**Q8.) Consider the standard normal, Student’s t, χ2, and the Fisher-Snedecor distributions.**

**a) Describe these distributions.**

A standard normal distribution (sometimes known as a bell curve) is a distribution used to represent variables whose distributions are not known. According to the central limits theorem, the averages of samples of random variable observations independently drawn from independent distributions converge to become normally distributed when the observations are sufficiently large. A standard normal distribution will always appear as a symmetrical bell-shaped curve.

A Student’s t distribution is a distribution that arises when estimating the mean of a normally distributed population in situations such that sample sizes are small and the population standard deviation is unknown. A Student’s t distribution appears like a symmetrical bell-shaped curve (same as the normal standard distribution).

A χ2 (chi-squared) distribution is a distribution of a sum of the squares of k independent standard normal random variables with k-degrees of freedom. The line of the chi-squared distribution depends on the degrees of freedom available.

A Fisher-Snedecor (F) distribution is the ratio of two variance estimates. The distribution is used to in analyses of variance to compute probability values.

**b) Discuss their use.**

Standard Normal Distributions are widely used in physical, chemical, and biological sciences. Any phenomenon that has a quantitative mean and variance in distribution can be analyzed using a standard normal disturbution.

The Student’s t test uses a Student’s t distribution to determine if two sets of data are statistically significant from each other.

The Chi-square test uses the chi-square distribution to evaluate the likelihood of observed differences in categorical data arising by chance.

Fisher-Snedecor distributions are used for Analyses of Variance and Multivariate Analyses of Variance.

**c) Discuss the relationship amongst them.**

The F distribution can be defined as the distribution of the ratio of two independent chi-squared random variables, each divided by their respective degrees of freedom.

Two datasets analyzed for similarities t test can be analyzed in chi-square test so long as each dataset is divided into categories. The t distribution is used to analyze whether differences between samples is significant, whereas the chi-square is used to determine if a relation between samples exists.

**d) Where does the binomial distribution ﬁt in?**

A binomial distribution is the probability distribution of binomial random variables, which are the number of successes [x] in [n] repeated trials. A binomial distribution requires multiple comparisons with repeated trials, whereas standard normal, Student’s t, chi-squared, and F distributions require only a single comparison.

**e) Why are we so obsessed with the standard normal?**

The only two statistics needed to establish a standard normal distribution is a mean and a variance. More complex distribution can be understood as modifications of the standard normal. Any natural phenomenon for which observations follow the Central Limits Theorem can be studied using the standard normal distribution.