15. Statistics I Paper (311) Descriptive Statics & Introduction to Probability

Exam 2066

Time: 3 hrs

Full Marks: 100

Group 'A'.

1. Compulsory Questions. [5×3=15]

Attempt any FIVE questions.

a) Describe multiple diagram with a suitable example.

b) State whether each of the following variables is qualitative or quantitative and indicate the measurement scale that is appropriate for each.

i)	Age	ii)	Class rank
iii)	Annual sales	iv)	Gender
v)	Temperature	vi)	Soft drink size (small, medium, large)

c) Write down the normal equation to fit the model $Y = ae^{bx}$.

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

e) The first three moments of a distribution about the value 1 are 2, 25 and 80 respectively. Find the mean, standard deviation and third moment about mean.

f) Define a class, frequency. Find the number of classes for classifying two dichotomous attributes.

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

2. What do you mean by statistics? Discuss its limitations.

3. For a discrete distribution show that $\beta_2 \geq \beta_1$.

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

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

5. What do you mean by independence of attribution? Give criteria of independence of attributes.

Given that $(A) = (\alpha) = (B) = (\beta) = N/2$,

Show that $(AB) = (\alpha\beta)$ and $(A\beta) = (\alpha\beta)$.

6. If X and Y are two uncorrelated variables and if $U = X + Y$ and σ_x and σ_y, the standard deviation of X and Y respectively.

7. A number of persons are measured for their height (X), weight (Y) and chest expansion(Z) and product moment correlation coefficients are calculated. Prove that $r_{xy} + r_{zy} + r_{zx} \geq -3/2$.

Group 'B'

8. Compulsory Questions. [5×3=15]

Attempt any FIVE questions.

a) A vendor has 25 helium balloons on string, out of which 10 balloons are yellow, 8 are red and 7 are green. What is the probability that two balloons selected at random by a buyer are yellow?

b) If A and B are independent show that A^C and B^C are also independent.

c) If a, b are two constants and X is a stochastic variate, then prove that $V(aX + b) = a^2 \text{ var } (X)$.

d) Define Hypergeometric distribution.

e) Suppose a book of 585 pages contains 43 topographical errors. If these errors are randomly distributed throughout the book, what is the probability that 10 pages, selected at random, will be free from errors?

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

$$f(x) = \frac{x}{6} + k, \ 0 \le x \le 3$$
$$= 0, \text{ otherwise}$$

Then find k and P $(1 \le x \le 2)$.

Attempt any FIVE questions. [5×7=35]

9. State Bay's theorem. A bottle manufacturing company has three machines A, B and C producing 20%, 30% and 50% of the total output respectively. 2%, 3% and 5% of their output (in the same order) are defective bottles. A bottle is chosen at random from the factory and is found to be defective. What is the probability that the bottles was produced by machine A?
10. Obtain the moment generating function of a binomial random variate. Show that the sum of two binomial random variates is a binomial random variate.
11. Show that
$cov(aX + bY + dY) = ac\ var(X) + bd\ var(Y) + (ad + bc)\ voc\ (X, Y)$.
12. Write down the properties of normal curve. If the waist measurements of X of 800 boys are normally distributed with μ = 6 cm and σ 5cm, find the number of boys with waist greater than or equal to 72 cm.
13. If X_1 and X_2 are independently distributed as Poisson random variates with parameters λ_1 and λ_2 respectively, find the probability distribution of $X_1 + X_2$.
14. Explain Negative Binomial distribution and calculate its mean and variance.

Exam 2067

Time: 3 hrs **Full Marks: 100**

1. Compulsory Questions. 5×3=15

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 the quality of instruction (very good, good, fair, poor)?

b) The number of sick days due to cold 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 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 bar 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 signs.
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 associated between literacy and employment.

Illiterate unemployment	220 persons
Literate employed	20 persons
Illiterate employed	180 persons
Total number of persons 500	

6. Discuss Spearman's rank correlation coefficient. The ranking 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 (Z0 and product moment correlation coefficient γ_{XY}, γ_{YZ} and γ_{XZ} are calculated. Prove that $\gamma_{XY} + \gamma_{YZ} + \gamma_{XZ} \geq -3/2$.

Group 'B'

8. Compulsory Questions. 5×3=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 accidents free days do you expect for a city in the year 2001.

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

Attempt any FIVE questions. 5×7=35

9. State Baye's theorem. Suppose a statistics class contain 70% make 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 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 72cm
   ii) between 60 and 72 cm.

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

Exam 2068

Group 'A'

Time: 3 hrs **Full Marks: 100**

1. Compulsory questions. 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 constants such that $u = \frac{x-a}{h}$.

b) The means of two sample of size 50 and 100 respectively are 54 and 54 and standard deviation 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 if fitting the model $y = ae^{bx}$.

d) A sample of shopper at a mall was asked the following questions. Identify the type of data each questions would produce. (i) what is your age? (ii) How much did you spend? (iii) 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. Discuss 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 ya re related as $y = a + bx$, show that $|r| = 1$.

6. Discuss Yule's coefficient of association.
   Given N = 820 (A) = 250, (αβ) = 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
   $1 - R^2_{1.23} = (1 - r^2_{12})(1 - r^2_{13.2})$.

Group 'B'

8. Compulsory questions. 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 the whether the following function is 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 importance properties of normal distribution.

Attempt any FIVE questions. 7×7=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 total number of items of a factory. The percentage defective items of these machines re 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 E(X + Y) = E(X) + E(Y).

11. Under what condition 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 to $Z = \frac{Z - \mu}{\sqrt{\mu}}$. Also obtain its limit when $\mu \to \infty$.

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

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

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

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

Exam 2069

Group 'A'

Time: 3 hrs **Full Marks: 100**

1. Compulsory Questions. 5×7=35

Attempt ALL the 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 score on the class test.

iv) A classification of students by state of birth.

v) A ranking of students as freshmen, junior, senior

vi) Number of hours students studying per week.

b) A researcher times 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 model $y = ab^x$.

Attempt any FIVE questions. 5×7=35

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

3. For a discrete distribution show that $\beta_2 \geq 1$.

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 mean M so that $\left(\frac{x}{m}\right)^3$ and higher poser of $\frac{x}{M}$ 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 AM. and the G.M. of the vaiate X.

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

$$1 - R^2_{1.23} = (1 - r^2_{12})(1 - r^2_{13.2})$$

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

Group 'B'

8. Compulsory questions. 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. Calculate (i) P(X = 3) (ii) P(X > 0).
   e) Verify whether the following function is a probability function:
   $f(x) = \frac{x^2}{3}, -1 < x < 2$
   $= 0$, 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 parameters n + p.

Attempt any FIVE questions. 5×7=35

9. State Baye's theorem. A factory has 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, 3% of items produced 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 Poisson distribution, show that $a = \frac{1}{e}$.

11. Define standard normal probability distribution. A normal populatin 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^2v (x).

13. Discuss hypergometric 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 (311)

Exam 2070

Full Marks: 100

Group "A"

Time: 3 hrs

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, ($\alpha\beta$)=5 and N=35 Calculate the coefficient of association.

(f) The simple correlation coefficient between temperature (X_1), corn yield (x_2) and rainfall (X3) are r12=0.59,r13=0.46 and r23=0.77. Calculate the partial correlation coefficient r12.3, Also K2.13.

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 number a and b, then prove that

(i) $A \geq G \geq H$ (ii) $G=\sqrt{A \times H}$

3. From the following data relating to the runs scored by two batsmen A and Bin series of innings, fine 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	$\sum x=-125$	$\sum x^2=128$

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 4_{13} are calculated $r_{12}+r_{23}+r_{13} \geq \frac{3}{2}$

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 point obtained in the single throw with an ordinary die?

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

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

$$+\ 0 \text{ otherwise}$$

(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 (l; 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 hyper geometric distribution. Show that the distribution tends to binomial distribution as $N \to \infty$

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 $V(aX+b) = a^2 V(X)$

12. In a certain pediatric population, systolic blood pressure is normally distributed with mean 115 mmHg. 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 $dp = y_0 e^{\frac{-x}{\sigma}}, \sigma > 0, 0 \le x \le \infty$

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.

16. Music Theory (311)

Exam 2066

Time: 1/2 hrs **Full Marks: 40**

प्रश्न नं. २ अनिवार्यसहित कुनै चार प्रश्नको उत्तर दिनुहोस् ।

१. १० थाट नै पूर्ण वा ३२ थाट चाहिन्छ । एक विचार व्यक्त गर्नुहोस् ।

२. नादको तारता (Pitch) र तिव्रता (Magnitude) लाई सम्फाउनुहोस् ।