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Question Booklet No. 600016	Question Booklet Series : **D**

AUAT — 2022

2-Year M.Sc. in Statistics (P14)

(TEST BASED ON MCQ)

Full Marks : 100	Duration : 2 Hours

Roll No. of the Candidate : [redacted]

Date of Examination : 23/07/2022

Name of Examination Centre : Aliah University

Signature of the Candidate : [redacted]

23/7/22

Signature of the Invigilator on Verification

IMPORTANT INSTRUCTIONS

Candidates should read the below instructions carefully and follow them accordingly.

1. The Question Booklet has paper seal pasted on it. Please do **NOT** open the Question Booklet until you are asked to do so by the Invigilator.
2. The Candidates must check immediately after breaking the seal that the Question Booklet contains **100 Multiple Choice Questions** in two parts (Part—I and Part—II).
3. Answer of questions of Part—I and Part—II both will have to be given on the **OMR Answer Sheet** provided for this purpose. Fill up the necessary fields that are intended for you by writing and/or shading appropriately. Otherwise the **OMR Answer Sheet *cannot*** be evaluated and will liable to be rejected. Question numbers progress from **1** to **100** continuously with alternative answers being shown as [A], [B], [C] and [D] for each question. Record your response by completely darkening the corresponding bubble. While responding, you should consider the best alternative answer and shade only one bubble with **black/blue ball point pen only**. For each correct response you will be awarded **1** mark. There will be negative marking for wrong responses. For each wrong response, **–0·25** mark will be awarded. Multiple responses against one **MCQ** will be treated as a wrong response.
4. On leaving the examination hall, candidates must submit the OMR Answer Sheet. They are allowed to keep the Question Booklet with them.
5. **OMR Answer Sheet** will be processed by electronic means. Any untoward/irrelevant remarks, folding or putting stray notes on the answer sheet, any damage to the answer sheet will lead to the rejection of the same and the sole liability shall remain with the candidate.
6. Rough Work may be done at the end of the Question Booklet.
7. No Candidate will be allowed to leave the examination hall before 60 minutes of the commencement of examination. Candidates leaving the examination hall before conclusions of the examination will not be allowed to take the Question Booklet with them while going outside the examination hall.
8. Use of any Electronic device like Mobile, Programmable Calculator etc. is strictly prohibited.

SEAL

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(PART—I : Core Subject)

1. Which one of these statistics is unaffected by outliers?

[A] Mean

[B] Interquartile range

[C] Standard deviation

[D] Range

2. If a square matrix of order 10 has exactly 5 distinct eigenvalues, then the degree of the minimal polynomial is

[A] at most 5

[B] at least 5

[C] exactly 5

[D] exactly 10

3. Suppose $X \sim$ Binomial $(2m, 1/2)$, then which of the following is ***not*** true?

[A] Mean = m

[B] Median = m

[C] Mode = $2m$

[D] Mode = m

4. Adjusted R squared is used to

[A] reduce homoscedasticity from a model

[B] delete outliers from a model

[C] select significant variable/ variables from a model

[D] None of the above

5. The 'expected counts' in a chi-square test involves a set of counts means

[A] the hypothetical counts that would occur of the alternative hypothesis were true

[B] the hypothetical counts that would occur if the null hypothesis were true

[C] the actual counts that did occur in the observed data

[D] the long-run counts that would be expected if the observed counts are representative

6. Pearson's correlation coefficient measures

[A] cubic relationship between two variables

[B] linear relationship between two variables

[C] curvilinear relationship between two variables

[D] None of the above

7. A random variable X has an exponential distribution with probability distribution function is given by

$$f(x) = 3e^{-3x}, \text{ for } x > 0$$
$$= 0, \text{ otherwise}$$

Find the probability that X is not less than 2.

[A] e^{-6}

[B] $e^{-3} - 3$

[C] e^{-3}

[D] $1 - e^{-6}$

8. Suppose the probability of injury on each individual parachute jump is 0·05. Then the greatest lower bound for probability of landing safely on both of two jumps is

[A] 0·09

[B] 0·1

[C] 0·9

[D] 0·01

9. Rank of the given matrix is

$$\begin{pmatrix} 1 & 4 & 8 & 7 \\ 0 & 0 & 3 & 0 \\ 4 & 3 & 2 & 1 \\ 3 & 12 & 24 & 2 \end{pmatrix}$$

[A] 1

[B] 4

[C] 2

[D] 3

10. Among the following, choose the most suitable test that can be applied to examine the influence of one factor on different (more than one) groups.

[A] Z-test

[B] t-test

[C] F-test

[D] None of the above

11. When A and B play tennis, the odds that A wins are 2 to 1. Suppose A and B play 2 matches. What is the probability that A wins at least 1 match?

[A] 1/9

[B] 3/8

[C] 1

[D] 8/9

12. Suppose we are dividing 6 bananas, 4 apples, 3 oranges and 2 pears amongst 5 people. What is the probability of everybody getting at least 1 banana?

[A] 1/42

[B] 1/21

[C] 1/3

[D] 1/45

13. Suppose X_1, X_2, X_3, X_4, X_5 be 5 independent random variables with $f(x) = 2x$, $0 < x < 1$. Let $X(1)$, $X(2)$, $X(3)$, $X(4)$ and $X(5)$ be the corresponding order statistics. Then $P(X(4) < 1)$ is

[A] 0·0245

[B] 0·0156

[C] 0·0378

[D] 0·0498

14. The area under a standard normal density curve is

[A] 0

[B] 1

[C] ∞

[D] 0·9976

15. Neyman-Pearson lemma provides always

[A] an unbiased test

[B] a minimax test

[C] the most powerful test

[D] None of the above

16. Goodman and Kruskal's Gamma measure is used to find the association between

[A] two nominal attributes

[B] one ordinal attribute and one nominal attribute

[C] two ordinal attributes

[D] None of the above

17. In Indore, it is observed that the probability of selecting a smoker or a male is 7/10. Also it is found that the probability of finding a male smoker is 2/5 and a male, if a smoker is already selected is 2/3. The probability of selecting a non-smoker, if a male is first selected, is

[A] 1/5

[B] 2/5

[C] 3/5

[D] 4/5

18. If the dependent variable increases as the independent variable increases in an estimating equation, the correlation coefficient will be in the range

[A] −1 to 0

[B] 0 to 0

[C] 0 to 1

[D] −1 to 1

19. The number of linearly independent eigenvectors is

$$\begin{pmatrix} 1 & 1 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 5 & 5 \end{pmatrix}$$

[A] 4

[B] 3

[C] 1

[D] 2

20. Sampling error can be reduced by

[A] non-probability sampling

[B] increasing the sample size

[C] decreasing the sample size

[D] increasing the population size

21. Suppose a dice is tossed 120 times and the following results are obtained :

Number in the topmost face	1	2	3	4	5	6
Frequency	30	25	18	10	22	15

Suppose it is given that the tabular value of Chi-square is 11·7, test whether the dice is

[A] unbiased

[B] biased

[C] more information needed

[D] None of the above

22. For a negatively skewed distribution

[A] Mean > Median > Mode

[B] Mean = Median = Mode

[C] Mean < Median < Mode

[D] None of the above

23. If there is linear trend present in the population, then which of the following methods is the most efficient sampling technique?

[A] Cluster sampling

[B] Stratified sampling

[C] Systematic sampling

[D] Simple random sampling

24. The Wishart distribution is a multivariate generalization of

[A] binomial distribution

[B] log-normal distribution

[C] F-distribution

[D] chi-square distribution

25. The exponential distribution is characterized by

[A] loss of memory property

[B] new better than used property

[C] constant hazard property

[D] non-monotone hazard property

26. If the probability that a bomb dropped from a place will strike the target is 60% and if 10 bombs are dropped, find mean and variance.

[A] (4, 1·6)

[B] (4, 2·4)

[C] (0·6, 2·4)

[D] (6, 2·4)

27. If $P(A) = 3/7$, $P(B) = 9/13$ and $P(A \cap B) = 4/13$. Find $P(A \mid B)$.

[A] 4/7

[B] 4/9

[C] 5/9

[D] 2/9

28. The radius of convergence of the power series $\Sigma a_n x^n$ is R and k be a positive integer. Then the radius of convergence of the power series $\Sigma a_n x^{kn}$ is

[A] R/k

[B] R

[C] not dependent on k

[D] R^1/k

29. $M : R^4 \to R^3$, where

$$M = \begin{pmatrix} 1 & 2 & 3 & 1 \\ 1 & 3 & 5 & -2 \\ 3 & 8 & 13 & -3 \end{pmatrix}$$

Then the dimension of kernel of M is

[A] 2

[B] 1

[C] 3

[D] 4

30. Which of the following is ***true*** for a survival/reliability curve?

[A] It always remains constant with time

[B] It can change shape with time

[C] It is always non-increasing

[D] It is always non-decreasing

31. The rejection probability of Null Hypothesis when it is true, is equivalent to

[A] level of confidence

[B] level of significance

[C] level of margin

[D] level of rejection

32. The range of a regression coefficient is

[A] -1 to 0

[B] $-\infty$ to ∞

[C] 0 to 1

[D] -1 to 1

33. If a hypothesis is rejected at 0·6 level of significance, then

[A] it will be rejected at any level of significance

[B] it must be rejected at 0·5 level of significance

[C] it may be rejected at 0·5 level of significance

[D] it cannot be rejected at 0·5 level of significance

34. The characteristic equation of a matrix A is $t^2 - t - 1 = 0$, then

[A] A^{-1} exists but cannot be determined from the data

[B] A^{-1} does not exist

[C] $A^{-1} = A - I$

[D] $A^{-1} = 2A$

35. Three companies A, B and C supply 25%, 35% and 40% of the notebooks to a school. Past experience shows that 5%, 4% and 2% of the notebooks produced by these companies are defective. If a notebook was found to be defective, what is the probability that the notebook was supplied by A?

[A] 44/69

[B] 25/69

[C] 13/24

[D] 11/24

36. Let A and B are square matrices such that $AB = I$, then zero is an eigenvalue of

[A] A but not B

[B] B but not A

[C] both A and B

[D] neither A nor B

37. For perfect correlation, both the regression lines

[A] will be perpendicular to each other

[B] will coincide

[C] make an angle of $\pi/6$

[D] make an angle of $\pi/4$

38. Education research claims that the average height (μ) of the students of 5th standard is 150 cm. Suppose you want to test whether the claim is true or not. Then the hypothesis to test is

[A] $H_0: \mu = 150$ against $H_1: \mu < 150$

[B] $H_0: \mu = 150$ against $H_1: \mu > 150$

[C] $H_0: \mu = 150$ against $H_1: \mu \neq 150$

[D] None of the above

39. Which one of the following is ***not*** only a parametric test?

[A] F-test

[B] Z-test

[C] t-test

[D] Chi-square test

40. Suppose for a statistical test α and β are the type I and type II errors respectively. Then the power of the test is

[A] α

[B] $1 - \alpha$

[C] $1 - \beta$

[D] β

41. The most appropriate average to be used to compute the average rate of growth in population is

[A] arithmetic mean

[B] harmonic mean

[C] geometric mean

[D] median

42. Condition for applying the Central Limit Theorem (CLT) which approximates the sampling distribution (with sample size n) of the mean with a normal distribution is

[A] $n < 30$

[B] $n > 30$

[C] $n = 15$

[D] $n > 60$

43. Suppose two dice are thrown. What is the probability that the sum is neither 7 nor 11?

[A] 5/9

[B] 7/9

[C] 1/9

[D] 2/9

44. Which of the following diagrams are used to detect the outliers?

[A] Line diagram

[B] Bar diagram

[C] Boxplot

[D] Ogive

45. When the population consists of heterogeneity, which sampling procedure is preferred?

[A] Double sampling

[B] Simple random sampling

[C] Stratified sampling

[D] Systematic sampling

46. In a city, out of the 400 persons, who are given a vaccine, 136 persons experienced some problems. The 95% confidence interval for the true proportion of persons having problems is

[A] (0·19, 0·29)

[B] (0·29, 0·39)

[C] (0·39, 0·49)

[D] (0·49, 0·59)

47. In general line, diagram is used to represent

[A] spatial series data

[B] time series data

[C] Both [A] and [B]

[D] Neither [A] nor [B]

48. Eigenvalues of a real symmetric matrix are always

[A] positive

[B] real and imaginary

[C] negative

[D] real

49. Under frequentist setup (non-Bayesian setup), a parameter is

[A] a random quantity

[B] always zero

[C] always 1

[D] a non-random quantity

50. The distribution of Hotelling's T-square is

[A] chi-square

[B] normal

[C] binomial

[D] F-test

51. A bar chart in which the area of each bar is proportional to the number of items in each group is known as

[A] pie-chart

[B] histogram

[C] frequency distribution table

[D] frequency polygon

52. A coin is tossed five times in succession. What is the probability of getting at least four heads?

[A] 1/2

[B] 1/16

[C] 3/4

[D] 3/16

53. Which of the following is ***not*** a measure of dispersion?

[A] Range

[B] Mean deviation

[C] Quartile

[D] Standard deviation

54. Criteria to check a point estimator to be good are

[A] consistency

[B] unbiasness

[C] efficiency

[D] All of the above

55. Arithmetic Mean is _____ affected by extreme values.

[A] not

[B] highly

[C] less

[D] Cannot be said anything

56. $A^2 - A = 0$, where A is a 9×9 matrix. Then A must be

[A] an identity matrix

[B] diagonalizable

[C] Rank (A) is 1 or 0

[D] a zero matrix

57. Suppose $X_i \sim$ Binomial$(1, p)$ independent for each i. The distribution of $\sum_{i=1}^{n} X_i^2$ is

[A] binomial$(1, p)$

[B] binomial(n, p)

[C] Poisson(n)

[D] Poisson(1)

58. Among the following tests which one is used for qualitative data?

[A] t-test

[B] F-test

[C] Chi-square test

[D] Z-test

59. A time series consists of

[A] short-term variation

[B] long-term variation

[C] irregular variation

[D] All of the above

60. Increase in the number of patients in a hospital due to heat stroke is due to

[A] secular trend

[B] irregular variation

[C] seasonal variation

[D] cyclical variation

61. If $X \sim N_p(\mu, \Sigma)$ and $L^{m \times p}$ has full rank $(m \leq p)$, then the distribution of LX would be

[A] $N_m(L\mu, L\Sigma L^T)$

[B] $N_m(\mu, \Sigma)$

[C] $N_p(L\mu, L\Sigma L^T)$

[D] $N_p(\mu, \Sigma)$

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62. Suppose $X \sim$ Exponential (1), then $Y = e^{-X}$ will follow

[A] binomial$(2, 0{\cdot}5)$

[B] Poisson$(0{\cdot}2)$

[C] rectangular$(0, 1)$

[D] binomial$(0, 1)$

63. Which of the following statements is correct for a positively skewed distribution?

[A] Third Quartile (Q_3) – Median < Median – Third Quartile (Q_3)

[B] Third Quartile (Q_3) – Median = Median – Third Quartile (Q_3)

[C] Third Quartile (Q_3) – Median > Median – Third Quartile (Q_3)

[D] None of the above

64. The non-parametric equivalent of one-way analysis of variance is

[A] Friedman test

[B] Kruskal-Wallis test

[C] Cochran test

[D] Chi-square test

65. A is 5×5 matrix, all of whose entries are 1, then

[A] A is not diagonalizable

[B] A is idempotent

[C] A is nilpotent

[D] the minimal polynomial and the characteristics polynomial of A are not equal

66. The 11th term of the sequence 1, 3, 9, 27, ... is

[A] 2^8

[B] 2^{10}

[C] 3^8

[D] 3^{10}

67. The eigenvalues of a skew-symmetric matrix are

[A] negative

[B] purely imaginary or zero

[C] real

[D] 1

68. Suppose $X \sim$ uniform (a,b). Then $E(X)$ and $V(X)$ are respectively

[A] $\frac{a}{2}$ and $\frac{b^2}{12}$

[B] $\frac{a+b}{2}$ and $\frac{(b-a)^2}{12}$

[C] $\frac{(a-b)}{2}$ and $\frac{(b-a)^4}{6}$

[D] $\frac{(a+b)}{2}$ and $\frac{(b-a)^2}{6}$

69. The correlation coefficient is dependent on the change of

[A] scale value only

[B] origin value only

[C] both origin and scale values

[D] neither the origin value nor the scale value

70. A committee of 6 persons is to be formed from a group of 7 men and 4 women. What is the probability that the committee will have exactly two women?

[A] 0·158

[B] 0·889

[C] 0·455

[D] 0·965

71. If in a call center, the average number of incoming calls is 8, what is the probability that in half an hour 3 or more calls will be received? (Take $e^{-4} = 0{\cdot}0183$)

[A] 0·7619

[B] 0·1672

[C] 0·5204

[D] 0·8921

72. Which of the following is ***not*** true for Horvitz-Thompson estimator?

[A] It is used for unequal probability sampling

[B] It is used strictly for sampling with replacement

[C] It is used both for sampling with and without replacement

[D] It is an unbiased estimator of the population parameter for the population total

73. If the regression coefficients $b_{xy} = 0{\cdot}25$ and $b_{yx} = 0{\cdot}64$, then correlation coefficient is

[A] 0·16

[B] 0·89

[C] 0·40

[D] 0·30

74. The distribution of test statistic used in sign test is

[A] Poisson

[B] normal

[C] gamma

[D] binomial

75. Which one of the following variables is ***not*** ordinal categorical?

[A] Age of a person

[B] Gender of a person : male or female

[C] Heights of students in a class (measured in centimetre)

[D] Satisfaction level of person (dissatisfied, neutral, satisfied, highly satisfied)

76. A medical study is conducted to observe the proportion or fraction of men and women over the age of 40 who have undergone full body check-up regularly. A sample of size 546 is chosen and among them there were 458 men and women, who had undergone this. Suppose we want to test whether the proportion is truly over 0·81. The p value of the test is

[A] 0·89

[B] 0·53

[C] 0·0002

[D] 0·04

77. A set of linear equations is represented by the matrix equation $Ax = b$. The necessary condition for the existence of a solution for this system is

[A] A must be invertible

[B] b belongs to the column space of A

[C] b does not belong to the column space of A

[D] None of the above

78. The difference between sample statistic and its corresponding population parameter is

[A] coverage error

[B] non-response error

[C] measurement error

[D] sampling error

79. Suppose $X \sim N(\mu, \sigma^2)$. Then which of the following is ***not*** true?

[A] The distribution of X is symmetric and $E(X) = \mu$

[B] The distribution of X has median at $x = \mu$

[C] The odd order moments are of odd values

[D] For the distribution of X, the coefficient of skewness is zero

80. A hypothesis test is being performed for a process in which a type I error will be very costly, but type II error will be relatively inexpensive and unimportant. Which of the following would be the best choice for α in this test?

[A] 0·10

[B] 0·05

[C] 0·01

[D] 0·50

PART—II

(General Knowledge, General English & Islamic History and Culture)

81. Select one word for the given definition :

A Government by one person.

[A] Aristocracy
[B] Autocracy
[C] Democracy
[D] Bureaucracy

82. Select one word for the given definition :

Movement from one country to another.

[A] Transfer
[B] Shift
[C] Entrance
[D] Immigration

83. Complete the following proverb/ phrase :

Practice makes a man _____.

[A] perfect
[B] idle
[C] angry
[D] handsome

84. Complete the following proverb/ phrase :

A little knowledge is a _____ thing.

[A] sweet
[B] beautiful
[C] good
[D] dangerous

85. Fill in the blank with the correct word given below :

He saved her _____ certain death.

[A] from
[B] with
[C] of
[D] in

86. The Battle of _____ was held in 1757.

[A] Plassey
[B] Panipat
[C] Buxar
[D] Mysore

87. How long is Ramadan?

[A] 1 day
[B] 1 month
[C] 4-12 days
[D] 1 week

88. How many daughters did Prophet Muhammad (PBUH) have?

[A] 7
[B] 3
[C] 4
[D] 2

89. Eid-al-Adha is also known as

[A] Ramadan Eid
[B] Bakri Eid
[C] Eid-e-Gadhir
[D] Eid-e-Milad

90. Eid-al-Adha falls in which month of the Muslim Calendar?

[A] Muharram
[B] Ramadan
[C] Zil-Hajj
[D] Safar

91. What does 'Eid-al-Adha' mean?

[A] Festival of Sacrifice

[B] Festival of Peace

[C] Festival of Sheep and Cattle

[D] Festival of Colors

92. The word Ramadan comes from

[A] Arabic

[B] Persian

[C] Turkish

[D] Latin

93. Ramadan is celebrated in the honor of

[A] A great Muslim Victory

[B] Islam was founded

[C] Prophet Muhammad (PBUH) was born

[D] The Quran was first revealed

94. During Ramadan, the meal eaten at sunset is called the

[A] Ishtar

[B] Iftar

[C] Imtar

[D] None of the above

95. Basic pillars of Islam are

[A] 4

[B] 5

[C] 6

[D] 7

96. Who was the first Indian to go into space?

[A] Ravi Malhotra

[B] Satish Dhawan

[C] Kalpana Chawla

[D] Rakesh Sharma

97. Which of the following is ***not*** a vertebrate?

[A] Snail

[B] Bird

[C] Kangaroo

[D] Fish

98. _____ is/are called the 'power house' of the cell.

[A] Lungs

[B] Pituitary gland

[C] Arteries

[D] Mitochondria

99. Who is regarded as the principal architect of the Constitution of India?

[A] B. R. Ambedkar

[B] Rajendra Prasad

[C] Jawaharlal Nehru

[D] C. Rajagopalachari

100. Kangaroo is the National Emblem of

[A] Canada

[B] Australia

[C] Italy

[D] Ireland