

65

B5N18321

(Pages : 2)

Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2018

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. Let  $A = \{x \in \mathbb{R} : x^2 + x > 2\}$ , then A is equal to.....
2. The supremum of the sequence  $\left\{\frac{(-1)^{n-1}}{n!}, n \in N\right\}$  is .....
3. The value of  $\lim_{x \rightarrow 0} \frac{\cos x - 1}{x}$  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. The value of  $c$  in Rolle's theorem where  $f(x) = x^3$  in  $[1, 3]$  is ...
6. An example of a bounded function which is not integrable is ...
7. If  $f(x) = x^2$  is defined on  $[0, 1]$ . Let  $P_n$  be the partition of  $[0, 1]$  into  $n$ -intervals of equal length  $1/n$ . Then  $\lim_{n \rightarrow \infty} U(f; P_n) = \lim_{n \rightarrow \infty} L(f; P_n) = \dots$

**Multiple Choice Questions (Questions 8-12)**

8. 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
9. Which of the following is continuous ?
 

(a)  $\sin |x|$       (b)  $|x|$       (c)  $3x + 1$       d)  $[3]^{1-x^2}$
10. Which of the following is not correct if  $a, b \in \mathbb{R}$ ,
  - (a)  $|a - b| \leq |a| - |b|$       (b)  $|a - b| \leq |a| + |b|$
  - (c)  $||a| - |b|| \leq |a - b|$       (d)  $|a + b| \leq |a| + |b|$
11. Consider the sequence  $\{a_n\}$ , where  $a_n = 1 + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!}$ , then
  - (a)  $\{a_n\}$  is bounded      (b)  $\{a_n\}$  monotonically increasing
  - (c)  $\{a_n\}$  monotonically decreasing      (d)  $\{a_n\}$  is convergent
12. Every non-empty set of real numbers that is bounded below has:
  - a) a supremum
  - b) an infimum
  - c) both supremum and infimum
  - d) neither a supremum nor an infimum

(12 x 1 =12 Marks)

### PART B

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

13. What is Completeness property?
14. State the Archimedian property.
15. Use Squeeze theorem to find the limit of  $\{n^{1/n^2}\}$
16. Give an example of a bounded sequence that is not a Cauchy sequence.
17. Write the Interior extremum theorem.
18. Define uniform continuity.
19. Explain various types of discontinuities of functions.
20. Describe properties of Riemann integral.
21. Describe integrability of monotone functions.

(7 x 2 = 14 Marks)

### PART C

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

22. Prove that there does not exist a rational number  $r$  such that  $r^2 = 2$ .
23. State and prove Bernoulli's inequality.
24. State and prove Cauchy's general principle of convergence for sequences.
25. Examine the convergence and find the limit of the following sequence  
a)  $\{(1+1/n)^{n+1}\}$  b)  $\{(1-1/n)^n\}$  Establish the squeeze theorem.
26. (i) State and prove Taylor's theorem and hence deduce Taylor's series  
(ii) Using Taylor's theorem, prove that  $\cos x \geq 1 - (x^2/2)$  for all real  $x$
27. State and prove the necessary and sufficient condition for Riemann integrability of a bounded function in terms of lower and upper Riemann Sums.
28. State and prove fundamental theorem of integral calculus.

(6 x 5 = 30 Marks)

### PART D

(Answer any THREE questions. Each carries 8 marks)

29. State and prove intermediate value theorem.
30. Evaluate (a)  $\lim_{n \rightarrow \infty} \left(\frac{1}{n} - \frac{1}{n+1}\right)$  (b)  $\lim_{n \rightarrow \infty} \frac{1}{3^n}$  (c)  $\lim_{n \rightarrow \infty} \frac{2^n}{n!}$
31. State mean value theorem. Use mean value theorem to prove that  $|\sin x - \sin y| \leq |x - y|$  for all  $x, y$  in  $\mathbb{R}$ .
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. If a function  $f$  is integrable on  $[a, b]$ , show that  $f^2$  and  $|f|$  is also integrable on  $[a, b]$ .

(3 x 8 = 24 Marks)

## FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2018

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 arithmetic operator for Exponentiation in R is \_\_\_\_\_.
2. The R command to input first ten natural number is \_\_\_\_\_.
3. The R command to draw a histogram is \_\_\_\_\_.
4. The R command for generating 100 standard Cauchy random numbers is \_\_\_\_\_.
5. If  $X \sim N(0,1)$ , R command for finding  $P(0.83 < X < 2.1)$  is \_\_\_\_\_.
6. The output of the R command `qnorm(0.50)` is \_\_\_\_\_.
7. The R command for paired t-test is \_\_\_\_\_.

## Multiple Choice Questions (Questions 8-12)

8. The logical operator equal to is  
(a) = (b) == (c) != (d) none of these
9. If  $X$  follows a Binomial distribution  $B(10, 0.4)$  R command for finding  $P[X \leq 5]$  is  
a) `pbinomial(5, 10, 0.4)` (b) `dbinomial(5, 10, 0.4)`  
(c) `pbinom(5, 10, 0.4)` (d) `dbinom(5, 10, 0.4)`
10. What is the output of the R command `rep(1:3, 2)`?  
(a) 1 2 3 (b) 1 2 3 1 2 3 (c) 1 3 1 3 (d) none of these
11. The output of the R command `xt = table(x); which(xt == max(xt))` for a data vector  $x$  is  
(a) mode (b) median (c) quantile (d) none of these
12. The R command arranging data vector  $x$  in descending order.  
(a) `sort(x)` (b) `sort(x, decreasing = T)` (c) `sort(x, decreasing = F)` (d) none of these

(12x1=12 Marks)

## Part B

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

13. How do you install R in your computer?
14. Briefly describe data types in R.
15. Explain how will you import data in R from excel.
16. Briefly describe the built in functions `abs()` and `diff()`.
17. Write down the R command to find the median of a data vector  $x$ .
18. Explain the procedure for finding standard deviation of a grouped frequency distribution in R.
19. Explain the quantile plot in R.
20. How will you test the normality of the given data?
21. Write a short note on t-test using R.

(7x2=14 Marks)

**Part C**

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

22. Write a short note on data accessing and indexing in R.
23. Write a short note on graphical functions in R.
24. Explain the R commands for selecting random sample with and without replacement scheme.
25. Explain various measures of dispersion of the data in R.
26. Write a short note on correlation coefficient and testing its significance. What are the corresponding R commands?
27. Explain how to find interval estimate of the difference of two population means in R.
28. Justify R as a set of statistical tables.
29. Write the use of var.test command and explain its arguments.

(6x5=30 Marks)

**Part D**

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

30. Write a short note on the saving, storing and retrieving work in workplace of R. Illustrate with suitable example.
31. (a) For the sales data given in the following table. Write the R commands for drawing a bar diagram.

Year	2000	2001	2002	2003	2004	2005
Sales	15	25	30	28	24	24

- 
- (b) For Tax Revenue data given in the following table. Write the R commands for drawing a pie diagram.

Source	Excise	Customs	Corporation Tax	Income Tax	Other
Tax Revenue	6526	7108	2568	560	763

32. Define arithmetic mean, geometric mean and harmonic mean for raw data, frequency distribution and grouped frequency distribution. Also write down the corresponding R commands.
33. Simulate 100 observations from the following distributions and find the sample mean and sample standard deviation in R
  - a) Normal with mean 50 and Standard Deviation 10
  - b) Exponential with mean 5
  - c) Gamma distribution with parameters  $m=4$  and  $p=2$
34. (a) Following are the average weekly losses of work hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation. Write the R commands to test whether the safety program is effective.  
Before: 45, 73, 46, 124, 33, 57, 83, 34, 26, 17  
After: 36, 60, 44, 119, 35, 51, 77, 29, 24, 11  
(b) Explain how the non-parametric counterparts of one sample and two sample t-tests is conducted in R.

(3x8=24 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE  
 Fifth Semester B.Sc Statistics Degree Examination, November 2018  
**ST5B07- Sample Survey**  
 (2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

**Part A**

(Answer **all** questions; each question carries **1** mark)

1. In linear systematic random sampling, an unbiased estimator of population mean is .....
2. In SRSWOR, probability of including any two specified units in to the sample of size  $n$  selected out of  $N$  units is.....
3. Sampling method in which there is equal probability of selection for each unit at each draw is.....
4. In cluster sampling, an unbiased estimator of population total is.....
5. Number of possible samples in a simple random sample without replacement of size "n" from a population of size  $N$  is .....
6. The collection of all possible samples, sequences or sets is called .....
7. Quota sampling, judgment sampling and convenience sampling are classified as types of  
 (a) Random sampling (b) Non random sampling  
 (c) Direct sampling (d) Indirect sampling
8. A combination of a sampling design and an estimator is called a  
 (a) Sampling frame (b) Sampling strategy  
 (c) Sampling technique (d) None of these
9. A population is heterogeneous with respect to the characteristic under study. Which sampling procedure would you prefer?  
 (a) SRSWR (b) Systematic sampling  
 (c) Stratified sampling (d) Cluster sampling
10. If  $n$  units are selected to a sample from a population of size  $N$  then the finite population correction is:  
 (a)  $\frac{n-N}{N}$  (b)  $\frac{N-n}{n}$   
 (c)  $\frac{N-n}{N}$  (d)  $\frac{n-N}{n}$
11. Sampling which consists in first selecting the clusters and then selecting a specified number from each cluster is  
 (a) Cluster sampling (b) Two-stage sampling  
 (c) Stratified sampling (d) Two phase sampling
12. A high level of non response to a survey  
 a. Create a bias that can be eliminated by increasing the sample size.  
 b. Will produce biased result due to non sampling error.  
 c. Is normal in research studies and should not be concern  
 d. Is a sampling error related to defining the sampling unit.

(12x1=12 Marks)

### Part B

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

13. What are the main limitations of sampling ?
14. Distinguish between estimate and estimator.
15. What is meant by optimal allocation and proportional allocation in stratified random sampling?
16. Distinguish between population and sample.
17. Give any two situations where sampling is inevitable.
18. What do you mean by two stage cluster sampling?
19. Show that sample mean is unbiased estimator of population mean when sampling is done by SRSWR.
20. Write down any four points to be considered while preparing a questionnaire?
21. Write a short note on SRSWR and SRSWOR.

(7x2=14 Marks)

### Part C

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

22. Write a short note on probability and non probability sampling, give examples.
23. Explain systematic random sampling, what are its advantages.
24. Write a short note on cluster sampling.
25. What are the principal steps in organizing a sample survey?
26. What is Neyman allocation in stratified sampling, obtain sampling variance of unbiased estimate of population mean under this allocation.
27. Define sampling and non sampling error with examples.
28. How will you determine sample size in SRSWOR for estimating population mean?
29. Write a short note on stratified random sampling.

(6x5=30 Marks)

### Part D

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

30. Show that sample proportion is an unbiased estimator of population proportion in SRSWOR. Also derive an estimate of variance of sample proportion.
31. Carry out a comparison between census and sampling.
32. If the population consists of a linear trend, then prove that

$$Var(\bar{y}_{st}) \leq Var(\bar{y}_{sys}) \leq Var(\bar{y}_{ran})$$

where the notations have their usual meanings.

33. In cluster sampling with equal cluster sizes obtain an unbiased estimator of population mean, obtain its sampling variance and compare the efficiency with SRSWOR.
34. In stratified random sampling give an unbiased estimator for population mean, when sampling in each stratum is done using SRSWOR also obtain its variance.

(3x8=24 Marks)

## FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2018

ST5B08– Operations Research &amp; statistical Quality Control

(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

## Part A

(Answer all questions; each question carries 1 mark)

1. A basic feasible solution which optimizes the objective function of the LP problem indefinitely is called
  - a) Indefinite solution
  - b) Infinite basic solution
  - c) Unbounded solution
  - d) Optimum solution
2. The Hungarian method is an algorithm which finds an optimal assignment for a given \_\_\_\_\_ matrix.
  - a) Cost
  - b) Objective
  - c) Constraint
  - d) Current feasible
3. For maximization LPP, the objective function coefficient for an artificial variable is
  - a)  $+M$
  - b)  $-M^*$
  - c)  $+1$
  - d)  $-1$
4. Control charts consist of
  - a) Three control lines
  - b) Upper and lower control limits
  - c) The level of the process
  - d) All the above
5. The graph of the proportion of defectives in the lot against average sample number is
  - a) OC curve
  - b) A.S.N curve
  - c) Power curve
  - d) All the above
6. The probability of rejecting a lot having  $\bar{p}$  as the process average defectives is known as
  - a) Consumers risk
  - b) Type II error
  - c) Producers risk
  - d) All the above.
7. Determination of the \_\_\_\_\_ and \_\_\_\_\_ are the two steps in graphical procedure of an LPP.
8. Dual of the \_\_\_\_\_ of an LPP is a primal.
9. If the lower control limit on  $p$  chart has a negative value then it is taken as \_\_\_\_\_
10. The cause leading to vast variation in the specifications of a product are usually due to \_\_\_\_\_
11. The \_\_\_\_\_ problem is a special case of the transportation problem.
12. The steeper the OC curve, \_\_\_\_\_ the discriminatory power.

(12 x 1=12 Marks)

### Part B

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

13. Write the dual of

Maximize  $Z = 3x_1 - 4x_2$  Subject to

$$3x_1 + 11x_2 \geq 20, \quad 4x_1 - 5x_2 \leq 12, \quad 5x_1 + 9x_2 \leq 30, \quad x_1 \geq 0, \quad x_2 \geq 0.$$

14. What do you mean by an *infeasible solution* to an LPP?

15. Outline Vogel's technique of finding a basic feasible solution for a transportation problem.

16. Differentiate between assignment problem and transportation problem.

17. What are the characteristics of control charts?

18. What are the reasons for variation in quality?

19. What do you understand by acceptance sampling?

20. Define consumer's risk and producer's risk.

21. What is Acceptance Quality Level?

(7 x 2 = 14 Marks)

### Part C

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

22. Explain in brief

i) Feasible solution

ii) Basic feasible solution

iii) Improved basic feasible solution

iv) Associated cost matrix

v) Optimal solution

23. Solve the following LPP using graphical method

Max  $Z = 3x_1 + 4x_2$  sub to

$$x_1 + x_2 \leq 450, \quad 2x_1 + x_2 \leq 600, \quad x_1 \geq 0, \quad x_2 \geq 0.$$

24. Define transportation problem and explain the North - West corner rule.

25. What is degeneracy in Transportation problem? Explain how it is solved.

26. Describe in detail about the control limits setting for mean.

27. Point out the situations that may indicate lack of control when using an  $\bar{x}$ -bar and  $R$  chart.

28. Distinguish between simple and double sampling plans.

29. Compare sampling inspection by attributes and inspection by variables.

(6x5=30 Marks)

### Part D

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

30. Solve the following LPP using simplex method

$$\text{Maximize } Z = x_1 + 3x_2 \text{ subject to } 3x_1 + 6x_2 \leq 8, \quad 5x_1 + 2x_2 \leq 10, \quad x_1 \geq 0, \quad x_2 \geq 0.$$

31. Solve the transportation problem

10	8	9	15
5	2	3	20
6	7	4	30
7	6	8	35
25	25	50	

32. Explain the following in detail

a) Construction of  $p$  chart

b) Construction of  $np$  chart

33. Compare attributes control charts and variable control charts.

34. Explain a double sampling plan and construction of the ASN curve for a double sampling plan.

(3 x 8 = 24 Marks)



FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE  
Fifth Semester B.Sc Statistics Degree Examination, November 2018  
ST5B09(P) – Practical – 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) From a study conducted by a manufacturing company, it is found that the sample correlation coefficient between lengths and weights of 15 articles is 0.75. Test the significance of this correlation for 5% level of significance?
- B) A tyre manufacturing company claims that the average life of their tyres is 38000 miles. A random sample 18 tyres was selected and it is found that the mean life of the selected tyres is 36500 miles with a standard deviation of 2100 miles. If it is assumed that the life of the tyres is normally distributed, test the significance of the claim for 5% level of significance.
- C) To investigate the effectiveness of a training programme 5 persons were selected and provide training. The IQ scores of these persons are calculated before and after the training and the results are as follows.

Candidate	1	2	3	4	5
Before	110	120	123	132	125
After	120	118	125	136	121

Assume the scores follow normal distribution and test the significance of the training programme for 1% level of significance

(6 + 6 + 8 = 20marks)

2. A) A random sample of the heights of 12 girls from standard IX shows a standard deviation of 2 cms and that of 16 girls from standard X shows a standard deviation of 4cms. Are the heights of girls from standard X more variable than the heights of girls from standard IX?
- B) One of the questions on the Subscriber study conducted by a business magazine was, "In the past 12 months, when travelling for business, what type of airline ticket you purchased most often?" The data obtained and given below:

Type of Ticket	Type of Flight	
	Domestic	International
First class	29	22
Business class	95	121
Economy class	518	135

Perform a statistical test to examine the independence of type of flight and type of ticket. What is your conclusion?

- C) Fit a Poisson distribution for the following data and test the goodness of fit.

x	0	1	2	3	4
Frequency	47	36	24	10	1

(7 + 7 + 6 = 20marks)

3. A) The mean time to locate flight information on Internet web sites of the major airline companies is generally 2 to 3 minutes. Sample results representative of the time for Airline A and Airline B are as follows:

Airlines	A	B
Sample size	32	34
Mean	2.5 minutes	2.1 minutes
Standard deviation	0.8 minutes	1.1 minutes

Formulate the hypotheses and test whether there is a significance difference between the mean times of Airlines or not?

B) In a random experiment of rolling a six faced die odd points appeared 184 times in 324 trials. Is it reasonable to think that the die is fair die?

C) In an election survey it is found that among 300 voters from district A 168 are supporting Mr. Kiran. Also from district B 96 out of 200 voters are supporting Mr. Kiran. Is he equally favorable in district A and district B?

(6 + 7 + 7 = 20 marks)

4. A) In an effort to estimate the mean amount spent per customer for dinner at a major restaurant, data were collected for a sample of 49 customers and it is found that the mean amount spent by the selected customers is Rs. 150. Assume a population standard deviation of Rs. 11 and construct a 95% confidence interval for population mean.

B) From a random sample of 16 items it is found to have the sample mean 41.5 inches with standard deviation 3.5 inches. Assume the data follows normal distribution and construct a 90% confidence interval for population variance.

C) A random sample of 500 pineapples was taken from a large consignment and 65 were found to be bad. Show that the proportion of bad apples almost certainly lies between 8.5 and 17.5.

(7 + 6 + 7 = 20 marks)

5. A) A) Apply Simpson's (i) one-third and (ii) three eights rule to find the value of

$$\int_0^1 \frac{dx}{1+x^2}$$

B) Determine the derivative of  $f(x)$  at  $x = 4$  from the following table using divided difference

$x$	1	2	4	8	10
$f(x)$	0	1	2	21	27

(10 + 10 = 20 marks)

6. Consider a population of 7 units with values 8, 5, 4, 1, 9, 2, 3
- Write down all possible samples of size 3 by SRSWOR from the population.
  - Verify that sample mean is an unbiased estimator of population mean.
  - Compare the efficiency of sample mean under SRSWOR and SRSWR for estimating population mean.

(6 + 6 + 8 = 20 marks)

B5N18326

(Pages : 2)

Reg. No: .....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics (Open Course) Degree Examination, November 2018

ST5D03- Basic Statistics

(2015 Admission onwards)

Max. Time: 2 hours

Max. Marks: 40

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

1. Given  $AM=24.6$ ,  $Mode=26.1$ , find the value of the median for a moderately asymmetrical distribution.
2. For a certain data, variance = 36 and  $CV = 5$  find the mean?
3. The square of standard deviation is known as.....
4. What are the limits of correlation?
5. State the relation between arithmetic mean, geometric mean and harmonic mean.

**(5 x 1 = 5 marks)****PART-B****Answer all questions. Each question carries two marks**

6. What are the axioms of probability?
7. Distinguish between quartile deviation and mean deviation.
8. Define random experiment.
9. What is meant by sampling and non-sampling errors?
10. State multiplication theory of probability.

**(5 x 2 = 10 marks)**

**PART-C**

*Answer any three questions. Each question carries five marks*

11. Distinguish between coefficient of variation and correlation coefficient.
12. Describe absolute and relative measure of dispersion.
13. Calculate geometric mean and harmonic mean for the numbers 1, 4, 8.
14. Write the merits and demerits of sampling.
15. (a) Define classical definition of probability.  
(b) State the probability conditions for which three events A, B, C are mutually independent.

**(3 x 5 = 15 marks)**

**PART-D**

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

16. Find standard deviation for the following data:  
Class: 0-5                      5-10                      10-15                      15-20                      20-25                      25-30  
f : 4                      8                      14                      6                      3                      1
17. Explain the meaning and significance of the concept of correlation
18. (a) What is the principle of least squares?  
(b) Describe how a straight line can be fitted to a given data.

**(1 x 10 = 10 marks)**