

## Assignment 3

### Probability Distribution

[Total Marks = 50, Due Date: 10/11/2021]

**Problem I:** From a list of 17 probability distributions each of you have been assigned 2 distributions(run the attached R code to know your distribution). For the probability distribution function(PDF) visit the corresponding wikipedia page. For each distribution you have to derive/find/calculate followings:

[Marks: 40]

1. Cumulative distribution function (CDF)
2. Quantile function
3. Mean
4. Median
5. Mode
6. First Quartile(Q1)
7. Third Quartile(Q3)
8. Variance
9. Average Absolute Deviation(MAD)
10. Skewness
11. Kurtosis
12. Entropy

**Note:-** For some distributions you may find that some of the statistics(i.e. some from the above list of 1 to 12) is “not defined”. In those cases you have to prove that its not defined. For example, mean for Cauchy distribution is not defined and its easy to prove that since the definite integral  $\int_{-\infty}^{\infty} f(x) dx \propto \tan^{-1}(\pi/2)$  and so on.

**Problem II:**  $E( )$  represents expectation.

1. If  $X$  and  $Y$  are random variables, then prove that  $E(X + Y) = E(X) + E(Y)$  when
  - (a)  $X$  and  $Y$  are discrete random variables
  - (b)  $X$  and  $Y$  are continuous random variables.
2. If  $X$  and  $Y$  are **independent** random variables, then prove that  $E(XY) = E(X)E(Y)$  when
  - (a)  $X$  and  $Y$  are discrete random variables
  - (b)  $X$  and  $Y$  are continuous random variables.

[Marks: 5+5]