7. Statistics I Paper (Stat.311), 2066

(Descriptive Statistics & Introduction to Probability)

Time : 3 hour Full Marks : 100

Attempt ALL the questions.

Group "A"

1. Compulsory Question. [5×3=15]

   Attempt any FIVE questions.

   a) Give the difference between ordinal scale and nominal scale.

   b) Discuss what you know about the classification and categorization. Write down the formula for estimating the number of classes required.

   c) For a number of 51 observations, the arithmetic mean and standard deviation are 58.5 and 11 respectively. It was found after the calculations were made that the one of the observations recorded as 15 was incorrect. Find the standard deviation of the 50 observations if this incorrect observation is omitted.

   d) Write down the normal equation in fitting the model $y = a + bx + cx^2$.

   e) If X and Y sare independent variates, prove that they are uncorrelated, that is $r_{xy} = 0$. Show by an example that the converse of theorem is not necessarily true.

f. Prove that the sum of two gamma variates with parameter 'n' and 'p' is also a gamma variate with parameter n + p.

Attempt any FIVE questions. [5×7=35]

9. State and prove Baye's theorem of probability.

10. Derive Poisson distribution from binomial distribution. Show that for a Poisson distribution the coefficient of variation is the reciprocal of its standard deviation.

11. Discuss the chief features of a normal distribution.

12. Obtain mean and variance of negative binomial distribution.

13. If X is a uniform random variable in the interval (a , b) then show that

$$E(X) = \frac{a+b}{2} \text{ and } var\ (X) = \frac{(b-a)^2}{12}.$$

14. Describe Beta and Gamma distribution . If X is a beta random variable finds E(X).

Statistics I Paper (Stat.311), 2067

Group 'A'

[5×3=15]

1. Compulsory Question.
   Attempt any Five questions.

   (a) The placement office at a university regularly surveys the graduates I year after graduation and asks for the following information. For each, determine the type of data.
      (i) What is your occupation ?
      (ii) What is your income ?
      (iii) What degree did you obtain ?
      (iv) How would you rate he quality of instruction (very good, good, fair, poor) ?

   (b) The number of sick days due to colds and flu last year was recorded by a sample of 15 adults. The data are 5, 7, 0, 3, 15, 6, 5, 9, 3, 8, 10, 5, 2, 0, 12 Compute mean, median and mode.

   (c) Give an example to show that zero correlation does not necessarily imply that the variables are independent.

   (d) For a moderately skewed distribution arithmetic mean 160, mode = 157 and standard deviation = 50.
      Find: (i) Coefficient of variation
            (ii) Pearsonian coefficient of skewness
            (iii) median

   (e) Define partial and multiple correlation.

   (f) According to the recent Nepal Highway Administration the percentage of ways in various road mileage related highway pavement conditions are

as follows : Poor 10%, Medicare 32%, Fair 22%, Good 20% and very good 16%. Construct a bark diagram.

Attempt any FIVE questions. [5×7=35]

2. Define standard deviation. Show that for any discrete distribution the standard deviation is not less than mean deviation from mean.

3. If the variable x and y are correlated by the equation $ax + by + c = 0$. Show that the correlation coefficient between them is −1 and a and b have same signs and +1 if they have opposite sings.

4. Fit a straight line to the following data, taking y as a dependent variable.

x:	1	2	3	4	5
y:	5	7	9	10	11

5. Give a brief idea of notations and terminology used in classification of attributes. From the following data prepare the 2 × 2 table and using Yule's coefficient discuss whether there is association between literacy and employment.

Illiterate unemployed	220 persons
Literate employed	20 persons
Illiterate employed	180 person
Total number of persons 500	

6. Discuss Spearman's rank correlation coefficient. The rankings of 10 individuals at the start and at the finish of a course of training are as follows:

Individual	A	B	C	D	E	F	G	H	I	J
Rank before	1	6	3	9	5	2	7	10	8	4
Rank after	6	8	3	7	2	1	5	9	4	10

Calculate Spearman's correlation coefficient.

7. A group of persons are measured their height (X), weight (Y) and chest expansion (Z) and product moment correlation coefficient Y_{XY}, Y_{YZ} and Y_{XZ} are calculated. Prove that $Y_{XY} + Y_{YZ} + Y_{XZ} \geq -3/2$.

Group "B"

8. Compulsory Question. [5x3=15]

Attempt any FIVE questions.

a) Define random experiment, event and sample space.

b) What is the expected value of the number of points obtained in a single throw with an ordinary die?

c) Find the parameter of the binomial distribution whose mean is 3 and variance 2.

d) If X is a continuous random variable with probability density function

$$f(x) = \frac{x}{6} + K, \, 0 \leq x \leq 3$$

$$= 0, \text{ otherwise}$$

then find K and P $(1 \leq x \leq 2)$

e) If a city has 2 accidents per day, how many accident free days do you expect for the city in the year 2011.

82

f) Prove that the sum of two gamma variates with parameters n and p is also a gamma variate with parameter n + p.

Attempt any FIVE questions. [5×7=35]

9. State Baye's theorem. Suppose a statistics class contain 70% male and 30% female students. It is known that in a test, 15% of male 10% of females got an "A" grade. If one student from this class is randomly selected and observed to have "A" grade, what is the probability that this is a male student?

10. Obtain mean and variance of Negative Binomial distribution.

11. Prove that for the normal distribution, the quartile deviation, the mean deviation and the standard deviation are approximately in the ratio 10: 12 : 15.

12. If X is Poisson variate with mean λ, show that $\frac{X - \lambda}{\sqrt{\lambda}}$ is a variable with mean zero and standard deviation unity.

13. If the waist measurements of 800 boys are normally distributed with mean = 66 cm and variance 25cm^2, find the number of boys with waist

(i) greater than or equal to 72 cm.

(ii) between 60 and 72 cm.

14. Discuss hypergeometric distribution. Show that the distribution tends to a binomial distribution as $N \to \infty$.

Statistics I Paper (Stat.311), 2068

Bachelor Level/I Year/ Sc. & Tech.+ Hum.
Full Marks: 75
Time: 3 hrs.

1. Compulsory Question. [5×3=15]

Attempt any FIVE questions.

(a) Establish the relation between $\bar{x}$ and $\bar{u}$ where x and u are variables and a and h are constant such that $u = \frac{x - a}{h}$.

(b) The means of, two sample of size 50 and respectively are 54 and 50 and standard deviations 8 and 7. Obtain the mean and standard deviation of the sample size 150 obtained by combining the two samples.

(c) Write down the normal equations in fitting the model $y = a\, e^{bx}$.

(d) A sample of shopper at a mall was asked the following questions. Identify the type of data each? question would produce, (i) What is your age? (ii) How much did you spend? (in)What is your marital status? (iv) Rate the availability of parking: excellent, good, fair or poor. (v) How many stores did you enter ?

(e) Define correlation coefficient and regression coefficient.

(f) Is it possible to get the following from a set of experimental data? $r_{12} = 0.6$, $r_{23} = 0.8$, $r_{31} = -0.5$

Attempt any FIVE questions. [5×7=35]

2. Distinguish between primary and secondary data. Discus the various methods of collecting primary data.

3. The first four moments of a distribution about the value 5 are 2, 20 40 and 50 respectively. Obtain, as far as possible, the various characteristics of the distribution on the basis of information given. comment upon the nature of the distribution.

4. Fit an exponential curve of the form $y = ab^x$ to the following data.

x:	1	2	3	4	5
y:	1	1.2	1.8	2.5	3.6

5. If two variables x and y are related as $y = a + bx$, show that $|r| = 1$.

6. Discuss Yule's coefficient of association.

   Given N = 820 (A) = 250, $(\alpha\beta) = 50$, (AB) = 35.

   Test the consistency of the data.

7. Show that for a trivariate distribution, the multiple correlation coefficient can be expressed in terms of total and partial correlation coefficients, such that

$$1 - R_{1.23}^2 = (1 - r_{12}^2)(1 - r_{13.2}^2)$$

Group "B"

8. Compulsory question   [5×3=15]

   Attempt any FIVE questions

   (a) Define random experiment, event and sample space.

   (b) For any two events A and B show that

   $P(\bar{A} \cap B) = P(B) - P(A \cap B)$.

   (c) If a balance coin is tossed two times. find the probability distribution for getting heads. Also find the expected number of heads.

   (d) Find whether the following function is a density function:

   $$f(x) = \frac{x^2}{3} - 1 < x < 2$$

   $= 0$, elsewhere.

   Also obtain $P(0 < x \leq 1)$.

   (e) Determine the binomial distribution for which the mean is 4 and standard deviation is $\sqrt{3}$.

   (f) State important properties of normal distribution.

Attempt any FIVE questions   [5×7=35]

9. What do you understand by union, intersection and complementation of events ? Three machines A, B and C produce respectively 60%, 30% and 10% of the total number of items of a factory. The percentage defective items of these machine are 2%, 3% and 4% respectively. An item is related at random and is found defective. Find the probability that the item was produced by machine A.

10. Define mathematical expectation of a random variable. If x and Y are two discrete random variables, prove that $E(X + Y) = E(X) + E(Y)$.

11. Under what conditions a binomial distribution turns into a Poisson distribution ? If $(x = 0) = P(x = 1) = K$ in a Poisson - distribution, show that $K = \frac{1}{e}$.

12. If x is a Poisson variate with mean μ, find the moment generating function of Z $= \dfrac{X - \mu}{\sqrt{\mu}}$, also obtain its limit when $\mu \to \infty$.

13. What is gamma distribution ? Find its mean and variance.

14. The marks on a midterm test are normally distributed with a mean of 78 and has a standard deviation of 6.

    (i)   What proportion of the class has a midterm marks of less than 73?

    (ii)   What proportion of the class has a midterm marks between 74 and 84 ?

Statistics I Paper (Stat.311), 2069

Bachelor Level/I Year/Sc. & Tech.+ Humanities   Full Marks : 100

(For: Regular Examinee only)   Time :3hrs.

GROUP 'A'

[5×3=15]

1. Compulsory Question.

    Attempt any FIVE questions.

    (a)   What is the type of data for each of the following variables?

        (i)   Student IQ ratings.

        (ii) Distance students travel to class

        (iii) Students scores on the class test

        (iv) A classification of students by state of birth

        (v) A ranking of students as freshman, junior, senior

        (vi) Number of hours students studying per week

    (b)   A researcher timed how long it took for each of 38 volunteers to perform a simple task. The results are shown in the table.

Time (second)	5-10	10-15	15-20	20-25	25-30
Frequency	2	6	13	12	5

    Draw a histogram and frequency curve to illustrate the data.

    (c)   Produce a set of data whose mean is 10 and standard deviation zero. Hence, find the median.

    (d)   Define correlation coefficient and regression coefficient.

    (e)   Is it possible to obtain the correlation coefficient from a set of experimental data?

           $r_{13} = -0.5$, $r_{12} = 0.6$, $r_{23} = 0.8$

    (f)   Write down the normal equations in fitting the model $y = ab^x$.

Attempt any FIVE   [5×7=35]

2. What do you mean by association attributes ? For two attributes A and B, we have (AB) = 8, (A) = 18, (αβ) = 5 and N = 35. Calculate the coefficient association.

3. For a discrete distribution show that $b_2 \geq 1$.

4. The following data give the measurement of armspan and height of the people.

Person	1	2	3	4	5	6	7	8
Armspan (inches)	68	62.25	65	69.50	68	69	62	60.25

Height (inches)	69	62	65	70	67	67	63	62

Find the correlation coefficient between armspan and height.

5. Show that if deviations are small compared with the mean M so that $\left(\dfrac{x}{M}\right)^3$ and higher power of $\dfrac{x}{M}$ may be neglected.

$$G = M\left(1 - \frac{\sigma^2}{2M^2}\right)$$

where σ is the standard deviation. M and G are respectively the A.M. and the G.M. of the variate X.

6. Show that for a trivariate distribution, the coefficient of multiple correlation can be expressed in terms of total and partial correlation coefficients, such that

$$1 - R_{1.23}^2 = (1 - r_{12}^2)(1 - r_{13.2}^2)$$

7. Distinguish between primary and secondary data. Discuss the various methods of collecting secondary data.

GROUP 'B'

8. Compulsory Question.   [5×3=15]

Attempt any FIVE questions

(a) Define each of these terms:

events, joint probability and conditional probability.

(b) For any two events A and B, show that

$$P(\bar{A} \cap B) = P(B) - P(A \cap B).$$

(c) If a balance coin is tossed two times, find the probability distribution for getting heads. Also find the expected number of heads.

(d) A random variable X has a binomial distribution with n = 6 and p = 0.6. Calculate (i) $P(X = 3)$ (ii) $P(X > 0)$.

(e) Verify whether the following function is a probability density function:

$$f(x) = \frac{x^2}{3}, \quad -1 < x < 2$$

$$= 0, \text{ otherwise}$$

Also obtain $P(0 < x : \leq 1)$.

(f) Prove that sum of two gamma variates with parameters n and p is also gamma variate with parameter n + p.

Attempt any FIVE questions.   [5×7=35]

9. State Baye's theorem. A factory has three machines A, B and C producing a large number of certain items. Of the total production of the items, 50% are produced on A, 30% on B and 20% on C. Records show that 2% of items produced on A are defective, 3 % of items produce on B are defective and 4% of items produced on C are defective. One item is chosen at random from a day's total production and found defective. Find the probability that it was produced on machine B.

10. What are the requirements for the Poisson distribution?

If $P(x = 0) = P(x = 1) = a$ in a poison distribution, show that $a = \dfrac{1}{e}$.

11. Define standard normal probability distribution. A normal population has mean 20 and standard deviation of 4.
   (i) Compute Z value associated with 25.
   (ii) What proportion of the population is between 20 to 25?

12. Define random variable. Distinguish between discrete and continuous random variables. If a and b are two constants and X is a stochastic variate, then prove that $V(ax + b) = a^2 V(x)$.

13. Discuss hypergeometric distribution. Show that the distribution tends to binomial distribution as $N \to \infty$.

14. Obtain mean and variance of a negative binomial distribution.

Statistics I Paper (Stat.311), 2070

Bachelor Level /I Year / Sc. & Tech. + Humanities

Full Marks: 100
Time: 3 hrs.

Group "A"

1. Compulsory Question.   [5×3=15]
Attempt any FIVE questions.

  (a) Give the difference between nominal scale and ordinal scale.

  (b) Describe the pie chart with a suitable example.

  (c) The first three moments of the distributions about the value 2 of the variables are 1, 16 and −40. Find mean, variance and skewness.

  (d) Write down the normal equations to fit the model $y = ab^x$ to the given set of data.

  (e) For two attributes A and B, we have (AB) = 8, (A) = 18, (αβ) = 5 and N = 35. Calculate the coefficient of association.

  (f) The simple correlation coefficient between temperature (X_1), corn yield (X_2) and rainfall (X_3) are $r_{12} = 0.59$, $r_{13} = 0.46$ and $r_{23} = 0.77$. Calculate the partial correlation coefficient $r_{12.3}$. Also $R_{2.13}$

Attempt any FIVE questions.   [5×7=35]

2. If A, G and H be the arithmetic mean, geometric mean and harmonic mean respectively of two positive numbers a and b, then prove that
  (1) $A \geq G \geq H$ (2) $G = \sqrt{A \times H}$

3. From the following data relating to the runs scored by two batsmen A and B in a series of innings, find out who is more consistent as a batsman.

A:	5	50	25	35	12	48	62	20	53	60
B:	40	25	18	65	10	49	42	38	22	51

4. What do you understand by skewness and kurtosis? Examine whether the following results of a piece of computation for obtaining the second moments are consistent or not.

n = 120	$\Sigma x = -125$	$\Sigma x^2 = 128$

5. Explain the method of least square as a tool for curve fitting. Fit a straight line to following data y as a dependent variable.

x:	1	2	3	4	5
y:	5	8	12	16	14

6. Define regression coefficient. Show that regression coefficients are independent of the change of origin but not of scale.

7. A group of persons are measured for their height (X_1), weight (X_2) and chest expansion (X_3) and product moment correlation coefficients r_{12}, r_{23} and r_{13} are calculated $r_{12} + r_{23} + r_{13} \geq -\frac{3}{2}$.

Group "B"

8. Compulsory Question. [5×3=15]

   Attempt any FIVE questions.

   (a) State the conditions for two events to be mutually exclusive and independent.

   (b) What is the expected value of the number of points obtained in the single throw with an ordinary die?

   (c) Check whether the following function is a density function or not.

   $$f(x) = \frac{1}{18} (3 + 2x) \text{ for } 2 \leq x \leq 4$$

   $$= 0 \text{ otherwise}$$

   (d) It has been found that on the average the number of mistakes per typed page of a typist is 1.5. Find the probability that there are exactly one mistake.

   (e) What are the properties of normal curve?

   (f) If X is a uniformly distributed random variable on (I, b) then show that

   $$E(X) = \frac{a+b}{2}$$

   Attempt any FIVE questions. [5×7=35]

9. State Baye's theorem. A survey asked a group of 400 people whether or not they were doing daily exercise. The responses by sex and physical activity are as in following table.

	Male	Female
Daily exercise	50	61
No daily exercise	177	112

   A person is selected.

   (i) What is the probability that this person is doing daily exercise?

   (ii) What is the probability that this person is doing daily exercise if we know that this person is male?

10. Discuss hypergeometric distribution. Show that the distribution tends to binomial distribution as $N \rightarrow \infty$.

11. Define random variable. Distinguish between discrete and continuous random variable. If a and b are two constants and X is a stochastic variate, then prove that $V(aX + b) = a^2V(X)$.

12. In a certain atric population, systolic blood pressure is normally distributed with mean 115 mm Hg. and standard deviation 10 mm Hg. Find the probability that a randomly selected child from this population will have:

   (i) A systolic pressure greater than 125 mm Hg.

(ii)   A systolic pressure less than 95 mm Hg.

13.   Obtain m.g.f. for the distribution

$$dp = y_0 e^{\frac{x}{\sigma}}\, dx,\ \sigma > 0,\ 0 \le x \le \infty.$$

y_0 being a constant. Hence show that its mean and standard deviation is equal to σ.

14.   What is gamma distribution? Obtain its moment generating function.

Statistics I Paper (Stat 101), 2070 (New course)

Four Year Bachelor Level/Science & Tech.   Full Marks: 100

Time: 3 hrs.

Group "A"

Attempt any FOUR questions.   [4×10=40]

1.   Define the term 'Statistics' and discuss it function and limitations.   [2+4+4]

2.   If the deviation $x_1 = X_i - M$ is very small in comparison with mean M and $\left(\dfrac{x_1}{M}\right)^3$ and higher powers of $\dfrac{x_1}{M}$ are neglected, prove that

$$V = \sqrt{\sqrt{\frac{2(M-G)}{M}}}$$

where G is the G.M. of $X_1, X_2, \ldots\ldots X_n$ variate values and V is the coefficient of variation.   [10]

3.   What is meant by kurtosis? Show that for a discrete distribution $\beta_2 \ge \beta_1$.   [3+7]

4.   What do you understand by correlation between two variables? For two variables X and Y with the same mean, the two regression equations are Y = aX + b and X = αY + β. Show that $\dfrac{b}{\beta} = \dfrac{1-\alpha}{1-\alpha}$

Also find the common mean.   [2+6+2]

5.   What is time series? What are its main components? Fit a trend line to the following data by the least square method

Year :	2010	2011	2012	2013	2014
Production (1000 tons) :	18	21	23	27	25

Estimate the production for 2015.   [2+2+5+1]

6.   Define cost of living index number. How cost of living index is used to determine the real wage? An enquiry into budgets of middle class families of a certain city on an average the percentage expenses on the different groups were: Food 45; Rent 15; Clothing 12; Fuel and Light 8 and Miscellaneous 20. The group index number for the current year as compared with a fixed base period were respectively 310, 150, 240, 200, 210. Calculate the cost of living index number for the current year.

Mr. X was getting Rs.22,000 in the base period. State how much he ought to have received in the current year to maintain his former standard of living?

[2+1+5+2]

Group "B"

Attempt any EIGHT questions. [8×5=40]

7. What is official statistics? Mention the basic components of official statistics. [2+3]

8. Explain the terms 'classification' and 'tabulation' of statistical data and point out their importance in statistical investigation. [3+2]

9. E Cornmerce.Com, a large internet retailer, is studying the lead time (elapsed time between when an order is placed and when

Land time (days)	0-5	5-10	10-15	15-20	20-25	Total
Frequency	6	7	12	8	7	40

   i. How many orders were studied ?
   ii. What is the midpoint of the first class ?
   iii. About how many orders are less than lead time 8 days ?
   iv. Draw a histogram and frequency polygon. [1+1+1+2]

10. What are the desirable properties for an average to possess? The A.M. of n numbers of a series is $\bar{X}$. The sum of the first $(n-1)$ terms is K. Show that n^{th} number is $n\bar{X} - K$. [2+3]

11. Show that for any discrete distribution standard deviation is not less than mean deviation from mean. [5]

12. The standard deviation of three numbers a, b, c is 3.2. Find the standard deviation of the three numbers
   i. 3a, 3b, 3c
   ii. a + 2, b + 2, c + 2
   iii. 2a + 5, 2b + 5, 2c + 5 [2+1+2]

13. What do you mean by skewness? The standard deviation of symmetrical distribution is 5. What must be the value fourth moment about mean in order that the distribution be (1) mesokurtic (2) leptokurtic (3) platykurtic. [2+1+1+1]

14. Show that the coefficient of correlation r between two variables X and Y is given by

$$r = \frac{\sigma_x^2 + \sigma_y^2 - \sigma_{x-y}^2}{2\sigma_x\sigma_y}$$

   where, σ_x^2, σ_y^2 and σ_{x-y}^2 are the variance of X, Y and X – Y respectively. [5]

15. If the lines of regression of Y on X and X on Y are respectively $a_1X + b_1Y + c_1 = 0$ and $a_2X + b_2Y + c_2 = 0$ prove that $a_1b_2 \le a_2b_1$. [5]

16. How do the additive and multiplicative models of time series differ from each other? Why is the multiplicative model the most commonly used assumption in time series analysis? [3+2]

17. Distinguish between stratified and systematic sampling. In which situation systematic sampling preferred to stratified sampling? [3+2]

Group "C"

18. Attempt All questi [10x2=20]
   (a) Differenti veen parameter and statistic.

90

(b) Identify the following quantitative variables as discrete or continuous.
  (i) Population in a particular area of Nepal.
  (ii) Weight of newspapers received for recycling on a single day.
  (iii) Time to complete a statistics exam.
  (iv) Number of voters in an election.

(c) The marks of 20 students in an assignment are as follows:
  51, 62, 84, 42, 50, 44, 65, 75, 65, 65, 65, 45, 72, 65, 61, 54, 65, 80, 48, 65
  Draw a Stem and leaf diagram. Find the modal marks.

(d) Differentiate between cross sectional data and time series data.

(e) The mean and standard deviation of 100 observations were found to be 40 and 12 respectively. Find sum of observations and sum of square of observations.

(f) If two regression coefficient are −0.2 and −0.8. What would the value of coefficient of correlation.

(g) Given two values x_1 and x_2, prove that A.M. $\geq$ G.M.

(h) The take-home pay of Mr. X and Consumer Price Index (CPI) for 2012 and 2014 are:

Year	Take-home pay	CPI (2010 = 100)
2012	Rs 25,000	140
2014	Rs 36,000	160

Calculate real income of Mr. X for 2012 and 2014.

(i) While fitting a straight line trend of the type $y = a + bx$, what is signified y, x, a and b?

(j) Particulars relating to the wage distribution of two manufacturing firms are as follows:

	Firm A	Firm B
Mean	Rs 1625	Rs 1850
S.D.	Rs 200	Rs. 175

Find which firm has more uniform wage distribution.

Statistics I Paper (Stat.101), 2071

Bachelor Level (4 Yrs.)/I Year/Science & Tech.

Full Marks: 100

Time : 3hrs.

Group "A"

Attempt any FOUR questions. [4×10=40]

1. Define statistics and discuss its scope and limitations. [10]

2. In a frequency table the upper boundary of each class interval has a constant ratio to the lower boundary. Show that the geometric mean G may be expressed by the formula

$$\log G = x_0 + \frac{C_0}{N} \Sigma f_i (i - 1).$$

where x_0 is the logarithm of the mid values of the first interval and C_0 is the logarithm of the ratio between upper and lower boundaries. [10]

3. Prove the following relation for Pearson's β - coefficient: [10]
$$\beta_2 > \beta_1 + 1.$$

4. From a partially destroyed laboratory only following records would be available: $x = 4y + 5$ and $y = kx + 4$ are the regression lines of x on y and y on x respectively, show that $0 \le k \le 1/4$, and if $k = 1/16$, find the means of two variables and coefficient of correlation. Also if the variance of $x = 9$, find the variance of y and covariance (x, y) when $k = 1/16$. [2+2+1+2+3]

5. What is a time series? What are its main components? Fit a trend line to the following data by the least square method:

Year	1	2	3	4	5
Value :	4	7	10	8	12

Also, estimate the value for sixth year. [2+2+5+1]

6. What is meant by deflating the index numbers? The employees of the Australian Steel Ltd. have presented the following data in support of their contention that they are entitled to a wage adjustment. Amounts shown represent the average weekly take-home pay of the group.

Year	2011	2012	2013	2014
Pay in Rs.	7,000	8,500	9,350	10,800
Index	5	130	138	145

   (i) Compute the real wages based on the take – home pay.
   (ii) Compute the real wages based on the take - home pay. Compute the index numbers of real wages assuming 2011 as base year.
   (iii) Compute the amount of pay needed in 2014 to provide buying power equal to that enjoyed in 2011. [2+3+3+2]

Group "B"

[8×5=40]

Attempt any EIGHT questions.

7. Explain failure time data and panel data. [5]

8. The following is the number of minutes to commute from home to work for a group of automobile executives.

43	29	28	25	48	37	41	19	32	26
35	23	23	36	31	26	21	32	25	31

   (i) What class interval would you suggest?
   (ii) Organize data into a frequency distribution
   (iii) Comment on the shape of the frequency distribution. [2 +1]

9. Find the standard deviation of the first 'n' natural numbers. [5]

10. The first three moments of a distribution about the value 2 of the variables are 1, 16 and −40. Find mean, variance and μ_3. Also find β_1. [2+2+1]

11. What do you understand by correlation between two variables? Show by an example that r = 0 though x and y are related. [2+3]

12. What do you understand by a population in a statistical sense? Distinguish between stratified and systematic sampling. [2+3]

13. State in brief the ir ses of index numbers. Calculate Fisher index number from the follow: [2+3]

	Item A		Item B		Item C	
	Price	Qty.	Price	Qty.	Price	Qty.
Base year	12	4	45	12	32	7
Current year	15	6	60	15	40	8

14. What purpose is served by time series analysis? The revenues of a chain of ice cream stores are listed for each quarter during the previous 4 years.

Quarter	Year			
	2011	2012	2013	2014
1	16	14	17	20
2	25	20	25	32
3	31	30	32	28
4	24	25	20	25

Determine the seasonal indexes. [1+4]

15. Define regression coefficient. Prove that the arithmetic mean of the regression coefficients is greater than the correlation coefficient if correlation is positive. [1+4]

16. If r be the range and $S^2 = \dfrac{1}{n-1} \sum\limits_{i=1}^{n} (x_i - \bar{x})^2$ be the variance of a set on f observation $x_1, x_2, \ldots, x_n$, then show that

$$S \le r \left(\frac{n}{n-1} \right)^{1/2}$$
[5]

17. What are the desirable properties for an average to possess? If A, G and H be the arithmetic mean, geometric mean and harmonic mean respectively of two positive numbers 'a' and 'b', then prove that $G^2 = A \times H$. [2+3]

Group "C"

18. Attempt All questions. [10×2=20]

(a) For each of the following examples of data, determine the type of scale.

(i) The number of miles jogeers ran per day.

(ii) The starting salaries of graduate of science program.

(iii) The months in which a firm's employees choose to take their vacation.

(iv) The final letter grades received by students in a statistics course.

(b) The maximum temperature °C, measured to the nearest degree, was recorded each day during June in Kathmandu with the llowing results:

32, 30, 28, 19, 28, 32, 30, 27, 28, 20,

18, 25, 28, 30, 32, 22, 22, 28, 28, 19

Draw a stem and leaf diagram to illustrate the temperatures and write down the modal temperature.

(c) Salt is packed in bags which the manufacturer claims contains 25 kg each. Eighty bags are examined and the mass x, kg, of each found. The result $\sum(x - 25) = 27.2$, $\sum(x - 25)^2 = 85.1$. Find the mean and standard deviation of masses.

(d) Karl Pearson's coefficient of skewness of a distribution is 0.32. Its standard deviation is 6.5 and mean 29.6. Find the mode of the distribution.

(e) In February 2013 the price for a commodity X was Rs.85 per kg. In March 2014 the price for the some commodity was Rs.98 per kg. Use February 2013 as base period to develop a simple index. By what percent has the cost of commodity increased?

(f) Differentiate between primary data and secondary data.

(g) While fitting straight line trend of the type y = a + bx, what is the signified y, x a and b.

(h) If the line of regression of Y on X : $Y = \frac{1}{4} X$ and the line of regression of X on Y : $X = \frac{1}{9} Y$, find correlation coefficient.

(i) Write the list of any four elements that a check list generally possesses.

(j) Draw a box plot from the following information:
Minimum value = 13, Q_1 = 15, Median = 18, Q_3 = 22 and maximum value = 30.

Statistics I Paper (Stat.101), 2072

Bachelor Level (4 Yrs. Prog.) I Year/Scice. & Tech.

Full Marks: 100
Time : 3 hrs

Group "A"

[4×10=40]

Attempt any FOUR questions.

1. Define the term statistics. Discuss the scope of statistics and point out its limitations.

2. What are the requisites of a good average? Prove that if deviations are small compared with the mean M so that $(x/M)^3$ and higher powers of x/M may be neglected, $G = M \left(1 - \frac{\sigma^2}{2M^2}\right)$, where M, G and σ are respectively Arithmetic Mean, Geometric Mean and Standard Deviation of variate x.

3. How does skewness differ from dispersion? Prove the following relation for Pearson's β-coefficients for skewness and kurtosis: $\beta_2 > \beta_1 + 1$.

4. Differentiate correlation and regression analysis. For two variables X and Y with the same mean the two regression equations are Y = aX + b and X = αY + β.

   Show that : $\frac{b}{\beta} = \frac{1-a}{1-\alpha}$. Also find the common mean.

5. What is a time series? Describe the uses of time series. How will you analyses the time series?

6. What is an index number? Explain briefly how Fisher's ideal index number is constructed. Justify its being called ideal.

Group "B"

7. What do you understand by official statistics? Mention the basic components of the official statistics.

8. What is a sample survey? In what respect it is superior to a census survey?

9. Measure of central tendency from the following distributions Compute appropriate.

Value	less than 100	100-120	120-140	140-160	160 and more
Frequency	5	12	18	10	5

10. Show that for any discrete distribution the standard is not less than the mean deviation from the mean.

11. Establish the relationship between the moments about mean and the terms of moments about any arbitrary point.

12. For the following bivariate data, find the correlation coefficient 'r', draw a scatter diagram and the comment on the value of 'r'.

X	−2	−1	0	1	2
Y	4	1	0	1	4

13. Define unexplained variation and explained variation in regression analysis.

14. Show that correlation coefficient is independent of change of origin and scale.

15. Sam Steward is a freelance Web page designer. Listed below are his yearly wages for several years between 2008 and 2014. Also included is an industry index for Web page designers that reports the rate of wage inflation in the industry. This index has a base period of 2006.

Year	Wage (Rs.)	Index (2006 = 100)
2008	1340	160
2010	1450	173
2012	1560	187
2014	1680	1 203

Compute Sam's real income for the selected years during the six-year period.

16. What do you understand by 'seasonal variations' in time series data? Explain with an example the utility of such a study.

17. Below are given the figures of the production of sugar (in 1000 quintals) of a factory.

Year	2011	2012	2013	2014	2015
Production	80	90	92	83	94

Fit a straight line trend by using method of least squares. Estimate the production for the year 2016.

Group "C"

18. Attempt All questions. [10×2=20]

   (a) Give two examples of ordinal scale and nominal scale of measurements.

   (b) A.M. and Median of 50 items are 100 and 95 respectively. At the time of calculations one item 85 was wrongly taken as 58. What is the correct values of mean and median?

c. A sample of 20 rods gave the following results for the length, x in cm. $\Sigma fx = 997$, $\Sigma fx^2 = 49711$. Calculate coefficient of variation.

d. Karl Pearson coefficient of skewness of a distribution is 0.32. Its standard deviation is 6.5 and mean is 29.6. Find the mode.

e. The coefficient of correlation between two variables X and Y is Their covariance is 10.2. The variance of X is 4, find the standard deviation of Y- series.

f. Give two properties of regression coefficients.

g. Suppose you have fitted a straight line trend: $Y = 85.4 + 2.5 X$. Origin 2010, X unit = 1 year. Y = Annual production of sugar in 1000 quintals, (i) What is the slope of the line? (ii) What is the monthly increase in the production?

h. From the following data, construct an index number for 2074 and 2075 taking 2070 as base, using simple aggregative method.

	In 2070	In 2074	In 2075
Price of sugar per kg	Rs 55	Rs 65	Rs. 68
Price of flour per kg	Rs 28	Rs 40	Rs 44

i. Give two formulae for constructing cost of living index number.

j. Write down the additive and multiplicative model of a time series.

8. Meteorology I Paper(Met. 311), 2066

Time : 3 hrs.   Full Marks : 100

Attempt TWELVE questions including Q.No. 1 and Q. No. 2 which are compulsory.

1. Differentiate between weather and climate. What are the factors affecting climate of Kathmandu Valley ? Explain qualitatively the relationship between increasing number of vehicles and air pollution.   [2+4+4]

2. Describe the composition and structure of the earth's atmosphere with a schematic diagram. Explain the importance of the presence of carbon dioxide in the atmosphere.   [6+4]

3. Define and explain briefly the dew point temperature , surface temperature, wetbulb temperature and virtual temperature.   [2+2+2+2]

4. What do you understand by temperature lapse rate ? Describe a typical diurnal variation of earth's surface air ter .perature.   [3+5]

5. Explain briefly the relationship between atmospheric air density and atmospheric pressure. What are the factors affecting atmospheric pressure of the earth ?   [4+4]

6. Describe forms and types of precipitation . Explain briefly the formation of precipitation.   [5+3]

7. What are the factors affecting evaporation. Explain a simple method of estimating evaporation.   [4+4]

8. Describe hydrological cycle of a catchment with a neat schematic diagram. [8]