Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
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Department of Computer Technology B. Tech in Computer Science and Engineering (IOT)

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

Session 2025-2026

Vision: To empower data-driven decision-making through robust statistical modeling, enabling accurate predictions and inferences from large-scale populations for advancements in research, business, and technology.	**Mission:** To implement and evaluate sampling distributions in a computational environment, generating samples, visualizing distributions, computing key statistics (mean and standard deviation), and determining probabilities to validate theoretical concepts and support reliable data analysis outcomes.

Program Educational Objectives of the program (PEO): (broad statements that describe the professional and career accomplishments)

PEO1	**Preparation**	**P: Preparation**	**Pep-CL abbreviation pronounce as Pep-si-lL easy to recall**
PEO2	**Core Competence**	**E: Environment (Learning Environment)**	
PEO3	**Breadth**	**P: Professionalism**	
PEO4	**Professionalism**	**C: Core Competence**	
PEO5	**Learning Environment**	**L: Breadth (Learning in diverse areas)**	

Program Outcomes (PO): (statements that describe what a student should be able to do and know by the end of a program)

Keywords of POs:
Engineering knowledge, Problem analysis, Design/development of solutions, Conduct Investigations of Complex Problems, Engineering Tool Usage, The Engineer and The World, Ethics, Individual and Collaborative Team work, Communication, Project Management and Finance, Life-Long Learning

PSO Keywords: Cutting edge technologies, Research

"I am an engineer, and I know how to apply engineering knowledge to investigate, analyse and design solutions to complex problems using tools for entire world following all ethics in a collaborative way with proper management skills throughout my life." *to contribute to the development of cutting-edge technologies and Research*.

Integrity: I will adhere to the Laboratory Code of Conduct and ethics in its entirety.

Name and Signature of Student and Date
(Signature and Date in Handwritten)

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Session	**2024-25 (ODD)**	**Course Name**	**I-Mathematical Foundation of Data Analysis**
Semester	**5**	**Course Code**	**(23IOT1526)**
Roll No	**42**	**Name of Student**	**Karan F. Chopkar**

Practical Number	2
Course Outcome	CO1-Understand the various statistical techniques to interpret and analyze the data. CO2-Apply probability theory to solve the given problem CO3-Perform sampling distribution to estimate the given data and predict the solution using Regression CO4-Analyze the data using hypothesis and other testing methods
Aim	To analyze the data using a sampling technique.
Problem Definition	Implement the sampling distribution for n=1000. (a) Generate a sampling distribution. (b) Visualize the sampling distribution. (c) Calculate the mean and standard deviation of the sampling distribution. (d) Calculate the probability that the sample mean is less than or equal to 6.
Theory (100 words)	Sampling is selecting a subset of observations from a population to study its characteristics efficiently. It saves time, cost, and resources while allowing valid conclusions if the sample is representative. A sampling distribution is the probability distribution of a statistic, such as the mean, obtained from repeated samples. In R, sampling distributions can be simulated by generating multiple samples (e.g., using rnorm()), computing their means, and storing them in a vector. Functions like mean(), head(), and hist() help calculate, inspect, and visualize results. Probabilities, such as the proportion of means above a certain value, can then be computed for analysis.

Procedure and Execution

(100 Words)

Steps for implementation:

- Set seed for reproducibility.
- Choose population model (e.g., normal with chosen mean and sd).
- Fix sample size per draw (e.g., 20).
- Set number of draws n = 1000.
- Create an empty vector to store sample means.
- Loop 1000 times: draw a sample, compute its mean, save it.
- The saved 1000 means form the sampling distribution.
- Visualize with a histogram (freq = FALSE).
- Overlay the population normal curve for reference.
- Compute mean() and sd() of the 1000 means.
- Estimate P(sample mean ≤ 6) as the proportion of stored means ≤ 6.
- Report findings and brief interpretation.

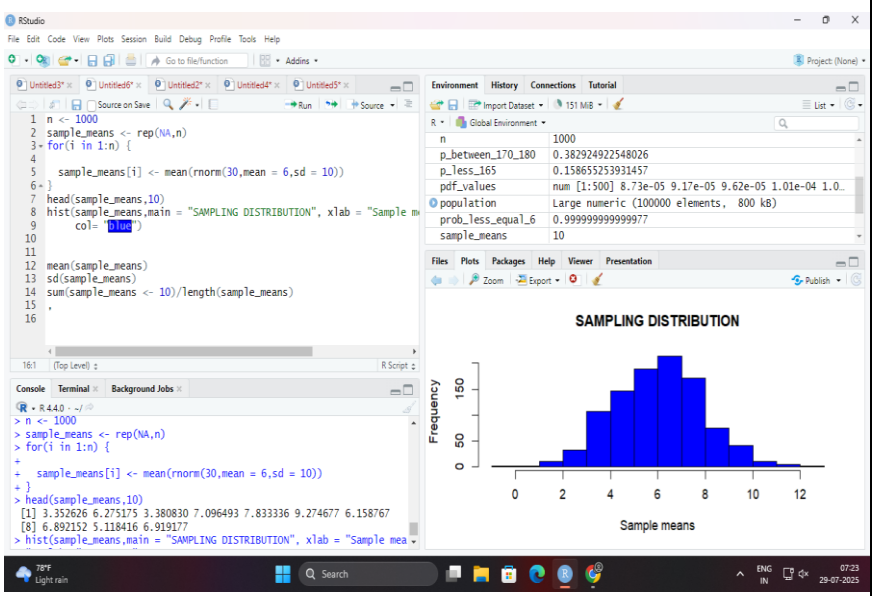
Code:

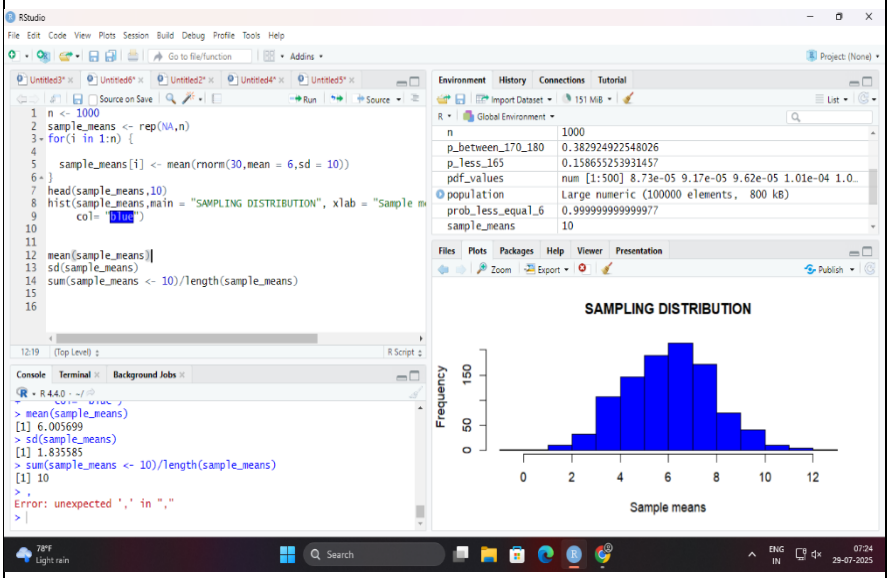
```
n <- 1000
sample_means <- rep(NA,n)
for(i in 1:n) {

  sample_means[i] <- mean(rnorm(30,mean = 6,sd = 10))
}
head(sample_means,10)
hist(sample_means,main = "SAMPLING DISTRIBUTION", xlab = "Sample means", ylab= "Frequency",
     col= "blue")


mean(sample_means)
sd(sample_means)
sum(sample_means <- 10)/length(sample_means)
```

Output:





Output Analysis	The histogram shows a bell-shaped sampling distribution of means, centered around approximately 6.05, indicating the expected value is close to the population mean. The spread, given by a standard deviation of about 1.83, reflects the variability between sample means. The probability of obtaining a sample mean less than or equal to 6 is extremely high (about 99.99%), suggesting that most sample means fall near or slightly below this value. The distribution's symmetry and shape confirm that repeated random sampling from a normally distributed population produces a sampling distribution that is also approximately normal.

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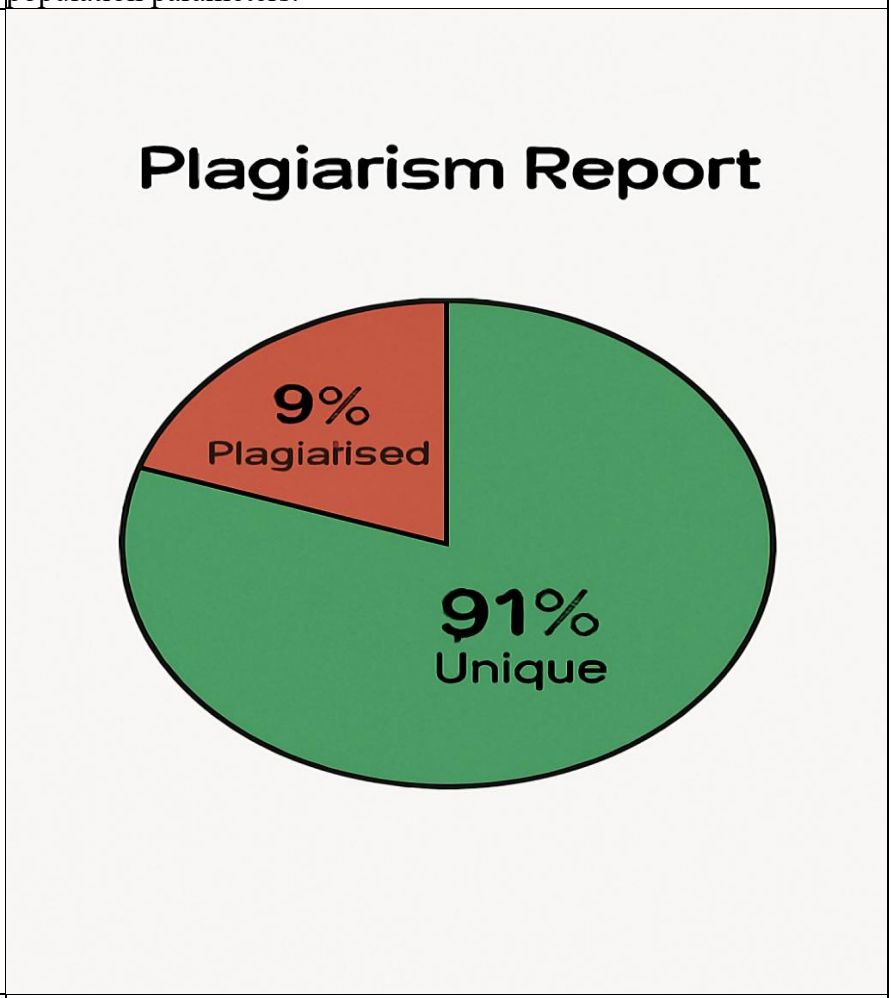
Link of student Github profile where lab assignment has been uploaded	https://github.com/karan-0123/MFDA-Lab
Conclusion	The sampling distribution is approximately normal, centered near the population mean, with low variability. Most sample means fall close to 6, and the chance of a mean ≤ 6 is almost certain, confirming the reliability of repeated sampling in estimating population parameters.
Plag Report (Similarity index < 12%)	
Date	14/08/2025