**Link:**

[**https://www.transum.org/Maths/Activity/Graph/Desmos.asp**](https://www.transum.org/Maths/Activity/Graph/Desmos.asp)

**UNIT - III**

**30.05.2021**

Curve Fitting -Method of least squares

1. Fitting of a straight line:
2. Fitting of a parabola:
3. Fitting of an exponential curve:
4. Fitting of an exponential curve:

Fitting of a straight line

Normal equations are:

Fitting of a Parabola:

Normal equations are:

Fitting of an exponential curve:

Normal equations are:

After solving for and , take antilog to get back the original values.

Mean

Variance

Covariance

Correlation

Where

**Karl pearson’s coefficient of correlation**

**31.05.2021**

Spearman’s Rank Correlation Coefficient:

where

**Tie or Repeated Ranks:**

When there is repetition in ranks...

Here

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | Y | Rank | Rank |  |  |
| 78 | 124 | 7 | 3 |  |  |
| 89 | 123 | 4 | 7 |  |  |
| 79 | 124 | 6 | 3 |  |  |
| 89 | 124 | 4 | 3 |  |  |
| 89 | 125 | 4 | 5.5 |  |  |
| 98 | 125 | 1.5 | 5.5 |  |  |
| 98 | 126 | 1.5 | 1 |  |  |

Where correlation factor

Consider x:

98 is repeated twice, therefore

Correlation factor for 98

89 is repeated thrice, therefore

Correlation factor for 98

Consider y:

125 is repeated twice, therefore

Correlation factor for 125

124 is repeated thrice, therefore

Correlation factor for 124

Multiple correlation formula:

Regression line for on :

Where

and

From the tabulated value, how to find

Regression line for on :

Where

From the tabulated value, how to find

**Formula for correlation coefficient from given regression coefficients (say**  and  **):**

**For problems:**

[**https://www.brainkart.com/article/Solved-Example-Problems-for-Regression-Analysis\_37036/#:~:text=The%20two%20regression%20lines%20were%20found%20to%20be%204X%E2%80%935Y,and%202Y%3D5%E2%80%93X%20**](https://www.brainkart.com/article/Solved-Example-Problems-for-Regression-Analysis_37036/#:~:text=The%20two%20regression%20lines%20were%20found%20to%20be%204X%E2%80%935Y,and%202Y%3D5%E2%80%93X%20)**.**

**Partial Regression**

How to write regression equations:

Regression equation of on and :

Partial Correlation coefficient:

Regression equation of on and :

Partial Correlation coefficient:

Regression equation of on and :

Partial Correlation coefficient:

Computation of partial standard deviation:

**Relation between partial correlation coefficient and partial regression coefficients:**

**Multiple Correlation**

Multiple correlation coefficient is the simple correlation coefficient between a variable and its estimate.

The multiple correlation coefficient can be defined as the simple correlation coefficient between and its estimate .

Where

Total regression coefficient:

Where

Note:

Usually formula for Correlation is ratio of covariance and product of standard deviations of and

Ie.,

**UNIT II - Distributions**

Discrete Distributions

1. Bernoulli trial
2. Binomial Distribution
3. Poisson Distribution
4. Geometric Distribution
5. Discrete Uniform Distribution

Continuous Distributions

1. Normal Distribution
2. Exponential Distribution
3. Gamma Distribution
4. Continuous Uniform Distribution

**Bernoulli trial**

Let be the probability that an event will happen in any single Bernoulli trial (called the *probability of success*). Then is the probability that the event will fail to happen in any single trial (called the *probability of failure*).

Moment Generating Function,

Binomial Distribution

The probability that the event will happen exactly times in trials (i.e., successes and failures will occur) is given by the probability function

The special case of a binomial distribution with is also called the *Bernoulli distribution*.

Properties of Binomial Distribution:

1. Mean
2. Variance ; standard deviation
3. Moment Generating Function, M.G.F. ,
4. Characteristic Function,

Formula:

Mean

Find the M.G.F. of Binomial Distribution:

kth moment of a random variable :

First Moment:

Put ,

Second Moment:

Put ,

Variance:

Hence,

Characteristic Function

Poisson Distribution:

Poisson distribution may tend to Binomial Distribution for a large n ie., and for a small p i.e,

Let be a discrete random variable that can take on the values 0, 1, 2, . . . such that the probability function of is given by

Properties of Poisson Distribution:

1. Mean
2. Variance ; standard deviation
3. Moment Generating Function, M.G.F. ,
4. Characteristic Function,

Derivation of Moment Generating Function, M.G.F. ,

Formula:

kth moment of a random variable :

First Moment:

Take log on both sides,

Differentiate with respect to ,

Second Moment:

Take log on both sides,

Differentiate with respect to ,

Put ,

Variance:

Hence,

Derivation of Characteristic Function,

Geometric Distribution

Suppose a discrete random variable has the following probability mass function, p.m.f. Then is said to have geometric distribution with parameter .

Derivation of Moment Generating Function, M.G.F.:

Formula:

First Moment:

Second Moment:

Variance:

Hence,

Discrete Uniform Distribution

A random variable X has a discrete uniform distribution if each of the n values in its range, say has equal probability. Then, where represents the probability mass function (PMF).

Mean of is

Variance of is

Continuous Distributions:

Normal Distribution:

The probability density function for Normal Distribution is

M.G.F.

First moment:

Second moment:

Variance:

Exponential Distribution

A continuous random variable X is said to have an Exponential distribution if it has probability density function

where is the rate of the distribution.

In the study of continuous-time stochastic processes, the exponential distribution is usually used to model the time until something happens in the process.

Moment Generating Function:

Mean:

Second moment:

Variance:

Definite Integral:

Indefinite integral:

Gamma Function:

Example:

Gamma distribution:

A random variable  has a ***gamma distribution*** with parameters , write , if  has pdf given by

Moment Generating Function:

Extension of Integration by parts:

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Hint:

Find mean and variance using moments formula...

Bivariate Distribution:

Joint probability density function, joint pdf:

Marginal Distribution:

The marginal pdf of Y is:

The marginal pdf of X is:

The conditional pdf of the conditional distribution is

The conditional pdf of the conditional distribution is