

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Degree Examination, November 2016

ST1C01 – Basic Statistics &amp; Probability

(2016 Admission onwards)

Max. Time: 3 hours

Max. Marks : 80

**PART - A**Answer *all* questions. Each question carries *one* mark**Fill in the blanks:**

1. The average which is not affected by extreme values is \_\_\_\_\_ .
2. If 10 is the mean of a set of 7 observations and 5 is the mean of a set of another 3 observations. The mean of the combined set is \_\_\_\_\_
3. The minimum value of the root mean square deviation is \_\_\_\_\_
4. In a moderately asymmetrical distribution,  $2\text{Mean} + \text{Mode} =$  \_\_\_\_\_
5. If the regression coefficients of X on Y and Y on X are -0.4 and -0.9 respectively, then the correlation between X and Y is \_\_\_\_\_
6. A simple outcome of a random experiment is called \_\_\_\_\_
7. From a pack of 52 cards, two cards are drawn. The probability that one is a king and the other is a queen is \_\_\_\_\_
8. If  $f(x) = \frac{1}{k}$ ;  $a \leq x \leq b$  is the probability density function of a continuous random variable X, then the value of k is \_\_\_\_\_

**Write True or False:**

9. If a constant C is added to all the observations in the data, the S.D is unaltered.
10. The range of multiple correlation coefficient is - 1 to + 1.
11. If A, B and C are three arbitrary events, the expression for the occurrence of at least one of the events is  $(A \cup B \cup C)^c$
12. If  $X_1$  and  $X_2$  are random variables and  $c_1$  and  $c_2$  are constants, then  $c_1X_1 + c_2 X_2$  is also a random variable.

(12 x 1 = 12)

### PART - B

Answer *any seven* questions. Each question carries *two* marks

13. Distinguish between census and sampling method.
14. For a certain data, the variance is 36, C.V is 5 and mode is 118. Find the mean and median.
15. What is regression?
16. What do you mean by partial correlation?
17. Explain the frequency approach to probability.
18. Show that  $P(A^c) = 1 - P(A)$
19. If  $P(A) = P(B) = P(B|A) = 0.5$ , examine whether A and B are independent.
20. Let X be a random variable with the following probability distribution:

$$\begin{array}{l} X \quad \quad \quad : \quad -1 \quad 0 \quad 1 \\ P(X = x) \quad : \quad \frac{11}{32} \quad \frac{1}{2} \quad \frac{5}{32} \end{array}$$

Find the probability distribution of  $Y = X^2 + 2$ .

21. Define distribution function of a random variable . What are its properties.

(7 x 2 = 14)

### PART - C

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

22. Explain the principle of least squares.
23. What is a scatter diagram? What conclusions can be drawn from it?
24. The coefficient of rank correlation between marks in Statistics and marks in Mathematics obtained by a certain group of students is 0.8. If the sum of squares of the differences in ranks is 33, find the number of students in the group.
25. For a distribution of the marks of 200 students, the mean and S.D were found to be 40 and 15 respectively. Later it was discovered that the score 43 was misread as 53 in obtaining frequency distribution. Find the corrected mean and S.D, corresponding to the corrected distribution.
26. State and prove Bayes' theorem.

27. The distribution function of a random variable is given by:

$$F(x) = \begin{cases} 0 & \text{if } x < -2 \\ \frac{x+2}{4} & \text{if } -2 \leq x < 2 \\ 1 & \text{if } x \geq 2 \end{cases}$$

(i) Find the pdf corresponding to  $F(x)$

(ii) Compute  $P\left(-\frac{1}{2} < X < \frac{1}{2}\right)$

(iii) Compute  $P(2 < X < 3)$ .

28. In a college, 25% students failed in Mathematics, 15% failed in Physics and 10% failed in both subjects. A student is selected at random.

- If he has failed in Physics, find the probability of his failure in Mathematics.
- If he has failed in Mathematics, find the probability of his failure in Physics.
- Find the probability of his failure in Mathematics or Physics.

29. Find  $C$  if  $F(x) = C\left(\frac{2}{3}\right)^x$ ;  $x = 1, 2, 3, \dots$  is a probability mass function. Also compute  $P(X \geq 3)$ .

(6x 5 = 30)

#### PART - D

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

30. Suppose that a prospective buyer tests bursting pressure of the samples of two polythene bags received from two manufacturers A and B. The test reveals the following results:

Pressure (in lbs.)	:	10 - 16	17 - 23	24 - 30	31 - 37	38 - 44
No. of bags: A	:	7	12	13	10	8
No. of bags: B	:	5	8	10	8	5

- Which manufacturer's bag, judging from these samples has highest bursting power average?
- Which of them is more uniform in bursting power?

31. In a partially destroyed laboratory record of an analysis of correlation data, the following results were obtained: Variance of  $X = 9$ , Regression equations are  $8x - 10y + 66 = 0$ ;  $40x - 8y = 214$ . What are

- The mean values of  $X$  and  $Y$
- S.D of  $Y$
- Correlation coefficient between  $x$  and  $Y$

32. The judges in a beauty contest ranked the ten competitors in the following order:

Chest no.	:	1	2	3	4	5	6	7	8	9	10
Judge 1	:	6	4	3	1	2	7	9	8	10	5
Judge2	:	4	1	6	7	5	8	10	9	3	2

Do the judges appear agree in their standards?

33. There are three similar coins, one of which is ideal and the other two are biased, with the chances of head and tail are respectively  $\frac{1}{3}$  and  $\frac{2}{3}$ . A coin is selected at random and tossed twice. If head occurs both times, find the probability that the ideal coin was selected.

34. The time in minutes that a person has to wait at a certain bus stop is found to be a random variable with probability density function given by

$$f(x) = \begin{cases} k, & 0 \leq x \leq 5 \\ kx, & 5 \leq x \leq 10 \\ 0, & \text{elsewhere} \end{cases}$$

- Determine  $k$
- Obtain the distribution function  $F(x)$
- Sketch the graph of  $f(x)$  and  $F(x)$ .

**(3 x 8 = 24)**

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**Part A**

Answer all questions.

**Fill in the blanks**

1. \_\_\_\_\_ is a positional average.
2. The relation between AM, GM, and HM is \_\_\_\_\_.
3. If CV = 100 then mean = \_\_\_\_\_.
4. The suitable measure of dispersion for an asymmetrical distribution is \_\_\_\_\_.

**Multiple Choice Questions**

5. The second quartile is always same as  
a. Mean                      b. Median                      c. Mode                      d. SD
6. The regression lines coincide when  
a.  $r = 0$                       b.  $r = -1$                       c.  $r = +1$                       d.  $R = 0$  and  $r = -1$
7. Range of multiple correlation coefficient is  
a.  $-1$  to  $+1$                       b.  $0$  to  $+1$                       c.  $-\infty$  to  $+\infty$                       d.  $-\infty$  to  $0$
8. If the regression coefficients are 0.1 and 0.9 then the correlation is :  
a. 0                      b. 0.1                      c. 0.9                      d. 0.3

**True or False**

9. Frequency definition provides posterior probability.
10. Classical approach of probability was introduced by Laplace.
11. Probability is always positive .
12. The distribution function is always continuous .

**(12 x 1=12)****Part B**

(Answer any seven questions)

13. Define GM and HM.
14. Define QD.
15. Define partial correlation coefficient.
16. Why there are two regression lines?
17. Define mutually exclusive and independent events. Give one example for each.
18. Write down the sample space for 'tossing a coin until a head appears'?

19. If  $n$  persons are seated around a table, what is the probability that two of them are always together?
20. Define continuous r.v. and give one example.
21. If the pdf of  $X$  is  $f(x) = a ; 0 < x < 1$ , find  $a$ ? (7 x 2 = 14)

### Part C

(Answer any six questions)

22. The average rainfall from Sunday to Friday was 5cm. Due to heavy rainfall on Saturday the average for the week has increased to 8cm. What is the rainfall on Saturday?
23. If the median of the following data is 46. Find the missing frequencies.
- |         |       |       |       |       |       |       |       |       |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|
| Class : | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | Total |
| Freq :  | 12    | 30    | —     | 65    | —     | 25    | 18    | 229   |
24. Explain the method of fitting an exponential curve using the method of least squares.
25. Define Karl Pearson's coefficient of correlation and show that it lies between -1 and +1.
26. Explain the Axiomatic definition of probability.
27. State and prove the addition theorem on probability for three events.
28. If pdf of  $X$  is given by
- $$f(x) = k / (1 + x^2) ; -\infty < x < +\infty$$
- Find  $k$  and the distribution function of the random variable  $x$ .
29. If a random variable  $X$  has pdf,  $f(x) = 1 ; 0 < x < 1$ . Find the pdf of  $Y = -\ln X$  (6 x 5 = 30)

### Part D

(Answer any three questions)

30. a) Derive the angle between the regression lines and comment on it.  
b) Show that the correlation coefficient is the GM of the regression coefficients.
31. State and prove Bayes theorem.
32. a) If the regression lines are  $x + 2y = 5$  and  $2x + 3y = 8$  and if variance of  $x = 12$  find  $\bar{x}, \bar{y}$  and  $V(y)$ .  
b) If  $\bar{x} = 10, \bar{y} = 90$ , SD of  $x = 3$ , SD of  $y = 12$ ,  $r = 0.8$  find the value of  $\bar{y}$  when  $\bar{x} = 100$
33. a) Define sample space,  $\sigma$ -field, probability measure and probability space.  
b) If  $(S, B, P)$  is a probability space and  $Q = P(A|B)$ ,  $P(B) > 0$ , show that  $(S, B, Q)$  is also a probability space.
34. If  $f(x) = kx(1-x)$ ,  $0 < x < 1$  is the pdf of  $X$  find  
a)  $k$       b) the cdf of  $X$       c)  $c$  such that  $P(X < c) = P(X > c)$

(3 x 8 = 24)