i = 0$ and $\sum c_i d_i = 0$
- 50) In which of the following situation(s), CRD is most suitable?
- i) all experimental units are homogeneous
 ii) the units are likely to be destroyed during experimentation
 iii) some units are likely to fail to response
- A) Only i) B) Only i) and ii)
 C) Only ii) D) All i), ii) and iii)
- 51) _____ visualizes the most significant problem to be worked out first.
- A) histogram B) control chart
 C) pareto chart D) flow chart
- 52) Generally, in process control cost of production is _____ as compared to that in product control.
- A) high B) low
 C) almost the same D) exactly the same
- 53) The probability of false alarm for \bar{X} chart with $3\sqrt{2}$ limits and with usual assumptions is _____.
- A) 0.027 B) 0.27
 C) 0.0027 D) 0.0027%

54) _____ invented the PDCA cycle.

- A) Shewhart
- B) Deming
- C) Montgomery
- D) Fisher

55) Acceptance sampling is used for all but which one of these?

- A) Incoming raw material
- B) Work-in-progress
- C) Final goods
- D) Incoming purchased parts

56) The output of the following statements in R is

```
x=rep(seq(1,3), c(rep(1,2),3))
mean(x[c(4,3)])
```

- A) 2
- B) 2.5
- C) 3
- D) 3.5

57) The output of the following statements in R is

```
x=100
y= (x <= 200*20)
y
```

- A) TRUE
- B) FALSE
- C) 4000
- D) 100

58) pchisq(2,3) command in R returns _____.

- A) $P(X \leq 2)$ where $X \sim \chi_3^2$
- B) $P(X \geq 2)$ where $X \sim \chi_3^2$
- C) $P(X \leq 3)$ where $X \sim \chi_2^2$
- D) $P(X \geq 3)$ where $X \sim \chi_2^2$

59) The output of the following R program is

```
t=1
x={}
for(i in c(10,15,20)){
  if(i%%2==0) x[t]=i
}
x[2]
```

- | | |
|-------|-------|
| A) 10 | B) 15 |
| C) 20 | D) NA |

60) The output of the following R statements is _____.

```
s1=10
s2=-5
x=seq(10,40,10)
for(i in 1:2){
  s1=s2+x[i]
  s2=s1-x[i]
}
s1+s2
```

- | | |
|-------|----------------------|
| A) 10 | B) -5 |
| C) 30 | D) None of the above |

61) Let X_1, X_2, \dots, X_n be i.i.d. random variables with pdf $f(x)$ and distribution function $F(x)$ then distribution function of $X_{(1)}$ is _____.

- | | |
|-------------------|---------------------|
| A) $1-[1-F(x)]^n$ | B) $[F(x)]^n$ |
| C) $[1-F(x)]^n$ | D) $[1-F(x)]^{n-1}$ |

62) Let $X_{(1)}, X_{(2)}, \dots, X_{(n)}$ be order statistics of size n from $U(0,1)$ distribution, then the distribution of range is _____.

- | | |
|---------------------|---------------------|
| A) $\beta_1(n-2,2)$ | B) $\beta_1(n,2)$ |
| C) $\beta_1(n-1,2)$ | D) $\beta_1(2,n-1)$ |

63) Let X_1, X_2, \dots, X_n be a random sample of size n from $U(0,1)$ distribution, then expected value of n^{th} order statistic is _____.

- | | |
|----------------------|----------------------|
| A) $\frac{n-1}{n+1}$ | B) $\frac{1}{n+1}$ |
| C) $\frac{n}{n+1}$ | D) $\frac{n-1}{n+1}$ |

64) If X_1 and X_2 are independent exponential variates with mean 1 and 2 respectively, then $P[\min\{X_1, X_2\} > 1]$ is _____.

- | | |
|-------------|---------------|
| A) e^{-2} | B) e^{-3} |
| C) e^{-1} | D) $e^{-1.5}$ |

65) If $X_n \xrightarrow{p} a$ as $n \rightarrow \infty$ then which of the following is/are always true?

i) $X_n^2 \xrightarrow{p} a^2$

ii) $\frac{1}{X_n} \xrightarrow{p} \frac{1}{a}$

iii) $(X_n - a) \xrightarrow{p} 0$

- | | |
|-------------|-------------------------|
| A) Only i) | B) Only i) and iii) |
| C) Only ii) | D) All i), ii) and iii) |

- 71) The most preferred confidence interval for a parameter should be _____.
- A) with shortest width and largest confidence coefficient
 - B) with largest width and smallest confidence coefficient
 - C) based on sufficient statistics
 - D) none of these
- 72) If X_1, X_2, \dots, X_n is a random sample from exponential distribution with parameter θ then interval estimate of θ can be obtained by use of _____.
- A) Normal distribution
 - B) t distribution
 - C) F distribution
 - D) Chi-square distribution
- 73) A sample of size 144 from $N(\mu, \sigma^2)$ gives the sample mean $\bar{X}=10$ and sample variance $s^2=36$ then 95% confidence interval for μ is _____.
- A) (9.02, 10.98)
 - B) (9.02, 9.98)
 - C) (10.02, 10.98)
 - D) (9.20, 10.98)
- 74) If random variable X has $N(\mu, \sigma^2)$ -distribution then which of the following is simple null hypothesis?
- A) $|\mu|=0$
 - B) $\mu=10$
 - C) $\sigma^2=16$
 - D) None of the Above
- 75) The critical region of a likelihood Ratio test criterion is always _____
- A) Left tailed
 - B) Right tailed
 - C) Two tailed
 - D) Depends on null hypothesis

76) In SPRT of strength (0.02, 0.03) the stopping bounds (A, B) are given by _____.

- A) $\left(\frac{97}{3}, \frac{2}{98}\right)$ B) $\left(\frac{97}{2}, \frac{3}{98}\right)$
 C) $\left(\frac{98}{3}, \frac{2}{98}\right)$ D) $\left(\frac{98}{2}, \frac{3}{97}\right)$

77) The likelihood ratio test statistic for testing $H_0: \sigma^2 = \sigma_0^2$ against $H_1: \sigma^2 \neq \sigma_0^2$ based on a sample of size n from normal population N (2, σ^2) leads to _____.

- A) χ_n^2 distribution B) χ_{n-1}^2 distribution
 C) t_{n-1} distribution D) t_{2n-1} distribution

78) For small sample Sign Test, Test statistics will follow _____.

- A) Normal Distribution B) t-Distribution
 C) Binomial Distribution D) Chi-Square Distribution

79) Wilcoxon’s Signed Rank Test is used to test _____?

- A) Mean B) Median
 C) Mode D) None of the above

80) Which of the following Non-parametric test utilizes the empirical distribution function?

- A) Median test B) Wilcoxon’s signed rank test
 C) Wald-Wolfowitz run test D) Kolmogorov -Smirnov test

81) Consider the statements :

Statement I : In SRSWOR, sample mean is unbiased estimator of population mean.

Statement II : In SRSWOR, S. E. $(\hat{Y}) = \sqrt{\frac{N-n}{Nn}} S$

Which of the following is true?

- A) Only Statement - I
- B) Only Statement - II
- C) Both Statement I and II are true
- D) Neither statement I nor statement II

82) In SRSWR, which of the following is not true?

- A) Total number of possible samples is N^n
- B) Units in the sample are independent
- C) Any unit in the population has the same chance of being selected at any draw
- D) Sample mean square is unbiased estimator for population mean square

83) In SRSWOR (N=5, n=2), which of the following is not true?

- A) Probability that unit 1 selected at 2nd draw is 1/5.
- B) Probability that unit 1 selected at 2nd draw is 1/4.
- C) Probability that unit 1 selected at 2nd draw given that unit 2 selected at first draw is 1/4.
- D) Probability that sample {1,2} selected is 1/10.

84) Consider the following statements

Statement I: In SRSWOR, sampling error is directly proportional to sample size.

Statement II: In SRSWOR(N, n), confidence interval for sample mean is

$$(\bar{y} \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{(1-f)}{Nn}} S^2)$$

Then which of the following is true?

- A) Both Statement I and II are true
- B) Neither statement I nor statement II
- C) Only Statement - II
- D) Only Statement - I

85) Let {25, 15, 23, 34, 12, 20, 37, 48, 36, 42, 18, 60} be the population. Which of the following is not a systematic sample of size 4?

- A) 25,34,37,42
- B) 15,12,48,18
- C) 23,20,36,60
- D) 42,25,12,37

86) Which of the following is true?

- A) In stratified random sampling $V(\hat{Y}) = \sum_{i=1}^k \left(\frac{N_i - n_i}{N_i n_i} \right) N_i^2 S_i^2$
- B) In Stratified sampling with proportional allocation $n_i \propto 1/N_i$
- C) In stratified random sampling with equal allocation $n_i \propto N_i$
- D) In stratified random sampling with Neyman allocation $n_i \propto \frac{1}{N_i S_i}$

- 87)** What is true about two stage sampling method?
- A) In stage I sample is drawn from auxiliary variable and in stage II true sample about study variable is drawn.
 - B) In stage I population is divided into clusters and some clusters are drawn randomly, and in stage II from each of the selected cluster, a sample of the specified number of elements is selected.
 - C) In cluster sampling population is divided into N clusters with equal cluster size and n clusters are selected randomly.
 - D) Cluster sampling is always superior to stratified sampling.
- 88)** Ratio method of estimation is useful _____.
- A) When there exists auxiliary information on sampling units and relation between the study variable and auxiliary variable is linear.
 - B) When there exists auxiliary information on sampling units and relation between the study variable and auxiliary variable is quadratic.
 - C) In all situations
 - D) When there exists auxiliary information on sampling units and relation between the study variable and auxiliary variable is exponential.
- 89)** Which of the following is true?
- A) As sample size increases, sampling error increases
 - B) As sample size increases non sampling errors decrease
 - C) Sample size does not affect sampling as well as non sampling errors.
 - D) As sample size increases, sampling error decreases.
- 90)** Which of the following is not random sampling?
- A) Quota sampling
 - B) Two phase sampling
 - C) Stratified sampling
 - D) Cluster sampling

Rough Work

Rough Work