

**BAHRIA UNIVERSITY - Karachi Campus**

**FALL SEMESTER – 2022**

**Quiz - 3:**

**Random Variable to Time Series**

**Assigning Date**: January 24, 2022 **Due Date**: January 24, 2022

**Marks**: 2.5

**Submission Criteria**:

1) Complete the handwritten solution by blue pen only on any kind of pages.

2) Write your name, registration number and page number on every page until the last page.

3) Take clear images of solution properly, be conscious about brightness, cropping, etc.

4) Convert all images into the .pdf format.

5) Combined all pdf files sequence wise.

6) No other format of the document will be accept for marking.

1. **Random Variable to Time Series**

Define any ten of the following terms: **(2.5)**

1. Discrete Random Variable

A random variable defined over a discrete sample space is called discrete random variable

1. Continuous Random Variable

A random variable defined over a continuous sample space is called a continuous random variable.

1. Change of origin

Change of origin means some value has been added or subtracted in the f(x)

F(x)=x+a

1. Change of Scale

Change of scale means some value is multiplied or divided to in the f(x)

F(x)=2x

1. Discrete Probability Distribution

A table listing all possible values that a discrete random variable can take along with its associated probabilities is called discrete probability distribution

1. Continuous Probability Distribution

A probability distribution in which the random variable X can take on any value (is continuous). Because there are infinite values that X could assume. The normal distribution is one example of a continuous distribution.

1. Probability Mass/ Density Function

A probability mass function (PMF) is the representation of the discrete random variable and associated probabilities.

A probability density function (PDF) is the representation of the continuous random variable and associated probabilities.

1. Cumulative Density Function

The **Cumulative Distribution Function (CDF)**, of a real-valued random variable X, evaluated at x, is the probability function that X will take a value less than or equal to x. It is used to describe the [probability distribution of random variables](https://byjus.com/maths/probability-distribution/) in a table.

1. Mean by using mathematical expectations

E(X)=∑[xn f(xn)]

1. Variance by using mathematical expectations

variance=E(X2)-E(X)

1. Any two Properties of mathematical expectations

E(a)=a

E(Ax)=E(X)-a

1. Union of two independent events

P(A∪B) =P(A)+P(B)

1. Union of two dependent events

P(A∪B) =P(A)+P(B)−P(A∩B)

1. Standard deviation by using mathematical expectations

Standard deviation=√ E(X2)-E(X)

1. Importance of control charts
2. Regression Equation Concept

Regression analysis is a statistical method that helps us to analyze and understand the relationship between two or more variables of interest.

1. Sample Linear Correlation

A correlation or simple linear regression analysis can determine if two [numeric variables](http://sites.utexas.edu/sos/variables/) are significantly linearly related.

Chart

Description automatically generated

1. Population Linear Correlation

Table

Description automatically generated with low confidence

1. Graph of two perfect positive correlated variables
2. Graph of two perfect negative correlated variables
3. Graph of two weak positive correlated variables
4. Graph of two weak negative correlated variables

Chart, shape, polygon

Description automatically generated

Table

Description automatically generated

1. Binomial Distribution

It can be thought of as simply the probability of a SUCCESS or FAILURE outcome in an experiment that is repeated multiple times

* The number of trials n must be fixed
* Each trial is independent of other
* The probability of success or failure is same from one trial to another

1. Poisson Distribution

Poisson distribution gives us the probability of a given number of events happening in a fixed interval of time.

1. Standard Normal Distribution

A type of normal distribution where mean = 0 and standard deviation=1

1. Generalized Normal Distribution

Data is symmetrically distributed with no skew when plotted on a graph most values cluster around a central region.

1. Normal Distribution pattern via sigma, two sigma and three sigma

We can extend our graph towards the outliers using sigma, two sigma and three sigma

There is 68% data present between one sigma

95% data present between two sigma

99.7% data present between three sigma

1. Component of Time Series Trend

**Secular Trend**

The trend is the long-term pattern of a time series. A trend can be positive or negative depending on whether the time series exhibits an increasing long-term pattern or a decreasing long-term pattern. If a time series does not show an increasing or decreasing pattern, then the series is stationary in the mean.

**Cyclical component**

Any pattern showing an up and down movement around a given trend is identified as a cyclical pattern. The duration of a cycle depends on the type of business or industry being analyzed. **Seasonal component**

Seasonality occurs when the time series exhibits regular fluctuations during the same month (or months) every year, or during the same quarter every year. For instance, retail sales peak during the month of December.

**Irregular component**

This component is unpredictable. Every time series has some unpredictable component that makes it a random variable. In prediction, the objective is to “model” all the components to the point that the only component that remains unexplained is the random component.

1. Composition Time Series Trend

**Multiplicative Model**

Y= T × C × S × I

**Additive Model**

Y= T + C + S + I

1. Decomposition of Time Series Trend

**1-VARIABLE:**

Y/T=C ×S× I

Y-T=C+S+I

**2-VARIABLE:**

Y/TC=S× I

Y-T-C=S+I

**3-VARIABLE:**

Y/TCS= I

Y-T-C-S=I

Best Wishes