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2B5N20322 (Pages : 3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2020

BSTA5B05 – Mathematical Methods in Statistics – I

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

PART A

(Answer *ALL* the questions. Each question carries 1 mark)

1. If a,b,c are real numbers such that $a>b$ and $c<0$, then

   a) $ac \geq bc$ b) $ac \leq bc$ c) $ac > bc$ d) $ac < bc$

2. The sequence (S_n) where $S_n = 1+\frac{1}{2^p}+\cdots+\frac{1}{n^p}$ converges if

   a) $p>0$ b) $p>1$ c) $p<1$ d) $p=1$

3. The function $f(x)=\begin{cases} x, \text{when } x \text{ is rational} \\ 0, \text{when } x \text{ is irrational} \end{cases}$ is

   a) Continuous on R

   b) Continuous at $x=0$

   c) Discontinuous everywhere

   d) Differentiable everywhere

4. Let f and g be integrable on $[a,b]$. Then

   a) $f+g$ is not integrable on $[a,b]$

   b) $f-g$ is not integrable on $[a,b]$

   c) $f+g$ and $f-g$ are integrable on $[a,b]$

   d) None of the above are true

Fill up the blanks:

5. $\lim_{n\to\infty} \sqrt[n]{n} =$ _____

6. If sequence (x_n) converges to a limit x, then $(|x_n|)$ converges to _____

7. The supremum of the sequence $\left\{-1,-\frac{1}{2},-\frac{1}{3},-\frac{1}{4},\cdots\right\}$ is _____

8. If $\lim(a_n)=a$ and $a_n \geq 0$ for all n, then _____

9. Every absolutely convergent series is _____

Write True or False:

10. Let $a \geq 0$, $b \geq 0$ then $\sqrt{ab} \leq \frac{a+b}{2}$.

11. Every bounded and monotonic function on a finite interval is integrable.

12. Every constant function on $[a, b]$ is integrable on $[a, b]$

(12 x 1 = 12 Marks)

PART B

(Answer any *SEVEN* questions. Each questions carries 2 marks)

13. Show that the supremum of a set, if it exists, is unique.

14. State triangle inequality.

15. Show that the sequence $\{S_n\}$ where $S_n = 1 + \frac{1}{2!} + \cdots + \frac{1}{n!}$ is convergent.

16. State the first fundamental theorem on integral calculus.

17. Define Riemann integral of a function.

18. Check the derivability of the function $f(x) = |x|$ at the origin.

19. State Bolzano-Weierstrass theorem.

20. Differentiate absolute convergence and conditional convergence of a series.

21. State Rolle's Theorem.

(7 x 2 = 14 Marks)

PART C

(Answer any *SIX* questions. Each question carries 5 marks)

22. State and prove Archimedean property.

23. Show that the set of all rational numbers is not order-complete.

24. Show that a sequence of real numbers is convergent iffit is a Cauchy sequence.

25. Let $X = (x_n)$ and $Y = (y_n)$ are two sequences of real numbers converging to real numbers x and y respectively. Show that $X.Y = (x_n y_n)$ converges to $x\,y$.

26. Show that every monotonic increasing sequence bounded above is convergent.

27. Define absolute convergence of a series. Show that the series $x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$ converges absolutely for all values of x.

28. Show that a function which is derivable at a point is also continuous at that point.

29. Show that a bounded function is integrable on $[a,b]$ iff for every $\varepsilon > 0$ there exists a partition P of $[a,b]$ such that $U(P,f) - L(P,f) < \varepsilon$.

(6 x 5 = 30 Marks)

PART D

(Answer any *THREE* questions. Each question carries 8 marks)

30. What do you mean by nested intervals? State and prove nested intervals property.

31. Show that the sequence $\left(r^n\right)$ converges iff $-1 \leq r \leq 1$.

32. Prove that every bounded sequence of real numbers has a convergent subsequence.

33. a) Prove that any continuous function defined on a closed interval is uniformly continuous on that interval.

    b) Show that the function $f(x) = x^2$ is uniformly continuous on $[-1, 1]$.

34. State and prove Lagrange's Mean value theorem.

(3 x 8 = 24 Marks)

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2B5N20323 (Pages : 3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2020

BSTA5B06 – Statistical Computing

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

Part A
(Answer all questions; each question carries 1 mark)

Fill in the blanks (Questions 1-7)

1. The logical operator for equal to in R is _____ .
2. The R command for generating 100 standard Cauchy random numbers is _____ .
3. If $X \sim N(0,2)$, R command for finding $P(X \geq 2)$ is _____ .
4. The output of the R command qnorm(0.5) is _____ .
5. If Δ, ∇ and E are forward difference operator, backward difference operator and shift operator respectively, the relation between them is given by _____ .
6. Trapezodial rule formula is given by _____ .
7. In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to _____ matrix.

Multiple Choice Questions (Questions 8-12)

8. The arithmetic operator multiplication in R is

   (a) * (b) ** (c) × (d) none of these

9. If X follows a chisquare distribution with 5 degrees of freedom R command for finding $P[X \geq 13.9]$ is

   (a) 1-pchisq(13.9, 5) (b) 1-qchisq(13.9, 5) (c) 1-pchisq(5, 13.9) (d)1- qchisq(5, 13.9)

10. The R command for finding the ninth decile of a data vector x is

    (a) quantile(x, 9) (b) quantile(x, 0.9) (c) quantile(x, 0.09) (d) none of these

11. The default option of the argument alternative in R command t.test is

    (a) two-sided (b) greater (c) less (d) none of these

12. A root of the equation $x^3 - 2x - 5 = 0$ correct to four decimals using Newton Raphson method is

    (a) 2.0737 (b) 2.0945 (c) 2.0836 (d) none of these

(12x1=12 Marks)

Part B

(Answer any seven questions; each question carries 2 marks)

13. Write a short note on the saving, storing and retrieving work in workplace of R.
14. Briefly describe data types in R.
15. Write a short note on acceptable object names.
16. Describe the built in function plot( ).
17. How will you test the normality of the given data?
18. Explain the argument legend in a barplot function.
19. Find a real root of the equation $x^3 - 5x + 3 = 0$.
20. What do you mean by interpolation?
21. Write down the Lagrange's formula for interpolation.

(7x2=14 Marks)

Part C

(Answer any six questions; each question carries 5 marks)

22. Explain how will you import data in R from excel.
23. Define standard deviation for raw data, frequency distribution and grouped frequency distribution. Also write down the corresponding R commands.
24. Write a short note on regression analysis. What are the corresponding R commands for simple regression model?
25. Justify R as a set of statistical tables.
26. Derive weddle's rule of numerical integration.
27. Evaluate $\int_0^1 \frac{1}{1+x^2} dx$, using Trapezodial rule with h=0.5 and 0.25.
28. Find the root of the equation $\sin x = 10(x-1)$ correct to three decimal places using iteration method.
29. Explain Newton Raphson method. Obtain the root of the equation $x + \log x = 2$, using Newton Raphson method.

(6x5=30 Marks)

Part D

(Answer any three questions; each question carries 8 marks)

30. (a) Write R codes to simulate a random sample from normal (1,1) distribution and then to draw box plot and qq plot.

(b) What do you mean by partition values? How will you find the partition values of a raw data using R?

31. (a) Explain how to find interval estimate of the variance of the normal population.

(b) Write the corresponding R commands.

32. (a) Explain the situation in which the R command t.test is used. Explain its arguments and also explain its output.

(b) Explain how the non-parametric counterparts of one sample and two sample t-tests is conducted in R.

33. Describe Graeffe's root squaring method. Find the real root of $x^3 - 6x^2 + 11x - 6 = 0$ using Graeffe's root squaring method.

34. Explain Gauss Jordan method for solving a system of linear equations and write down the R commands to solve the following system.

$$5x - 2y + z = 4$$
$$7x + y - 5z = 8$$
$$3x + 7y + 4z = 10$$

(3x8=24 Marks)

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2B5N20324 (Pages : 4) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2020

BSTA5B07 – Sample Surveys

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

Part A
(Answer all questions; each question carries 1 mark)

Fill in the blanks (Questions 1-6)

1. The combination of all samples of size 'n' along with their associated probability of selection is known as:.....
2. If sampling is done with replacement, total number of samples of size 'n' from a population of size ' N' is :.....
3. In estimating population mean under SRSWOR, fpc is .....
4. In stratified random sampling, an unbiased estimator of population mean is:.....
5. The probability of selecting a circular systematic sample is:.....
6. When sampling units are evenly spaced after a random starting position A, the sampling technique is known as.....

Multiple Choice Questions (Questions 7-12)

7. Any real valued function of the sample values is called:

   (a) Statistic (b) Estimator

   (c) Parameter (d) Sampling Unit

8. In SRSWR various selections are:

   (a) Positively Correlated (b) Negatively Correlated

   (c) Dependent (d) Independent

9 Under Proportional allocation, sample size from the h^{th} stratum, n_h=...

(a) $n_h = \dfrac{N_h S_h / \sqrt{c_h}}{\sum_{h=1}^{L} N_h S_h / \sqrt{c_h}}\, n$ (b) $n_h = \dfrac{N_h S_h}{\sum_{h=1}^{L} N_h S_h}\, n$

(c) $n_1 = n_2 = \ldots = n_L$ (d) $n_h = \dfrac{n}{N} N_h$

10. The sampling fraction for the h^{th} stratum is given by:

(a) $\frac{N_h}{N}$ (b) $\frac{n_h}{N_h}$ (c) $\frac{N}{N_h}$ (d) $\frac{n_h}{N}$

11. Systematic sample mean is more precise than SRS mean if:

(a) $\rho_{wsy} < \frac{-1}{N-1}$ (b) $\rho_{wsy} = 0$ (c) $\rho_{wsy} > \frac{1}{N-1}$ (d) $\rho_{wsy} > \frac{-1}{N}$

12. Efficiency of cluster sampling with respect to SRSWOR of nM elements from the whole population is:

(a) $\frac{S^2}{S_b^2}$ (b) $\frac{S^2}{MS_b^2}$ (c) $\frac{MS^2}{S_b^2}$ (d) $\frac{S_b^2}{S^2}$

(12x1=12 Marks)

Part B
(Answer any seven questions; each question carries 2 marks)

13. Mention situations where sampling method alone can be used.
14. What is meant by sampling error?
15. What is the probability of selecting a sample of size 3 from a population of size 10 if sampling is done according to simple random sampling without replacement?
16. Briefly explain the problem of allocation of stratified random sampling.
17. What is meant by Neyman allocation?
18. Assume that you are given a list of 12 villages and asked to select a systematic sample with sampling interval 3. What is the procedure of selection?
19 Give an unbiased estimator of population mean based on linear systematic sampling when the population size is an integral multiple of sample size. What is its standard error?
20. What are the advantages of cluster sampling?
21. Give an estimator of population total based on cluster sampling with equal clusters.

(7x2=14 Marks)

Part C
(Answer any six questions; each question carries 5 marks)

22. Distinguish between census and sampling. What are the merits of sample survey?
23. Nine villages in a certain administrative area contain 793, 170, 970, 657, 1721, 1603,864,383 and 826 fields respectively. Make a random selection of 6 fields using the random numbers 7358, 922, 4112, 3596, 633 and 3999.

24. With usual notations prove that $V(p)=\frac{N-n}{N-1}\frac{PQ}{n}$

25. Briefly explain the exigencies of stratified random sampling and highlight its advantages.

26. A flood affected district in Kerala is divided into three zones. The number of villages in each zone is given by 440, 405, and 100 respectively. In order to estimate the total number of houses affected by flood in the district, the number of villages selected from each zone are 25,15 and 8 respectively. If total number of houses affected in the sampled villages are 750, 600, 344 respectively, estimate the total number of houses affected by flood in the district.

27. By considering a suitable example establish that in linear systematic sampling if $N \neq nk$ $\bar{y}_{sy}$ is not unbiased for the population mean $\bar{Y}$.

28 In usual notations, prove that the systematic sample mean is more precise than the mean of a simple random sample taken without replacement if $S^2_{wsy} > S^2$

29 Show that the relative efficiency of cluster sampling with SRSWOR increases as the variance between cluster means decreases.

(6x5=30 Marks)

Part D
(Answer any three questions; each question carries 8 marks)

30 Describe various steps in planning and execution of a large scale sample survey.

31 (a) Explain how you would estimate the total number units in the population possessing an attribute.

(b)A simple random sample without replacement of n = 50 was drawn from a village in which there are N=500 households. It was found that amongst the sampled households, there are only 8 households each possessing a transistor radio. Estimate the total number of households in the village possessing transistor radios and calculate the standard error of the estimate

32. In stratified random sampling, find the value of the sample size in each stratum under optimum allocation with fixed sample size. Hence find the variance of the estimated mean.

33. In systematic sampling, show that $V(\bar{y}_{sy})=\left(\frac{N-1}{N}\right)\frac{S^2}{n}\left\{1+(n-1)\rho_{wsy}\right\}$, where ρ_{wsy} is the intra class correlation coefficient.

34. To estimate the average yield of grapes per village, 5 villages out of 50 villages, each having 5 vineyards of same area were selected from Karnataka state by SRSWOR. The yield per vineyard in selected villages are given below:

Vineyard No.	Villages				
	1	2	3	4	5
1	41	32	15	44	40
2	38	33	44	35	30
3	37	39	43	52	40
4	33	38	34	18	25
5	66	50	30	40	16

Estimate average yield per vineyard in this area along with its S.E.

(3x8=24 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2020

BSTA5B08 – Statistical Quality Control

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

Part A

Answer all the questions. Each question has ONE mark.

Fill in the blanks (Questions 1-7)

1. .....is a strategy for implementing and managing quality improvement activities on an organization-wide basis.
2. Quality is inversely proportional to .....
3. A sampling plan in which we take a decision based on one sample only is called-------
4. AOQ of double sampling plan is.....
5. ..... Plots the probabilities of accepting a lot versus the fraction defective.
6. The largest allowable value for a quality characteristic is called.....
7. For a normal distribution, the natural tolerance limits include .....% of process output.

Multiple Choice Questions (Questions 8-12)

8. The poorest level of quality that the consumer is willing to accept in an individual lot.
   (a) AOQL (b) LTPD (c) ATI (d) none of the above
9. Suitable control chart for defectives is
   (a) p chart (b) np chart (c) S chart (d) u chart
10. Chart used for fraction of defectives is based on ---- distribution
    (a) Bernoulli distribution (b) Binomial distribution
    (c) Normal distribution (d) Poisson distribution
11. A sampling plan in which we take the decision based on a sequence of samples from the lot is
    (a) single sampling plan (b) double sampling plan
    (c) multiple sampling plan (d) sequential sampling plan
12. EWMA control charts is useful for detecting
    (a) Large shifts (b) Medium shifts (c)Small shifts (d) all the above

(12 x 1 = 12 Marks)

Part B

Answer any Seven questions. Each question has TWO marks.

13. Compare chance causes and assignable causes.
14. Distinguish between defects and defectives.
15. What is the advantage of multiple sampling plan over double sampling plan.
16. Discuss statistical quality control.
17. Briefly explain economic design of control charts.
18. Describe a control chart.
19. Briefly explain median chart?
20. What is process capability analysis?
21. Why do we call CUSUM chart as a "control chart with memory"?

(7 x2 = 14 Marks)

Part C

Answer any Six questions. Each question has FIVE marks.

22. What is acceptance sampling. Write its advantages.
23. Explain the procedure for constructing R chart?
24. Describe chain sampling?
25. Explain single sampling plan.
26. Draw a control chart for the number of defectives using the given data and comment whether the process is under statistical control.

Day	1	2	3	4	5	6	7	8	9	10
Number of defectives	3	4	3	2	6	12	5	1	2	2

27. Discuss continuous sampling.
28. Explain various process capability ratios.
29. Describe the role of tabular CUSUM for monitoring the process mean.

(6 x 5 = 30 Marks)

Part D

Answer any Three questions. Each question has EIGHT marks.

30. Describe double sampling plan. Explain its merits and demerits. Also explain the construction of its OC curve.

31. Construct control chart of mean and standard deviation for the following data and comment on the state of control.

Sample No.	1	2	3	4	5	6	7	8	9
Sample values	8	9	13	7	11	15	17	9	9
	13	11	16	17	14	18	11	16	16
	9	15	7	12	9	11	8	7	12
	15	18	1	16	15	10	9	11	8
	17	9	15	13	9	8	11	13	13

(A_3= 1.427,B_3 = 0,B_4 = 2.089)

32. The number of nonconforming items in samples of size 100 are given below. Construct a fraction nonconforming control chart for the data. Does the process appear to be in control?

Sample number	No. of non-conforming items	Sample number	No. of non-conforming items
1	7	11	6
2	4	12	15
3	1	13	0
4	3	14	9
5	6	15	5
6	8	16	1
7	10	17	4
8	5	18	5
9	2	19	7
10	7	20	2

33. Discuss the construction of sampling plan for variables when AQL and LTPD along with the consumer's and producer's risk are given.

34. Explain EWMA control chart.

(3 x 8 = 24 Marks)

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2B5N20326 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics(Open Course) Degree Examination, November 2020

BSTA5D02 – Basic Statistics

(2018 Admission onwards)

Time: 2 hours Max. Marks: 40

PART-A
(Answer *all* questions. Each question carries *one* mark)

1. Write a short note on probability sampling.
2. What is the empirical relationship between mean, median and mode.
3. Given that $P(A) = \frac{1}{3}, P(B) = \frac{1}{4}, P(A/B) = \frac{1}{6}$, The probability $P(B/A)$ =.....
4. Define the independent events.
5. What is meant by central tendency?

(5 x 1 = 5 marks)

PART-B
(Answer *all* questions. Each question carries *two* marks)

6. Explain the sources of non-sampling error.
7. Distinguish between positive correlation and negative correlation with examples.
8. State addition theorem of probability.
9. What is judgement sampling?
10. Write the normal equations of fitting a straight line.

(5 x 2 = 10 marks)

PART-C
(Answer *any three* questions. Each question carries *five* marks)

11. State classical definition of probability. What are the limitations of this definition?
12. Calculate the Karl Pearson's correlation coefficient between X and Y if n=25,

    $\sum x = 125, \quad \sum x^2 = 650, \sum y = 100, \sum y^2 = 460, \sum xy = 508.$
13. What are the important measures of dispersion? Explain.
14. State multiplication theorem of probability. Three men working independently attempt to decode a secret message. If their individual probabilities of success are 0.2, 0.4, and 0.5. What is the probability that message is decoded.
15. Distinguish between coefficient of variation and correlation coefficient.

(3 x 5 = 15 marks)

PART-D

(Answer *any one* question. Each question carries *ten* marks)

16. Find the Coefficient of variation from the following data and compare

Life in years	0-2	2-4	4-6	6-8	8-10	10-12
A	5	16	13	7	5	4
B	2	7	12	19	9	1

17. Describe the following:

a) Simple random sampling.

b) Census Method

c) Lottery Method

d) Sampling error.

18. What you meant by curve fitting of a data. Fit straight line Y=A+BX for the following data

X	0	5	10	15	20	25	30
Y	10	14	19	25	31	36	39

(1 x 10 = 10 marks)