

DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
Assignments

Course: Experimental Methods
No. of students:31

Course No: PH51001
Total marks: 20

Please submit assignment no. 1 by the 31st of October, whereas assignment no.2 on or before 30.11.2022

1. The central limit theorem states that for a **large** sample size n , the **sample mean** \bar{x} follows a **normal/Gaussian** distribution with a mean μ , and standard deviation $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$; where, μ and σ are the mean and standard deviation of the **population**.

However, the notion of **large** sample size is **vague**. **This assignment aims to understand/assess the realistic value** of n , for which the central limit theorem **is applicable**. Using a programming language (of your choice, but Python/Matlab is preferable)-based simulation execute the following.

- a. Show that **regardless of the sample size**, the sample mean of a random sample of a normally distributed population exhibits a **normal/Gaussian** distribution.
- b. Consider two skewed population distributions (Poisson and Exponential) to show there exists a **threshold** sample size n , above which the central limit theorem is nominally applicable.

Please use histogram plots to discuss your results. At the end of the result, please provide the “simulation code” that you used in a consolidated form.

[10]

2. Write an essay (term paper) summarizing your understanding of an experimental technique of your choice. The paper should highlight the underlying theory, working principle, application, and an example. Your discussion **should not exceed three pages**, and you are allowed to **pick a technique mentioned in the syllabus** regardless of whether it is covered or not covered in the class.

[10]