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
NAAC A++
Ph.: 07104-237919, 234623, 329249, 329250 Fax: 07104-232376, Website: www.ycce.edu

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

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Session 2025-2026

Vision: To enable data-driven insights into human physical characteristics, fostering better health, urban planning, and demographic studies for inclusive and informed societal development.	**Mission:** To model and simulate height distributions using R's probability tools, calculating key probabilities and percentiles to understand population trends, validate assumptions, and support evidence-based decision-making in public health and research.

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)

Session	**2025-26 (ODD)**	**Course Name**	**Mathematical Foundation Of Data Analysis**
Semester	**5**	**Course Code**	**23IOT1306**
Roll No	**42**	**Name of Student**	**Karan F. Chopkar**

Practical Number	**1(B)**
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	Solve the problems using probability distribution in R for continuous random variable.
Problem Definition	You are analyzing the distribution of heights among adult males in a particular city. Previous studies suggest that the height follow a normal distribution with a mean (μ) of 175 cm and a standard deviation (σ) of 10 cm. Tasks: 1. Plot the Probability Density Function (PDF): o Use R to plot the PDF of the normal distribution with the given parameters. 2. Calculate Probabilities: o Calculate the probability that a randomly selected adult male is shorter than165 cm. o Calculate the probability that a randomly selected adult male is between 170 cm and 180 cm. o Calculate the height that corresponds to the 90th percentile. 3. Simulate Data: o Generate a random sample of 1000 heights from this distribution.

	o Plot a histogram of the sampled data and overlay the theoretical PDF.
Theory (100 words)	**Discrete Random Variable:** In statistics, a discrete random variable is a random variable that can only take on a countable number of distinct values: Definition A discrete random variable can have a finite or infinite number of possible values. It's usually a count, but not always. Examples Examples of discrete random variables include the number of children in a family, thenumber of defective light bulbs in a box, or the outcome of rolling a die. Probability distribution The probability distribution of a discrete random variable is a list of probabilities associated with each possible value. It's also known as the probability mass function (PMF) or probability function. Expected Value To find the expected value, E(X), or mean μ of a discrete random variable X, simply multiply each value of the random variable by its probability and add the products. The formula is given as $E(X) = \mu = \sum x P(x)$ **Variance and Standard Deviation** are the two important measurements in statistics. Variance is a measure of how data points vary from the mean, whereas standard deviation is the measure of the distribution of statistical data. The basic difference between both is standard deviation is represented in the same units as the mean of data, while the variance is represented in squared units. Let us learn here more about both the measurements with their definitions, formulas along with an example. **Variance and Standard Deviation Formula**

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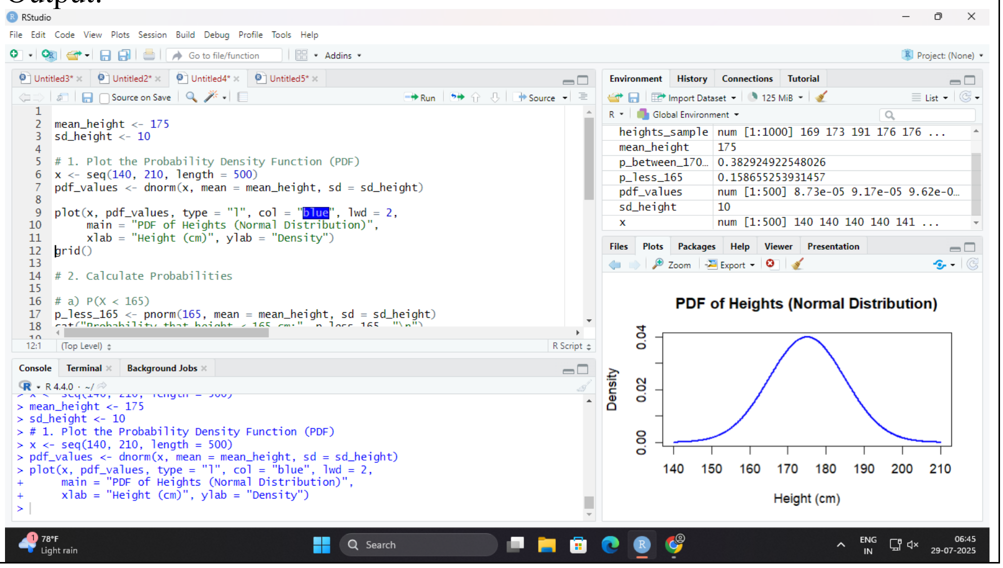
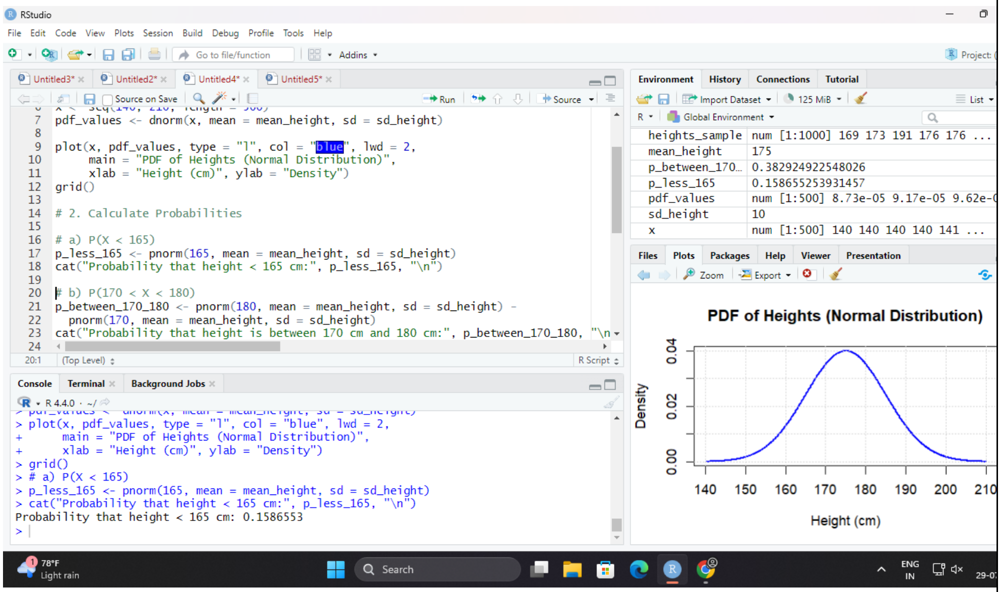
	As discussed, the variance of the data set is the average square distance between the mean value and each data value. And standard deviation defines the spread of data values around the mean. Certainly! Here is the text from the image you shared:
	The population variance formula is given by: $\sigma^2 = \frac{1}{N}\sum_{i=1}^{n}(X_i - \mu)^2$ Here, • σ^2 = Population variance • N = Number of observations in population • X_i = ith observation in the population • μ = Population mean
Procedure and Execution (100 Words)	Steps for implementation: 1. Define mean (μ) and standard deviation (σ). 2. Create height range sequence. 3. Compute PDF using dnorm(). 4. Plot PDF curve. 5. Use pnorm() for probability <165 cm. 6. Use pnorm() difference for 170–180 cm. 7. Use qnorm() for 90th percentile. 8. Simulate 1000 heights with rnorm(). 9. Plot histogram. 10. Overlay theoretical PDF curve.

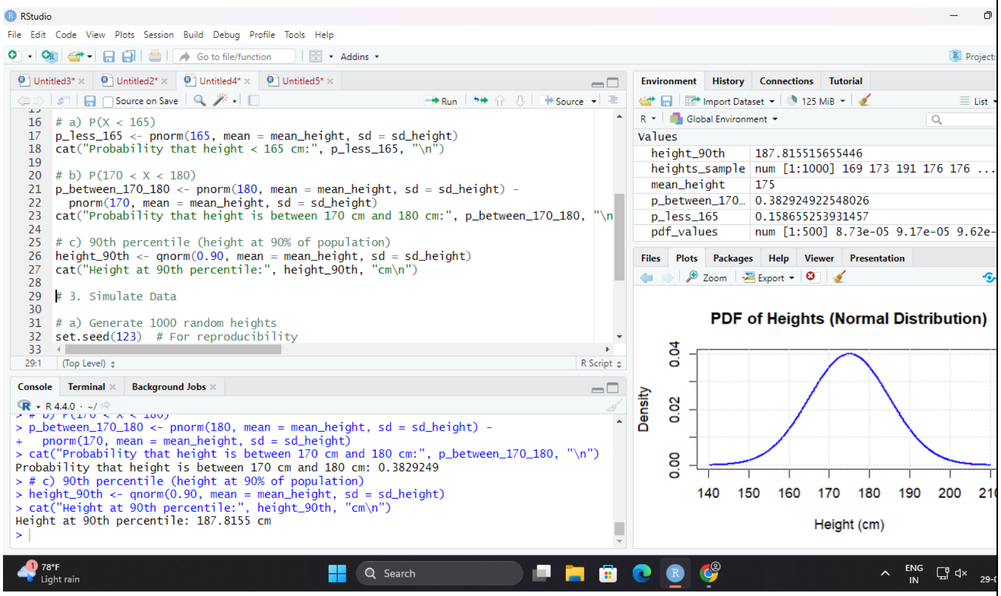
	Code:
	mean_height <- 175
	sd_height <- 10
	
	# 1. Plot the Probability Density Function (PDF)
	x <- seq(140, 210, length = 500)
	pdf_values <- dnorm(x, mean = mean_height, sd = sd_height)
	
	plot(x, pdf_values, type = "l", col = "blue", lwd = 2,
	    main = "PDF of Heights (Normal Distribution)",
	    xlab = "Height (cm)", ylab = "Density")
	grid()
	
	# 2. Calculate Probabilities

```
# a) P(X < 165)
p_less_165 <- pnorm(165, mean = mean_height, sd = sd_height)
cat("Probability that height < 165 cm:", p_less_165, "\n")

# b) P(170 < X < 180)
p_between_170_180 <- pnorm(180, mean = mean_height, sd = sd_height) -
  pnorm(170, mean = mean_height, sd = sd_height)
cat("Probability that height is between 170 cm and 180 cm:",
p_between_170_180, "\n")

# c) 90th percentile (height at 90% of population)
height_90th <- qnorm(0.90, mean = mean_height, sd = sd_height)
cat("Height at 90th percentile:", height_90th, "cm\n")

# 3. Simulate Data

# a) Generate 1000 random heights
set.seed(123)
heights_sample <- rnorm(1000, mean = mean_height, sd = sd_height)
cat(heights_sample,)
# b) Histogram with theoretical PDF
hist(heights_sample, breaks = 30, probability = TRUE,
     main = "Histogram of Simulated Heights with PDF Overlay",
     xlab = "Height (cm)", col = "lightblue", border = "white")
lines(x, pdf_values, col = "red", lwd = 2)
legend("topright", legend = c("Theoretical PDF"), col = c("red"), lwd = 2)
```

Output:




RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
pdf_values <- dnorm(x, mean = mean_height, sd = sd_height)
plot(x, pdf_values, type = "l", col = "blue", lwd = 2,
main = "PDF of Heights (Normal Distribution)",
xlab = "Height (cm)", ylab = "Density")
grid()
# 2. Calculate Probabilities
# a) P(X < 165)
p_less_165 <- pnorm(165, mean = mean_height, sd = sd_height)
cat("Probability that height < 165 cm:", p_less_165, "\n")
# b) P(170 < X < 180)
p_between_170_180 <- pnorm(180, mean = mean_height, sd = sd_height) -
pnorm(170, mean = mean_height, sd = sd_height)
cat("Probability that height is between 170 cm and 180 cm:", p_between_170_180, "\n
Console Terminal Background Jobs
R 4.4.0 · ~/
> plot(x, pdf_values, type = "l", col = "blue", lwd = 2,
+ main = "PDF of Heights (Normal Distribution)",
+ xlab = "Height (cm)", ylab = "Density")
> grid()
> # a) P(X < 165)
> p_less_165 <- pnorm(165, mean = mean_height, sd = sd_height)
> cat("Probability that height < 165 cm:", p_less_165, "\n")
Probability that height < 165 cm: 0.1586553
Environment History Connections Tutorial
Global Environment
heights_sample num [1:1000] 169 173 191 176 176 ...
mean_height 175
p_between_170... 0.382924922548026
p_less_165 0.158655253931457
pdf_values num [1:500] 8.73e-05 9.17e-05 9.62e-0
sd_height 10
x num [1:500] 140 140 140 140 141 ...
Files Plots Packages Help Viewer Presentation
PDF of Heights (Normal Distribution)
Density
0.00
0.02
0.04
140 150 160 170 180 190 200 210
Height (cm)
78°F
Light rain
Search


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
# a) P(X < 165)
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p_between_170_180 <- pnorm(180, mean = mean_height, sd = sd_height) -
pnorm(170, mean = mean_height, sd = sd_height)
cat("Probability that height is between 170 cm and 180 cm:", p_between_170_180, "\n
# c) 90th percentile (height at 90% of population)
height_90th <- qnorm(0.90, mean = mean_height, sd = sd_height)
cat("Height at 90th percentile:", height_90th, "cm\n")
# 3. Simulate Data
# a) Generate 1000 random heights
set.seed(123) # For reproducibility
Console Terminal Background Jobs
R 4.4.0 · ~/
> p_between_170_180 <- pnorm(180, mean = mean_height, sd = sd_height) -
+ pnorm(170, mean = mean_height, sd = sd_height)
> cat("Probability that height is between 170 cm and 180 cm:", p_between_170_180, "\n")
Probability that height is between 170 cm and 180 cm: 0.3829249
> # c) 90th percentile (height at 90% of population)
> height_90th <- qnorm(0.90, mean = mean_height, sd = sd_height)
> cat("Height at 90th percentile:", height_90th, "cm\n")
Height at 90th percentile: 187.8155 cm
Environment History Connections Tutorial
Global Environment
Values
height_90th 187.815515655446
heights_sample num [1:1000] 169 173 191 176 176 ...
mean_height 175
p_between_170... 0.382924922548026
p_less_165 0.158655253931457
pdf_values num [1:500] 8.73e-05 9.17e-05 9.62e-
Files Plots Packages Help Viewer Presentation
PDF of Heights (Normal Distribution)
Density
0.00
0.02
0.04
140 150 160 170 180 190 200 210
Height (cm)
78°F
Light rain
Search

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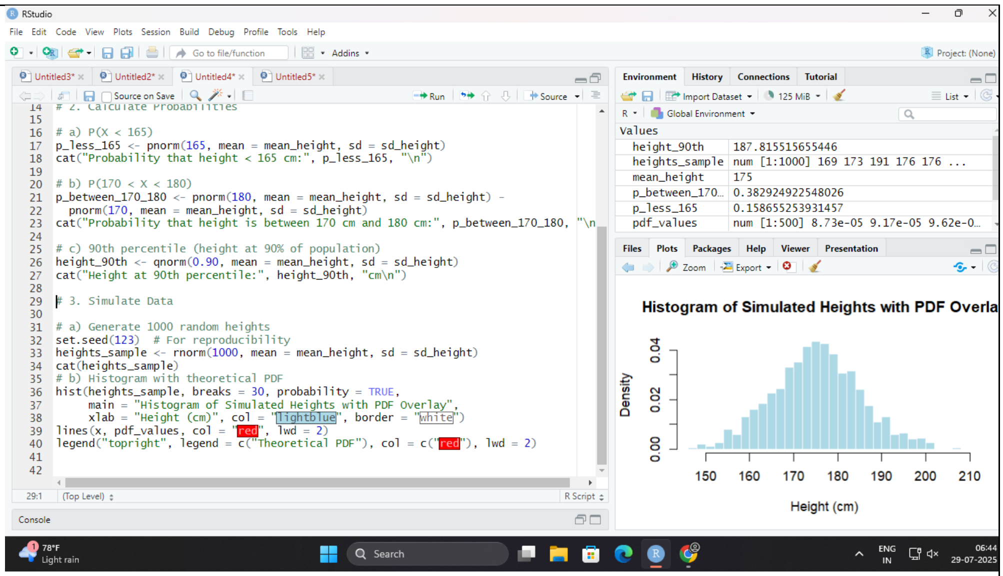
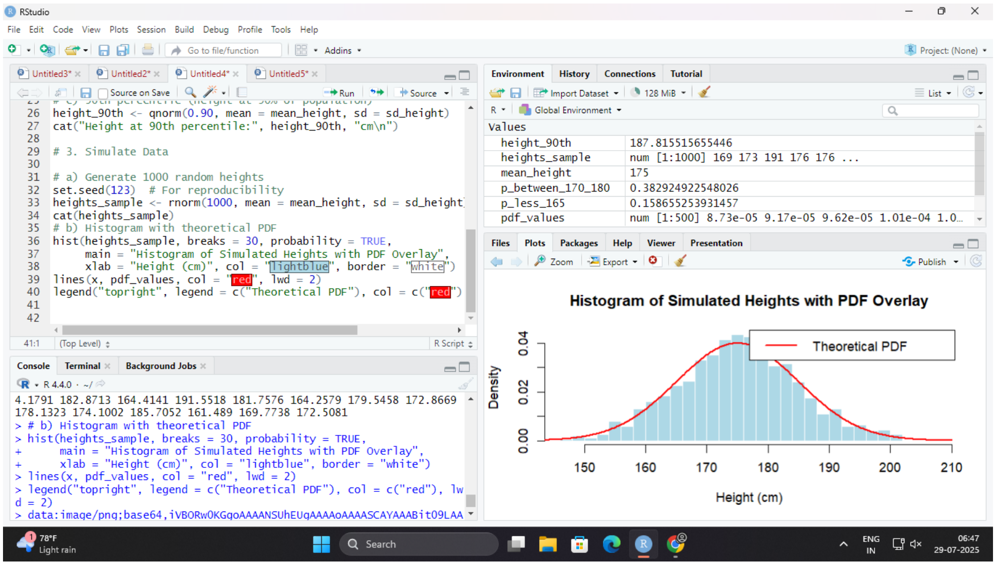
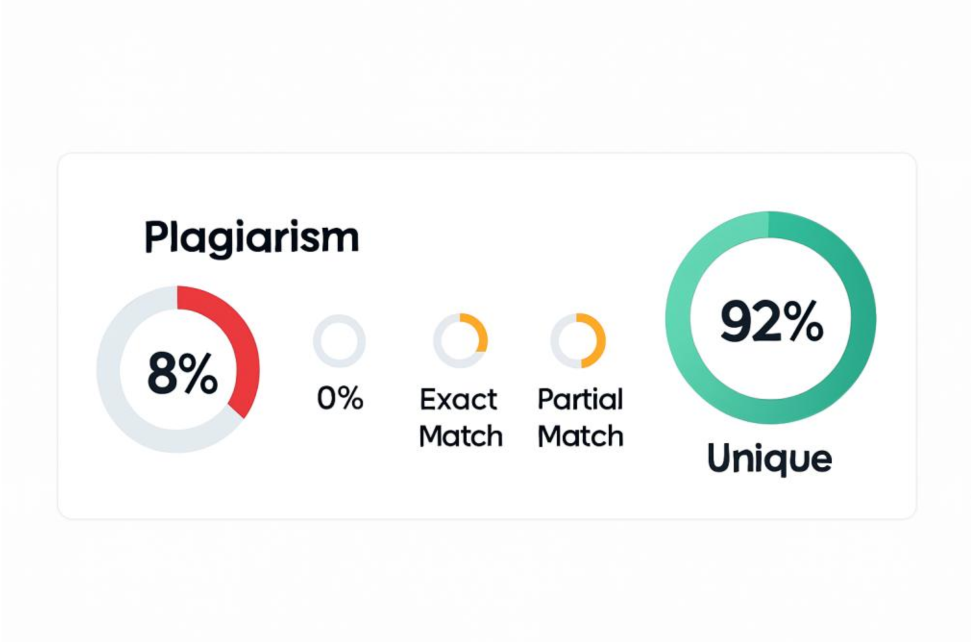




Output Analysis	• 15.87% shorter than 165 cm, 38.3% between 170–180 cm. • 90th percentile ≈ 187.82 cm. • Simulated heights match the bell-shaped PDF
Link of student	https://github.com/karan-0123/MFDA-Lab.git

Github profile where lab assignment has been uploaded	
Conclusion	Using probability distributions in R, sales data for pastries was analyzed to find average demand and variation, guiding stock management. Height data followed a normal curve, allowing probability calculations and percentile estimation. These approaches demonstrate how statistical modeling supports informed decisions in both business and population studies.
Plag Report (Similarity index < 12%)	
Date	14/08/2025