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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fifth Semester B.Sc Statistics Degree Examination, November 2017
ST5B05 – Mathematical Methods in Statistics
(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

PART A

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

Fill in the blanks (Questions 1-7)

1. Determine A such that $A = \{x \in \mathbb{R} : |x - 1| < |x|\}$.
2. The supremum of the sequence $\left\{1 - \frac{(-1)^n}{n!}, n \in \mathbb{N}\right\}$ is
3. The value of $\lim_{x \rightarrow 0} x \sin(1/x)$ is
4. If $f(x)$ satisfies the conditions of the mean value theorem and $f'(x) = 0$ for all x in (a, b) , then $f(x)$ is a ——— in $[a, b]$.
5. If P^* is a refinement of P , then the relationship between the lower sums of the corresponding partitions is
6. The value of c in Rolle's theorem where $f(x) = x^2 - 5x + 4$ in $[1, 4]$, is
7. If f is bounded integrable function then $\lim_{n \rightarrow \infty} \{U(P_n, f) - L(P_n, f)\} = \dots\dots$

Multiple Choice Questions (Questions 8-12)

8. The number $\sqrt{2}e^{i\pi}$ is

(a) a rational number	(b) a transcendental number
(c) an irrational number	(d) an imaginary number
9. Which of the following statements is not correct?

(a) A sequence cannot converge to more than one limit	(b) Every convergent sequence is bounded.	(c) Every bounded sequence is convergent	(d) None of these
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10. Which of the following is continuous but not differentiable?

(a) $\sin x$	(b) $ x $	(c) $3x + 1$	(d) none of these.
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11. The sequence $\left\{a + \frac{(-1)^n b}{n}\right\}$ is

(a) bounded	(b) unbounded	(c) divergent	(d) None of these
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12. The sequence $\{1 + (-1)^n\}$ has

(a) exactly one constant subsequence	(b) exactly two constant subsequences
(c) exactly three constant subsequences	(d) exactly four constant subsequences

(12 x 1 = 12 Marks)

PART B

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

13. What is principle of mathematical induction?
14. Describe nested interval property.
15. Give an example to show that an unbounded sequence may exist with a limit point.
16. Describe uniqueness of limit of a sequence.
17. State Bolzano-Weierstrass theorem.
18. Write the Interior Extremum theorem.
19. State Taylor's theorem.
20. Prove that every Riemann integrable function is bounded.
21. Explain Riemann integral and its existence.

(7 x 2 = 14 Marks)

PART C

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

22. Write the order property of real numbers.
23. State and prove the density theorem.
24. Show that limit point of a convergent sequence is unique.
25. (i) Show that sum of two continuous functions is continuous.
(ii) If a function is continuous in a closed interval, then prove that it is bounded.
26. Examine the continuity of the function:

$$f(x) = \begin{cases} xe^{1/x} & \text{when } x \neq 0 \\ 1 + e^{1/x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$$

27. Define uniform continuity. State and prove uniform continuity theorem.
28. Let $g: \mathbb{R} \rightarrow \mathbb{R}$ be defined by $g(x) := x^2 \sin\left(\frac{1}{x^2}\right)$ for $x \neq 0$ and $g(x) := 0$ at $x = 0$. Show that g is differentiable for all $x \in \mathbb{R}$ and g' the first derivative of g is not bounded on the interval $[-1, 1]$.
29. State and prove Rolle's theorem. Explain how to deduce mean value theorem from Rolle's theorem

(6 x 5 = 30 Marks)

PART D

(Answer any THREE questions. Each carries 8 marks)

30. Define monotone sequence. Prove that a monotone sequence of real number is properly divergent if and only if it is unbounded.
31. Evaluate (a) $\lim_{n \rightarrow \infty} \frac{(-1)^n n}{n^2 + 1}$ (b) $\lim_{n \rightarrow \infty} (2n)^{1/n}$ (c) $\lim_{n \rightarrow \infty} \frac{\sqrt{n}}{n+1}$
32. Define uniform continuity. If $f(x) := x$ and $g(x) := \sin x$, show that f and g are uniform continuous on \mathbb{R} , but their product fg is not uniform continuous on \mathbb{R} .
33. State Prove first and second fundamental theorems on integral calculus.
34. If f is a continuous function on $[-1, -1]$, then show that
$$\int_0^{\pi/2} f(\cos x) dx = \int_0^{\pi/2} f(\sin x) dx = \frac{1}{2} \int_0^\pi f(\sin x) dx.$$

(3 x 8 = 24 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fifth Semester B.Sc Statistics Degree Examination, November 2017
ST5B06 – Statistical Computing
 (2015 Admission onwards)

Max. 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 logic operator for not equal to in R is _____.
2. The R command for getting number of elements in vector x is _____.
3. The R command to draw bar diagram is _____.
4. The R command for generating 100 standard exponential random numbers is _____.
5. If X has B (10, 0.4) , R command for finding $P(X < 2)$ is _____.
6. The R-command for the output 10 10 10 10 is _____.
7. The R command for testing simple linear regression is _____.

Multiple Choice Questions (Questions 8-12)

8. The logical and operator equal to is
 (a) & (b) && (c) | (d) none of these
9. If X follows Poisson distribution with mean 0.6 , the R command for finding $P[X \leq 5]$ is
 (a) ppois(5, 0.6) (b) ppoisson(5, 0.6) (c) dpois(5, 0.6) (d)) dpoisson(5, 0.6)
10. What is the output of the R command rep(2, 4) ?
 (a) 2 (b) 2 3 4 (c) 2 2 2 2 (d) 4 4 4 4
11. The R command for finding the third quartile of a data vector x is
 (a) quantile(x, 4) (b) quantile(x, 0.25) (c) quantile(x, 0.50) (d) quantile(x, 0.75)
12. The default option of the argument alternative in R command t.test is
 (a) two-sided (b) greater (c) less (d) none of these

(12x1=12 Marks)**Part B****(Answer any seven questions; each question carries 2 marks)**

13. What are the basic features of R programming?
14. What are the different methods of inputting data in R?
15. Write a short note on basic operators in R.
16. Write down the R command to find out the covariance and correlation between the data vectors x and y.
17. Distinguish cbind() and rbind() functions in R.
18. Describe the built in functions curve () and plot ().
19. How will you test the normality of a given data?
20. Explain the argument legend in a scatter plot function.
21. If X follows Poisson distribution with mean 2, write R- program to obtain a table of Poisson probabilities.

(7 x 2 =14 Marks)

Part C

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

22. Explain various built in functions in R.
23. What do you mean by partition values? How will you find the partition values of a raw data using R?
24. Explain the arguments for interval estimation for mean in R.
25. Explain the procedure for finding median of a grouped frequency distribution in R.
26. Write a short note on correlation coefficient and testing its significance. What are the corresponding R commands?
27. Explain methods for computing skewness and kurtosis of the data in R.
28. Explain the situation in which the R command `chisq.test` is used. Explain its arguments.
29. Write R command for one way ANOVA. Explain its arguments and also explain its output.

(6 x 5=30 Marks)

Part D

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

30. What are the advantages of R over other statistical softwares?
31. Define arithmetic mean, geometric mean and harmonic mean for raw data, frequency distribution and grouped frequency distribution. Also write down the corresponding R commands.
32. Prepare R-program for 'Regression Analysis'. List the additional information obtained when `summary()` function is used.
33. Write R codes to simulate a random sample from $N(1,1)$ distribution and then to draw box plots and qq normal plots to judge whether the parent population is normal. Interpret the output.
34. (a) Explain the situation in which the R command `t.test` is used. Explain its arguments and also explain its output.
(b) Given two samples of equal size from two populations A and B, Write an R program to test the equality of means of A and B.

(3x 8=24 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2017

ST5B07- Sample Surveys

(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

Part A

(Answer all questions; each question carries 1 mark)

1. Number of possible samples in a simple random sample with replacement of size n from a population of size N is
2. In stratified random sampling, an unbiased estimator of population mean is
3. For SRSWOR the probability that a specified unit included in the sample is
4. Linear systematic sampling is used when N/n is.....
5. In cluster sampling, an unbiased estimator of population mean is
6. A representative part of the population is known as
7. The magnitude of the standard error of an estimate is an index of its
(a) Accuracy (b) Precision (c) Efficiency (d) All the above
8. Under proportional allocation in stratified sampling ,the size of the sample from each stratum depends on
(a) Total sample size (b) Size of the stratum (c) Population size (d) All the above
9. Sampling is inevitable in which of the following situation:
(a) When the item or unit is destroyed under investigation
(b) When the population is infinite
(c) When the area of survey is wide
(d) All the above
10. If N is the population size and n is the sample size, the quantity $\frac{n}{N}$ in usual notation is called
(a) Sampling interval (b) Sampling fraction
(c) Population correction (d) Finite Population correction
11. An unbiased estimator of the variance of sample mean in simple random sampling with replacement is given by
(a) $\frac{s^2}{n}$ (b) $\frac{s^2}{N}$ (c) $\frac{s^2}{N-1}$ (d) none of these
12. The Error which is likely to decrease with the increase in sample size is
(a) Sampling error
(b) Non sampling error
(c) Planning error
(d) None of the above

(12x1=12 Marks)

Part B

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

13. Describe sampling frame and sampling design.
14. Define Parameter and Statistic.
15. What are the drawback of systematic sampling?
16. When do you make use of stratified sampling?
17. What do you mean by cluster sampling and when will you use it?
18. What is meant by probability and non probability sampling?
19. What is meant by population proportion, show that sample proportion is unbiased for population proportion when sampling is done by SRSWOR.
20. What is meant by population and what are the important types of population?
21. Define any two methods of sample selection.

(7x2=14 Marks)

Part C

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

22. Explain linear and circular systematic sampling, give examples.
23. What are the advantages of sampling over complete enumeration?
24. Show that the relative efficiency of systematic sampling over stratified random sampling depends upon the values of ρ_{wst} where ρ_{wst} is the correlation coefficient between deviations from stratum means of pairs of items that are in the same systematic sample.
25. Estimate the variance of population mean of two stage cluster sampling
26. Describe any three methods of allocation of sample sizes to different strata in stratified random sampling.
27. What are the principal steps in sample survey?
28. Compare the efficiency of systematic sampling over simple random sampling.
29. What is meant by two stage sampling, and what are it's advantages?

(6x5=30 Marks)

Part D

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

30. What is meant by sampling and non sampling errors, give examples.
31. Compare the efficiency of SRSWR (N,n) over SRSWOR (N,n) for estimating population mean .
32. If fpc is ignored, show that

$$V_{opt} \leq V_{prop} \leq V_{srs}$$

Where V_{opt} , V_{prop} denote the variance of the estimates of mean in optimum allocation and proportional allocation in stratified random sampling and V_{srs} denote the variance of the estimate of mean in simple random sampling

33. Is sample variance an unbiased estimator of population variance in SRSWOR? If not, give an unbiased estimator.
34. Define cluster sampling. In a simple random sample of "n" clusters from a population of "N" clusters each containing "M" elements, obtain an unbiased estimator of population mean and also obtain its variance.

(3x8=24 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2017

ST5B08– Operations Research & Statistical Quality Control

(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

Part A

(Answer all questions; each question carries 1 mark)

1. In linear programming, objective function and objective constraints are
 - a) Solved
 - b) Linear
 - c) Quadratic
 - d) Adjacent
2. The objective of a linear programming problem is to _____ the objective function
 - a) Optimize
 - b) Model
 - c) Reduce
 - d) Plot
3. An optimal assignment exist if the total reduced cost of the assignment is,
 - a) Zero
 - b) One.
 - c) Two
 - d) None of these
4. The maximum number of basic solutions to a set of m simultaneous equation in n unknowns, ($n \geq m$) is
 - a) m
 - b) $n-m$
 - c) $\binom{n}{m}$
 - d) none of these.
5. Control chart for number of defects per sample is
 - a) p chart
 - b) np chart
 - c) C chart
 - d) U chart
6. In an acceptance sampling plan, N indicates
 - a) Sample size
 - b) Lot size
 - c) Rejection Number
 - d) Acceptance number.
7. An LPP of _____ variables can be solved graphically.
8. In an assignment problem involving five workers and four jobs, total number of assignments possible are _____.
9. If the cost matrix of an assignment problem is not a square matrix, then the problem is called _____ problem.
10. An R-chart is used to monitor _____.
11. The _____ is a quality control chart used to control the number of defects per unit of output.
12. _____ is a method of measuring samples of lots or batches of product against predetermined standards.

(12x1=12 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fifth Semester B.Sc Statistics Degree Examination, November 2017
ST5B09– Practical Paper – I
 (2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

Use of calculator and statistical table is permitted.
Answer any four questions.
Each question carries 20 marks.

1. A) A study of Department of transportation found that the sample correlation coefficient between Driving speed and Mileage for midsize automobiles is -0.91 from a sample of size 20. Test the significance of this correlation?
- B) Lengths in inches of 5 screws made by a machine are 2.0, 2.1, 1.9, 2.2 and 2.3. It is claimed that the average lengths of the screws produced by this machine is 2 inch. If it is assumed that the length of the screw is normally distributed, test the significance of the claim.
- C) Samples of final examination scores for two statistics classes with different instructors provided the following results.

Instructor	A	B
Sample size	12	15
Mean	72	78
Standard deviation	8	10

If we can assume that the scores follow normal distribution test whether there is any significant difference between the mean scores.

(6 + 6 + 8 = 20 marks)

2. A) A random sample of the weights of 10 boys from a college shows a variance of 16 and that of 15 girls shows a variance of 20. Are the weights of girls more variable than the weights of boys?
- B) A sample of parts provided the following contingency table data on part quality by production shift. Test the hypothesis that part quality is independent of the production shift. What is your conclusion?

Shift	Part Quality	
	Good	Defective
First	368	32
Second	285	15
Third	176	24

- C) Following data give information about number of goals secured per mach by a particular football team. Test at 1% level of significance if Poisson distribution fits the data

No. of goals per match	0	1	2	3	4	5
No. of matches	14	18	29	18	10	7

(6 + 7 + 7 = 20 marks)

3. A) In a random experiment of tossing a coin it turns up 5196 heads in 10000 trials. Is it reasonable to think that the coin is unbiased?
- B) A sample of 700 students is found to have a mean height 165 cms with a standard deviation of 12 cms. Could it be reasonably regarded as a sample from a population with mean 170 cms?
- C) In a sample of 700 men from Town A, 380 prefer Tea. In another sample of 940 from Town B, 418 men drink Tea. Do the data indicate that the two towns are significantly different with respect to the preference of Tea among men?

(6 + 6 + 8 = 20 marks)

4. A) In a study conducted by the Medical department it is identified that 68 out of 350 persons failed to recover from a particular disease. Find 95% confidence interval for the mortality rate of the disease.
- B) From a random sample of 18 ball bearings made by a machine it is found to have the sample mean 0.83cm with standard deviation 0.041cm. Assume the diameter follows normal distribution and construct a 90% confidence interval for population variance.
- C) Two random samples drawn from two normal populations with equal variance provide the following information.

Sample	Sample 1	Sample 2
Sample size	10	12
Mean	20	24
Standard deviation	5	6

Construct a 99% confidence interval for the difference of population means.

(6 + 7 + 7 = 20 marks)

5. A) Apply Simpson's (i) one-third and (ii) three eights rule to find the value of $\int_0^6 \frac{dx}{1+x}$
- B) Determine the derivative of $f(x)$ at $x = 10$ from the following table using divided difference

x	3	5	11	27	34
$f(x)$	-13	23	899	17315	35606

(10 + 10 = 20 marks)

6. Consider a population of 8 units with values 2, 2, 5, 3, 6, 9, 4
- a) Write down all possible samples of size 3 by SRSWOR from the population.
- b) Verify that sample mean is an unbiased estimator of population mean.
- c) Compare the efficiency of sample mean under SRSWOR and SRSWR for estimating population mean.

(6 + 6 + 8 = 20 marks)

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(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics (Open Course) Degree Examination, November 2017

ST5D03- Basic Statistics

(2015 Admission onwards)

Max. Time: 2 hours

Max. Marks: 40

PART-A

Answer all questions. Each question carries one mark

1. The geometric mean of 2,4 and 8 is
2. Name the measure of dispersion calculated in the case of open-end classes.
3. The square root of variance is known as.....
4. What are the limits of probability?
5. State the relation between mean ,mode and median.

(5 x 1 = 5 marks)

PART-B

Answer all questions. Each question carries two marks

6. What is a scatter diagram?.
7. Distinguish between arithmetic mean and harmonic mean.
8. Describe simple random sampling.
9. What is meant by relative measures of dispersion.
10. Define disjoint events. Give an example.

(5 x 2 = 10 marks)

PART-C

Answer any three questions. Each question carries five marks

11. Distinguish between classical and frequency definition of probability.
12. Distinguish between sampling and non-sampling errors with examples.
13. Define standard deviation. Also write the merits and demerits of standard deviation
14. Explain different types of correlation.
15. (a) Give the axiomatic definition of probability.
(b) Define sample space. Give an example?

(3 x 5 = 15 marks)

PART-D

Answer any one question. Each question carries ten marks

16. Find the mean, median and mode for the following data:

Class:	0-10	10-20	20-30	30-40	40-50	50-60
f :	5	15	40	32	20	8

17. (a) Explain sampling and census methods of survey.

(b) Describe the following:

- i. Probability sampling.
- ii. Judgment sampling.
- iii. Simple random sampling.

18. (a) Explain the principle of least squares

(b) Fit a straight line to the following data.

X: 10 12 14 16 18 20 22 24 26 28

Y: 20 25 31 36 40 44 49 54 60 64

(1 x 10 = 10 marks)