ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

Ph.D (STATISTICS)

COURSE CODE : 149

Register Number : [ ]

Signature of the Invigilator
(with date)

COURSE CODE : 149

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. Which of the following statements is true of Multivariate Analysis of Variance?

(A) allows us to have one dependent variable and one independent variables.

(B) allows us to have two or more dependent variables and up to two independent variables.

(C) allows us to have two or more dependent variables and one or more independent variables.

(D) allows us to have one dependent variable and two or more independent variables.

2. Which F-value is typically reported in a Multivariate Analysis of Variance?

(A) Wilks' lambda (B) Hotelling's trace.

(C) Pillai's trace (D) Roy's largest root.

3. Which one of these might you consider a violation in Multivariate Analysis of Variance and may be worth looking at alternative analyses?

(A) Box's M has an associated p-value of < 0.05 and you have unequal sample sizes.

(B) You have equal numbers of participants and it is a large sample size

(C) You have normally distributed dependent variables and all linear combinations of the dependent variables

(D) You have 30 participants per group in your between-participants design

4. An empirically based hypothetical variable consisting of items which are strongly associated with each other and upon which individuals differ is known as

(A) Rotating (B) A factor loading

(C) Factor analysis (D) A factor

5. Rotation usually involves _____ high correlations and _____ low ones.

(A) maximising; minimizing (B) minimising; maximizing

(C) plotting; omitting (D) retaining; omitting

6. Minimal sufficient statistic provide

(A) minimum possible reduction in data

(B) minimum information about data

(C) maximum possible reduction in data

(D) maximum information about data

7. Let $X_1, X_2, \ldots, X_n$ be a random sample of observations from a population with mean θ and finite variance. For estimating θ, the statistic $T_n = \frac{2\sum_{i=1}^{n} iX_i}{n(n+1)}$ is

(A) Biased and consistent

(B) Unbiased but not consistent

(C) Unbiased and consistent

(D) Biased and not consistent

8. Let $X_1, X_2, \ldots, X_n$ be iid observations from $U(-\theta, \theta)$, $\theta > 0$. The MLE of θ is

(A) $X_{(n)}$ (B) $X_{(1)}$

(C) $X_{(1)}+X_{(n)}$ (D) $X_{(n)}-X_{(1)}$

9. Consider the family of densities $\{f(x;\theta), \theta > 0\}$ where $f(x;\theta) = (\theta+1)x^{\theta}$, $0 < x < 1$. Based on a random sample of 'n' observations, the above family has MLR through

(A) $X_{(1)}$ (B) $X_{(n)}$

(C) $\prod_{i=1}^{n} X_i$ (D) $\sum_{i=1}^{n} X_i$

10. Which of the following statements is true in the case of locally most powerful tests?
(i) It is used for testing two sided alternatives.
(ii) It attains maximum power in the neighborhood of (simple) null hypothesis.

(A) (i) is true but not (ii) (B) (ii) is true but not (i)

(C) Both (i) and (ii) are false (D) Both (i) and (ii) are true.

11. For regular family, if $l(x)$ is the likelihood ratio for testing $H: \theta = \theta_0$ Vs $K: \theta \neq \theta_0$ where θ is a $k \times 1$ vector, then the asymptotic distribution of $-2ln(x)$ is

(A) Chi-square distribution with 'n-k' degrees of freedom where 'n' is the sample size

(B) Chi-square distribution with 'n' degrees of freedom where 'n' is the sample size

(C) Chi-square distribution with 'k' degrees of freedom

(D) Chi-square distribution with 'n+k' degrees of freedom where 'n' is the sample size

12. Empirical distribution function is

(A) Biased and inconsistent estimator of cumulative distribution function

(B) Unbiased and inconsistent estimator of cumulative distribution function

(C) Unbiased and consistent estimator of cumulative distribution function

(D) Biased and consistent estimator of cumulative distribution function

13. A design is said to be orthogonal if

(A) Treatment contrasts are correlated with block contrast

(B) Treatment contrasts are uncorrelated

(C) Block contrasts are correlated

(D) Treatment contrasts are uncorrelated with block contrast

14. Consistency in statistical inference refers to

(A) Small sample property

(B) Large sample property

(C) Property of the underlying family of distributions

(D) All the above

15. In a 3^3 factorial with factors A, B and C each at 3 levels, the interaction A^2BC^2 is same as the interaction

(A) ABC (B) AB^2C

(C) AB^2C^2 (D) A^2BC

16. If a researcher forms a 1/2 replicate in a factorial design with treatment combinations a, b, c, abc, the interaction which cannot be estimated is

(A) AB (B) ABC

(C) AC (D) BC

17. If a symmetrical Balanced Incomplete Block Design (BIBD) has the following parameter values $v = b = 13,\ k = r = 4,\ \lambda = 1$ then the efficiency factor of the design is

(A) 16/13 (B) 1/13

(C) 12/13 (D) 13/16

18. The tangent of the angle between two regression lines is given as 0.6 and the standard deviation of Y is known to be twice of that of X. Then the value of correlation coefficient between X and Y is

(A) 0.5 (B) -0.5 (C) 0.7 (D) 0.2

19. With the usual notations, the linear model $Y = A\theta + \epsilon$, where $E(\epsilon) = 0,\ Cov(\epsilon) = \sigma^2 I_n$ the number of linearly independent estimable parametric functions is

(A) Rank of A (B) Number of rows of A

(C) Number of columns of A (D) Rank of A +1

20. Consider a linear model $Y = X\theta + \epsilon$, $E(\epsilon) = 0$, $Cov(\epsilon) = \sigma^2 I_n$. The Hat matrix (H) is

(A) $(X^TX)^{-1}X^T$ (B) $X(X^TX)^{-1}X^T$

(C) $X^T(X^TX)^{-1}$ (D) $X(X^TX)^{-1}$

21. Consider a full rank linear model $Y = X\beta + \epsilon$, with $E(\epsilon) = 0$, $Cov(\epsilon) = \sigma^2 I_n$ and $\hat{\beta} = (X^TX)^{-1}X^TY$. Collinearity exists among the columns of X if

(A) X^TX is non-singular (B) X^TX is singular

(C) X^TX is idempotent (D) X^TX is symmetric

22. Which of the following test is called a multiple comparison test

(A) Cochran's Test (B) Bartlett's test

(C) Hartly's Test (D) Tukey's Test

23. The Chapman-Kolmogrov equation for discrete time Markov chain is

(A) $p_{ij}^{n+m} = \sum_{k=0}^{\infty} p_{ik}^n p_{kj}^m$ for all $n,m \geq 0$

(B) $p_{ij}^{n+m} = \sum_{k=0}^{\infty} p_{ik}^n p_{kj}^m$ for all $n,m \geq 0$ *and all* i,j

(C) $p_{ij}^{n+m} = \sum_{k=0}^{n+m} p_{ik}^n p_{kj}^m$ for all $n,m \geq 0$

(D) $p_{ij}^{n+m} = \sum_{k=0}^{m} p_{ik}^n p_{kj}^m$ for all $n,m \geq 0$

24. The inverse of the covariance matrix $\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix}$

(A) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22} - \sigma_{12}^2} \begin{bmatrix} \sigma_{22} & -\sigma_{12} \\ -\sigma_{21} & \sigma_{11} \end{bmatrix}$ (B) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22}} \begin{bmatrix} \sigma_{22} & -\sigma_{12} \\ \sigma_{21} & \sigma_{11} \end{bmatrix}$

(C) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22} - \sigma_{12}^2} \begin{bmatrix} \sigma_{11} & -\sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix}$ (D) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22} - \sigma_{12}^2} \begin{bmatrix} \sigma_{22} & \sigma_{12} \\ -\sigma_{21} & \sigma_{11} \end{bmatrix}$

25. In the case of one dimensional random walk on the positive and negative integers, the state represented by zero is

(A) transient (B) recurrent

(C) non null recurrent (D) null recurrent

26. If Σ is positive definite, so that Σ^{-1} exists, then $\Sigma e = \lambda e$ implies $\Sigma^{-1} e = ?$

(A) λe (B) $(1/\lambda)e$ (C) λ (D) $(1/\lambda)$

27. The Poisson process is

(A) Markov process

(B) Evolutionary process

(C) Process with stationary independent increments

(D) All the above

28. If $\{N(t); t \geq 0\}$is a Poisson process with rate λ, then for s<t, P[N(s)=k | N(t)=n] follows

(A) Binomial (n,p=s/t)

(B) Binomial (n,p=t/s)

(C) Binomial (n,p=st)

(D) Geometric distribution with p=st

29. If $X \sim N(\mu, \Sigma)$, then the linear combination of $C^TX = C_1 X_1 + C_2 X_2 + C_3 X_3 + ... + C_p X_p$ has mean = _____ and variance = _____

(A) $C^T\mu$ and $C^T\Sigma C$ (B) $C\mu$ and $C^T\Sigma C$

(C) $C\mu$ and $\Sigma|C|$ (D) $|C|\,\mu$ and $C^T\Sigma C$

30. Consider a process {X(t); T ∈ 0} whose probability distribution is given by

$$P[X(t) = n] = \frac{(at)^{n-1}}{(1+at)^{n+1}}; n = 1,2,...$$

$$= \frac{at}{1+at}; n = 0$$

Then the mean E[X(t)] is equal to

(A) 2 (B) 1 (C) at (D) a^2t^2

31. The characteristic equation of the matrix $\begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$ is

(A) $\lambda^2 + 3\lambda + 2 = 0$ (B) $\lambda^2 - 3\lambda - 2 = 0$

(C) $\lambda^2 - 3\lambda + 2 = 0$ (D) $\lambda^2 + 3\lambda - 2 = 0$

32. The process capability index Cp is used to measure

(A) The quality of the product (B) The suitability of the process

(C) The acceptance level of the product (D) The rejection level of the product

33. A research report concludes that there are significant differences among treatments, with "F(2,27) = 8.62, p < 0.01." How many treatment conditions were compared in this study?

(A) 2 (B) 3 (C) 29 (D) 30

34. In a RBD the treatments are tested with the F ratio with df (4, 20). The total number of observations considered in this design is

(A) 24 (B) 29 (C) 30 (D) 32

35. You are producing decaffeinated coffee using supercritical carbon dioxide as a solvent. To optimize the effectiveness of caffeine removal, you would like to test 2 different possible pressures of CO2, 3 possible temperatures, 3 ratios of CO2 to coffee beans, 3 residence times of supercritical CO2 with beans, and 2 different procedures for pre-roasting the beans prior to caffeine extraction. What is the most appropriate method to design your optimization experiments?

(A) Factorial design (B) Taguchi methods

(C) Randomized block design (D) Latin square design

36. Which of the following is inconsistent with the Taguchi philosophy of quality control?

(A) Variation is the opposite of quality

(B) Interactions between parameters affecting product quality are unimportant and should never be considered

(C) Customer dissatisfaction is the most important measure for process variation, and should be minimized

(D) A high signal to noise ratio (SN) should be present in a process to make it robust against uncontrollable factors that would cause variation

37. In a two variable linear model $Y_i = \alpha + \beta X_i + u_i \ \ (i = 1, 2, ..., n)$, the OLS estimator of β is $\sum_{i=1}^{n} w_i Y_i$, where w_i is equal to

(A) $\frac{X_i - \bar{X}}{\sum Y_i^2}$ (B) $\frac{X_i - \bar{X}}{\sum (X_i - \bar{X})^2}$ (C) $\frac{\bar{Y}}{\sum Y_i^2}$ (D) $\frac{\bar{X}}{\sum (X_i - \bar{X})^2}$

38. In the general linear model $Y = X\beta + U$, the unbiased estimator of the variance of the disturbance term $e = Y - X\hat{\beta}$ is

(A) $\frac{ee'}{n-k}$ (B) $\frac{e'e}{n-k}$ (C) $\frac{e'e}{n}$ (D) $\frac{ee'}{k}$

39. If a qualitative variable has 'm' categories, introduce only _____dummy variables.

(A) m (B) m−1 (C) m+1 (D) m−2

40. Adequate basis for family planning is provided by :

(A) general fertility rate (B) age specific marital fertility rate

(C) total marital fertility rate (D) total fertility rate

41. Lexis diagram is a way of measuring the following:

(A) Population growth (B) Nuptiality

(C) Migration (D) Mortality

42. In stratified random sampling $V(\bar{y}_{st})$ is minimized for a fixed total size of sample if

(A) $n_h = \frac{nN_h S_h}{\sum N_h S_h}$ (B) $n_h = n\frac{N_h}{N}$

(C) $n_h = \frac{nN_h S_h}{N \sum S_h}$ (D) $n_h = n\frac{\sum N_h S_h}{N_h S_h}$

43. If from a finite population of size N, the first unit in the sample is selected with probabilities $p_i (i = 1,2, \ldots \ldots, N_1); \sum p_i = 1$, and the remaining (n-1) units with equal probabilities without replacement, the probability of selecting a particular sample S is given by

(A) $\sum p_i / \binom{N+1}{n+1}$ (B) $\sum p_i / \binom{N-2}{n-2}$

(C) $\sum p_i / \binom{N-1}{n-1}$ (D) $\sum p_i / \binom{N}{n}$

44. SRS with the appropriate formula for $V(\bar{y}_r)$ is, where $\rho = S_{xy}/S_y S_x$ is the population correlation between y and x.

(A) $\frac{(1-f)}{n} S_y^2 (1+\rho^2)$ (B) $\frac{(1-f)}{n} S_y^2 (\rho^2 - 1)$

(C) $\frac{(1-f)}{n} S_y^2 (1-\rho^2)$ (D) $\frac{(1-f)}{n} (1+\rho^2)$

45. Two stage sampling is due to

(A) Cochran (B) Fisher (C) Midzuno (D) Mahalanobis

46. A simple random sample of size n is drawn from a finite population of N units, with replacement. The probability that the i^{th} $(1 \leq i \leq N)$ unit is included in the sample is

(A) n/N (B) $1 - \left(1 - \frac{1}{N}\right)^n$ (C) $\left(\frac{N-1}{N}\right)^n$ (D) $\frac{n(n-1)}{N(N-1)}$

47. When a sampling frame has a systematic pattern in the listing of sampling units, rather than a random pattern,

(A) systematic sample must be drawn (B) the problem of periodicity exists.

(C) a random error occurs (D) a cluster sample must be used.

48. If a researcher wishing to draw a sample from sequentially numbered invoices uses a random starting point draws every 50th invoice, the sample drawn is a _____ sample.

(A) simple random (B) sequential

(C) stratified (D) systematic

49. If

$$M = \begin{pmatrix} 3 & 4 & 0 & 0 & 0 \\ 2 & 5 & 0 & 0 & 0 \\ 0 & 9 & 2 & 0 & 0 \\ 0 & 5 & 0 & 6 & 7 \\ 0 & 0 & 4 & 3 & 4 \end{pmatrix}$$

then $|M|$ is

(A) 42 (B) 40 (C) 60 (D) 64

50. The conjugate of matrix $\begin{bmatrix} 1-i & 2 \\ i & 1+i \end{bmatrix}$ is

(A) $\begin{bmatrix} 1-i & 2 \\ 1+i & i \end{bmatrix}$ (B) $\begin{bmatrix} 1+i & 2 \\ -i & 1-i \end{bmatrix}$

(C) $\begin{bmatrix} 2 & 1-i \\ 1+i & i \end{bmatrix}$ (D) None

51. If $A = \begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$, find the eigen values of A^T

(A) Eigen values of A^T are 2, 2, -3 (B) Eigen values of A^T are -2, 2, -3

(C) Eigen values of A^T are 2, 2, 3 (D) Eigen values of A^T are 2, -2, -3

52. If $\lambda_1, \lambda_2 .... \lambda_n$ are eigen values of matrix A, then trace of A is

(A) $\lambda_1, \lambda_2, ... \lambda_n$ (B) $\lambda_1 + \lambda_2 + ... \lambda_n$

(C) $1/(\lambda_1 + \lambda_2 + ... + \lambda_n)$ (D) $1/(\lambda_1 \lambda_2 ..... \lambda_n)$

53. If $\begin{bmatrix} 2x & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} x \\ 3 \end{bmatrix} = 0$ find x?

(A) $x = 1$ or $x = -3/2$ (B) $x = 0$ or $x = -3/2$

(C) $x = -1$ or $x = -2/3$ (D) $x = 1$ or $x = -2/3$

54. The determinant of the matrix $\Delta = \begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix}$

(A) $2abc\,(a+b+c)^2$ (B) $abc\,(a+b+c)^3$ (C) $2ab^2c^3$ (D) $(a+b+c)^3$

55. The matrix $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ is

(A) Singular
(B) Orthogonal
(C) Skew Symmetric
(D) negative semi definite

56. For the subgroups of size n, the upper and lower control limits for rejection of a lot are termed as

(A) Modified control limits
(B) Natural control limits
(C) Specified control limits
(D) Tolerance control limits

57. Let A and B be the stopping bounds for SPRT with strength (α, β). Then A and B satisfies the following relations:

(A) $A \leq \frac{(1-\beta)}{\alpha}$; $B \geq \frac{\beta}{1-\alpha}$
(B) $A \geq \frac{(1-\beta)}{\alpha}$; $B \leq \frac{\beta}{1-\alpha}$
(C) $A \leq \frac{\alpha}{1-\beta}$; $B \geq \frac{1-\alpha}{\beta}$
(D) $A \geq \frac{(1-\alpha)}{\beta}$; $B \leq \frac{\beta}{1-\alpha}$

58. Operating Characteristic curve reveals the ability of the sampling plan to distinguish between

(A) Good & bad lots
(B) Good & bad sampling plans
(C) Good & bad product
(D) All the above

59. The wizard used to create tabulation reports in MS-Excel is

(A) Cross Tabulation Wizard
(B) Pivot Table Wizard
(C) Function Wizard
(D) Conditional Formatting

60. Which of the following is not true

(A) A straight line with finite length is a convex set and simplex
(B) A triangle is a convex set and simplex
(C) A square is a simplex but not convex set
(D) A cube is convex set but not simplex

61. If an LPP is having 'm' constraints and 'n' decision variables, where all the constraints are $\leq$ type with RHS is non-negative. Then in Initial basic feasible simplex tables, the number of slack variables, Surplus variables and Artificial variables respectively are equal to

(A) 'n-m' , 'm' and 'n'
(B) 'm', '0' and 'n'
(C) '0', 'm' and 'n'
(D) 'm', '0' and '0'

62. The 0-1 integer programming problem

(A) Requires that the decision variables have coefficients between o and 1

(B) Requires that all the constraints have coefficients between 0 and 1

(C) Requires the decision variables to have the values either zero or one

(D) All the above are true

63. For unbalanced transportation problems

(A) Number of origins are not equal to number of destinations

(B) Number of basic cells are more than the number of destinations

(C) Number of basic cells are more than the number of origins

(D) Total availability is not equal to total requirement

64. Dynamic programming problems deals with

(A) Single -stage decision making problems

(B) Multi stage decision making problems

(C) Time independent decision making problems

(D) Stage dependent decision making problems

65. Which of the following is not an assumption underlying with the fundamental problem of Economic order quantity

(A) Demand is Known and Uniform

(B) Lead time is not zero

(C) Holding cost per unit per time period is constant

(D) Shortage costs are not permitted

66. The cost of providing service in queue system decreases with

(A) Decreased arrival rate

(B) Increased arrival rate

(C) Decreased average waiting time in the queue

(D) Decreased number of servers in the system

67. Which of the following Operational research problem cannot be expressed as a network flow chart problem

(A) Queuing problem

(B) Assignment or allocation problem

(C) Transportation and Transshipment problems

(D) Sequencing problem

68. The following activity in network diagram is usually denoted with dotted lines

(A) Predecessor Activity (B) Successor activity

(C) Dummy activity (D) Dangling activity

69. The GNLPP with the constraints of inequality type can be solved with

(A) Branch and bound techniques (B) Agglomeration methods

(C) Lagrange's Method (D) Kuhn-Tucker conditions

70. Consider a two-factor fixed effects model without interaction. Let A and B the factors with a and b level respectively. Then MS_A becomes unbiased for σ^2, if

(A) $\frac{a}{b-1}\sum_{i=1}^{n}\alpha_i^2 = 0$ (B) $\frac{b}{a-1}\sum_{i=1}^{n}\alpha_i^2 = 0$

(C) $\frac{b}{a(n-1)}\sum_{i=1}^{n}\alpha_i^2 = 0$ (D) $\frac{a}{b(n-1}\sum_{i=1}^{n}\alpha_i^2 = 0$

71. Let $\{X_n; n = 0,1,2 \ldots \ldots\}$ be a branching process with offspring mean m<1. Then $E[\sum_{n=1}^{\infty} X_n]$ is equal to

(A) $m/(1-m)$ (B) $2/(1-m)$ (C) $3/(1-m)$ (D) 2m

72. Consider a Markov chain with TPM $\begin{bmatrix} 3/4 & 1/4 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1/4 & 3/4 \end{bmatrix}$ then $P[X_2 = 3, X_1 = 2, X_0 = 1]$ is equal to

(A) 1/12 (B) 7/12 (C) 1/24 (D) 5/24

73. In one-way ANOVA, assuming a-levels and n observations on each factor level, the distribution of the random variable SSE/σ^2 is

(A) $\chi^2(a(n-1))$ (B) $\chi^2(a-1)$ (C) $\chi^2(n(a-1))$ (D) $\chi^2(n-1)^2$

74. The rank of the matrix $A = \begin{bmatrix} 1 & 2 & -3 & -2 \\ 1 & 3 & -2 & 0 \\ 3 & 8 & -7 & -2 \\ 2 & 1 & -9 & -10 \end{bmatrix}$ is

(A) 4 (B) 2 (C) 3 (D) 1

75. If R^2 is the coefficient of determination of the general linear model, then the adjusted R^2 is given by

(A) $1-\frac{n-1}{n-k}\left(1-R^2\right)$ (B) $1-\frac{n}{n-k}\left(1-R^2\right)$

(C) $1-\frac{n-1}{k}\left(1-R^2\right)$ (D) $1-\frac{n}{k}\left(1-R^2\right)$

76. The following is a Balanced Incomplete Block Design (BIBD) with parameters $v = 4,\ b = 4,\ k = r = 3,\ \lambda = 2$.

BLOCK I	1	3	4
BLOCK II	2	3	4
BLOCK III	1	2	4
BLOCK IV	?	?	?

The treatments in Block IV are

(A) 1 4 2 (B) 2 4 3

(C) 2 3 1 (D) 4 1 3

77. Moment Generating Function (M.G.F) of χ_n^2 is

(A) $(1-2t)^{-1/2}$ (B) $(1-2t)^{1/2}$ (C) $(1-2t)^{n/2}$ (D) $(1-2t)^{-n/2}$

78. Let X ~ Weibull (α, μ). If $\alpha = 1,\ \mu = 0$ then the distribution of X is

(A) Lognormal (B) Cauchy (C) Gamma (D) Exponential

79. Excel function VARP is used to calculate:

(A) Variance of the population (B) Variance of the percentage

(C) Variance of the proportions (D) Pooled variance

80. In SPSS, where would you find the option for conducting a Kruskal-Wallis test?

(A) General linear model- non-parametric tests

(B) Non-parametric tests - independent samples

(C) Non-parametric tests- K independent samples

(D) Non-parametric tests - sample KW

81. For any particular x, CHIDIST(x, df) returns the value of _____

(A) Random variable x (B) the probability

(C) inverse function of CHIDIST ( ) (D) the function CHITEST ( )

82. When the between-groups variance is a much larger than the within-groups variance, the F-value is _____ and the likelihood of such a result occurring by sampling error ____

(A) Small; decreases
(B) large; decreases
(C) small; increases
(D) large; increases

83. The statistical function used to compute the one tail p-value associated with Z – test is

(A) 1-normsdist(abs(Z))
(B) 2*(1-normsdist(abs(Z))
(C) 2*(1-normdist(abs(Z)))
(D) 1-normdist(abs(Z))

84. Which initial steps would you follow in order to start to perform a one-way unrelated ANOVA in SPSS?

(A) Save datafile → compare means → analyse → one-way ANOVA
(B) Analyse → compare means → one-way ANOVA
(C) Save datafile → analyse → compare means → one-way ANOVA
(D) Save datafile → one-way ANOVA → analyse → compare means.

85. What is the nature of the relationship between the *p*-value and sample size?

(A) A larger sample size is more likely to yield a non significant result even when the effect is large
(B) A larger sample size is more likely to yield a significant result even when the effect is small
(C) A smaller sample size is more likely to yield a significant result when the effect is small
(D) There is no relationship, this is a trick question

86. Let $\{X_i\}$ denote the occurrence times of a renewal process $\{N(t);\ t \geq 0\}$ with $E(X_i) = \mu < \infty$, then according to elementary renewal theorem

(A) $\lim_{t \to 0} \frac{M(t)}{t} \to \mu$
(B) $\lim_{t \to \infty} \frac{M(t)}{t} \to \frac{1}{\mu}$
(C) $\lim_{t \to \infty} \frac{t}{M(t)} \to \mu$
(D) $\lim_{t \to \infty} \frac{t}{M(t)} \to \frac{1}{\mu}$

87. The renewal process M(t) is

(A) Random function
(B) Sure Function
(C) Sure function with $M(t) < \infty$ for all $0 \leq t < \infty$
(D) Non-decreasing and right continuous

88. The stopping time for the renewal process $\{N(t), t \geq 0\}$ with inter occurrence times X_i is

(A) N(t) – 1 (B) N(t) (C) N(t) +1 (D) 1 / N(t)

89. The number of decision variables in the objective function of the transportation cost matrix, which consists of 'm' origins and 'n' destinations are equal to

(A) m-n (B) mn (C) m+n (D) m/n

90. If the independent random variables X~ B(3, $\frac{1}{3}$) and Y~ B(5, $\frac{1}{3}$), then $P[X+Y \geq 1]$ is equal to

(A) $\left(\frac{2}{3}\right)^8$ (B) $1-\left(\frac{2}{3}\right)^8$ (C) $1+\left(\frac{2}{3}\right)^8$ (D) 1

91. Ratio of two independent standard normal variates is

(A) Binomial variate (B) Poisson variate

(C) Normal variate (D) Standard Cauchy variate

92. Let X be a continuous random variable with pdf

$$f(x) = \begin{cases} kx, & 0 \leq x < 1 \\ k, & 1 \leq x < 2 \\ -kx + 3k, & 2 \leq x < 3 \end{cases}$$

The value of k is

(A) 1 (B) 1/2 (C) 0 (D) 3/2

93. A continuous random variable X has pdf $f(x) = 3x^2, 0 \leq x \leq 1$. The value of b such that P[X > b] = 0.05 is

(A) $\left(\frac{19}{20}\right)^{\frac{1}{2}}$ (B) $\left(\frac{19}{20}\right)^{\frac{1}{3}}$ (C) $\left(\frac{19}{20}\right)^{\frac{1}{4}}$ (D) 0

94. The cdf of the smallest order statistic $X_{(1)}$ is

(A) $1-[1-F(x)]^n$ (B) $[1-F(x)]^n$

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

95. If X~N(μ,σ^2), then pdf of U=$\frac{1}{2}(\frac{X-\mu}{\sigma})^2$ follows gamma distribution with parameter

(A) ½ (B) 2 (C) 1 (D) 0

96. Neyman Pearson lemma can be used when

(A) Both the null and alternate hypothesis are composite

(B) Null hypothesis is simple and alternate is composite

(C) Both the null and alternate hypothesis are simple

(D) Null hypothesis is composite and alternate is simple

97. For large samples, under the null hypothesis, the distribution of the likelihood ratio statistic is

(A) Standard normal (B) Chi square

(C) Student-t (D) Uniform

98. Let X~ N (μ,σ^2). Suppose both μ and σ are unknown. Then which one of the following statement is incorrect.

(A) H: $\mu \leq \mu_0$, $\sigma^2 > 0$ (μ_0 is known constant) is a composite hypothesis

(B) H: $\mu > \mu_0$, $\sigma^2 > 0$ (μ_0 is known constant) is a composite hypothesis

(C) H: $\mu = \mu_0$, $\sigma^2 > 0$ is a composite hypothesis

(D) H: $\mu = \mu_0$, $\sigma^2 = 0$ is a composite hypothesis

99. The family of parametric distributions, for which the mean and variance does not exist is,

(A) Polya's Distribution (B) Cauchy Distribution

(C) Negative Binomial distribution (D) Pareto distribution

100. The components of variance of a variable in orthogonal factor model are

(A) Communality; dispersion matrix

(B) Communality and Specific variance

(C) Communality and correlation matrix

(D) Specific variance and dispersion matrix
