

Roll No.

Exam Code : D-23

Subject Code—15053

Dual Degree B.Sc. (Hons.)

Mathematics-M.Sc. Mathematics (Third
Semester) (Batch 2017 Onwards)

EXAMINATION

MATHEMATICAL STATISTICS

BML-305

Time : 3 Hours

Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting *one* question from each Section. Q. No. 1 is compulsory. All questions carry equal marks.

1. (a) Give geometric interpretation of arithmetic mean. 2
- (b) Find geometric mean of the observation given as follows : 2
 $20, 200, 2000, 2 \times 10^4, 2 \times 10^5, 2 \times 10^6$

- (c) Karl Pearson's coefficient of skewness of a distribution is 0.32, its standard deviation is 6.5 and mean is 29.6. Find the mode of the distribution. 3
- (d) The first three central moments of a distribution are 0, 15 and -31 . Find the moment coefficient of skewness. 3
- (e) State axioms of probability theory. 3
- (f) Define probability density of a random variable. 3
- (g) In regression analysis if X is independent variable and Y is dependent variable then comment on : 4
- (i) Corresponding to each value of X there is one value of Y .
- (ii) Corresponding to each value of X there is actually a distribution of values of Y .

Section I

2. (a) The A.M. of 25 items is found to be 78.4. If at the time of calculation, two items were wrongly taken as 96 and 43 instead of 69 and 34, find the value of correct mean. 7
- (b) The G.M. of wages of 200 workers working in a factory is Rs. 700. The G.M. of wages of 300 workers, working in another factory is Rs. 1,000. Find the G.M. of wages of all workers taken together. 7
- (c) The H.M. of the 200 observations is found to be 18. Later on, it was discovered that one item 20 was misread as 18. Find the correct value of H.M. 6
3. (a) The mean of 5 observations is 4.4 and the variance is 8.24. If three of the five observations are 1, 2 and 6, find the other two. 9

- (b) For a group of 50 male workers, the mean and standard deviation of their weekly wages are Rs. 63 and Rs. 9.60 respectively. For a group of 40 female workers, these measures are respectively Rs. 54 and Rs. 6. Find the S.D. for the combined group of 90 workers. 9
- (c) What is the significance of coefficient of variation ? 2

Section II

4. (a) Find the corrected values of the following moments using Sheppard's correction. The width of classes in the distribution is 10. 7
- (b) The first three moments of a distribution about the value 2 of the variable are 1, 16 and -40 respectively. Find the values of the first three moments about the origin. 7

- (c) Find the coefficient of variation of a frequency distribution with the help of the following information :

AM = 50, Mode = 56, Karl Pearson's

Coeff. of Skewness = -0.4 . 6

5. (a) Calculate the Kelly's coefficient of skewness for the following frequency distribution : 10

Daily Wages	No. of Students
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(in Rs.)

20-25	12
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25-30	16
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30-35	5
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35-40	4
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40-45	2
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45-50	1
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- (b) Obtain coefficient of kurtosis for the following data : 10

Income in Rs. (Below)	No. of Workers
90	8
110	11
130	18
150	19
170	24

Section III

6. (a) A die is loaded so that if D gives the score on this die, then $P[D = k] = \frac{k}{21}$, where $k = 1, 2, 3, 4, 5, 6$. Another die is loaded differently, so that if X gives the score on the die, then $P[X = k] = \frac{k^2}{91}$. Find $P[D + X = 4]$. 9

- (b) What is the least number of strangers whose birthdays you must ask in order to have a probability of at least $\frac{1}{2}$ of matching yours ? Assume that each stranger has birthday in a non-leap and you. also have birthday in a non-leap year. 9
- (c) Define random variable. 2
7. (a) Write four applications of distribution function of a random variable. 4
- (b) A fair die is tossed. If the resulting number is even, you add 1 to your score and get that many dollars. If the resulting number is odd, you add 2 to your score and get that many dollars. If X denotes

P.T.O.

the random variable counting your gain, in dollars. Then write probability distribution function of X . 8

- (c) A random variable X has probability mass function $p_X: \Omega \longrightarrow \mathbb{N}$ with $p_X(x) = \frac{C}{10^x}$ where C is a constant.

Find C . 4

- (d) A random variable X has distribution function :

$$F_X(x) = \begin{cases} 0, & x < 0 \\ \frac{x^2}{2}, & 0 \leq x < 1 \\ \frac{2}{3}, & 1 \leq x < 2 \\ \frac{3}{4}, & 2 \leq x < 3 \\ 1, & x \geq 3 \end{cases}$$

Draw graph of $F_X(x)$. 4

Section IV

8. (a) You know that line of regression of Y on X is given by $Y - \bar{Y} = b_{yx}(X - \bar{X})$.

Suppose $U = \frac{X - \bar{X}}{\sigma_X}$, $V = \frac{Y - \bar{Y}}{\sigma_Y}$. Then

write this equation in term of U , V and r , where r is correlation coefficient between X and Y . 4

- (b) Fit a straight line to the following data : 12

Values of Independent Variables	Values of Dependent Variables
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1	2.4
2	3
3	3.6
4	4
6	5
8	6

- (c) If correlation coefficient between X and Y is 0.8 and $\bar{X} = 10$, $\bar{Y} = 15$, $\sigma_X = 4$, $\sigma_Y = 6$, then find correlation coefficient between U and V , where $U = \frac{X-10}{4}$ and $V = \frac{Y-15}{\sigma}$. 4

9. (a) If $\sigma_Y = 2\sigma_X$ and correlation coefficient between X and Y is 0.3, then find angle between two lines of regression. 4

- (b) Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y): 16

X	Y
65	67
66	68
67	65
67	68

68	72
69	72
70	69
72	71

Also find line of regressions of Y on X
in two ways :

- (i) Using values of X and Y directly.
- (ii) Using standardised values.