Date 14/03/2024 Expt. No. 7

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EXPERIMENT - 7

Aim:- Visualize continous probability distributions, specifically uniform, Exponential and Normal distributions with a focus on the properties of normal distribution and area under the normal curve using R.

Introduction:- The aim of this experiment is to visualize continous probability distributions, specifically the Uniform, Exponential and Normal distributions, with a particular focus on understanding the properties of the Normal distribution and calculating the area under the normal curve using the R programming language.

Software Required:-

1. R statistical Software
2. R Studio.

Relevance of the Experiment:- Understanding continous probability distributions is crucial in statistical analysis and data science. This experiment is relevent for individuals who need to model and visualize continous random variables, with a special emphasis on the widely used Normal distribution. Knowledge of these distributions is fundamental for making statistical inferences and understanding the characteristics of datasets.

Description:- The experiment begins with a brief overview of the Uniform, Exponential and Normal distributions. Participants will learn to generate random sample from each distribution, create probability density functions. (PDFs), and visualize the distributions. Special attention will be given to the properties of the normal distribution, including the concept of

Teacher's Signature:

Aim:- Visualize continous probability distributions, specifically uniform, Exponential and Normal distributions with a focus on the properties of normal distribution and area under the normal curve using R.

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Source on Save

```r
# Load necessary libraries
library(ggplot2)

# Simulate Uniform distribution
uniform_data <- runif(1000, min = 0, max = 1)

# Simulate Exponential distribution
exponential_data <- rexp(1000, rate = 0.5)

# Simulate Normal distribution
normal_data <- rnorm(1000, mean = 0, sd = 1)

# Plot density plots
ggplot(data.frame(x = uniform_data), aes(x = x)) +
  geom_density(fill = "black", alpha = 0.5) +
  labs(title = "Uniform Distribution", x = "Value", y = "Density")

ggplot(data.frame(x = exponential_data), aes(x = x)) +
  geom_density(fill = "cyan", alpha = 0.5) +
  labs(title = "Exponential Distribution", x = "Value", y = "Density")

ggplot(data.frame(x = normal_data), aes(x = x)) +
  geom_density(fill = "red", alpha = 0.5) +
  labs(title = "Normal Distribution", x = "Value", y = "Density")
```

```
+   labs(title = "Normal Distribution", x = "Value", y = "Density")
> runif(1000, min = 0, max = 1)
  [1] 0.4446532433 0.3354971379 0.4088477083 0.2933749007 0.0286183832 0.8121776311 0.5160463068
  [8] 0.8240902242 0.1434461984 0.9498030168 0.6317801282 0.4130697844 0.5310765291 0.9992650154
 [15] 0.9356029297 0.0843806020 0.7116358571 0.1857424756 0.1534237214 0.7649185394 0.9521786519
 [22] 0.3647733417 0.1652525188 0.9245435912 0.2489557825 0.1171873775 0.1211219942 0.1095552710
 [29] 0.9633847226 0.8099082948 0.8470552769 0.8779795906 0.1829612369 0.6686384382 0.4117671875
 [36] 0.1695187518 0.6936570462 0.2537349013 0.0209689445 0.6415537861 0.3799378369 0.4067386023
 [43] 0.4832590090 0.3719218434 0.8870593137 0.8980311370 0.5562771133 0.8997648442 0.8852946858
 [50] 0.2376975368 0.7712389496 0.9974357123 0.5684377612 0.6368851322 0.5020669370 0.0639619792
 [57] 0.2010881554 0.5288888458 0.2448227264 0.2031008378 0.5714525231 0.1015762123 0.9577233312
 [64] 0.2985282401 0.0647413968 0.4245430019 0.2933341467 0.3118337807 0.1269805010 0.3161810082
 [71] 0.1293433525 0.8548526480 0.3858146323 0.8361016868 0.8891116548 0.7968308248 0.8603884573
 [78] 0.6798245427 0.1702146130 0.8639990783 0.7258114396 0.6194612796 0.0159660662 0.4600666375
 [85] 0.4921391096 0.5772839761 0.0336810127 0.3613417309 0.3591809229 0.1982504213 0.6205293131
 [92] 0.2101094841 0.8515465718 0.7052518788 0.7010716810 0.0513964100 0.9575229448 0.0504921337
```

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standardization and the calculation of probabilities using the area under the normal curve.

Pseudocode / Algorithm :-

1. Select the continuous probability distribution to visualize (Uniform, Exponential, or Normal).
2. Generate random samples from the chosen distribution using appropriate R functions.
3. Create probability density functions (PDFs) or cumulative distribution functions (CDFs) for the simulated data.
4. Visualize the distributions using plots, histograms or density plots.
5. For the Normal distribution, demonstrate standardization and calculate probabilities using the area under the normal curve.

Learning Outcomes :-

1. Understanding the principles of continuous probability distributions : Uniform, Exponential, and Normal.
2. Proficiency in generating random samples from these distributions using R.
3. Visualization skills for representing continuous probability distributions through density plots.
4. Understanding the properties of the Normal distribution, includi standardization

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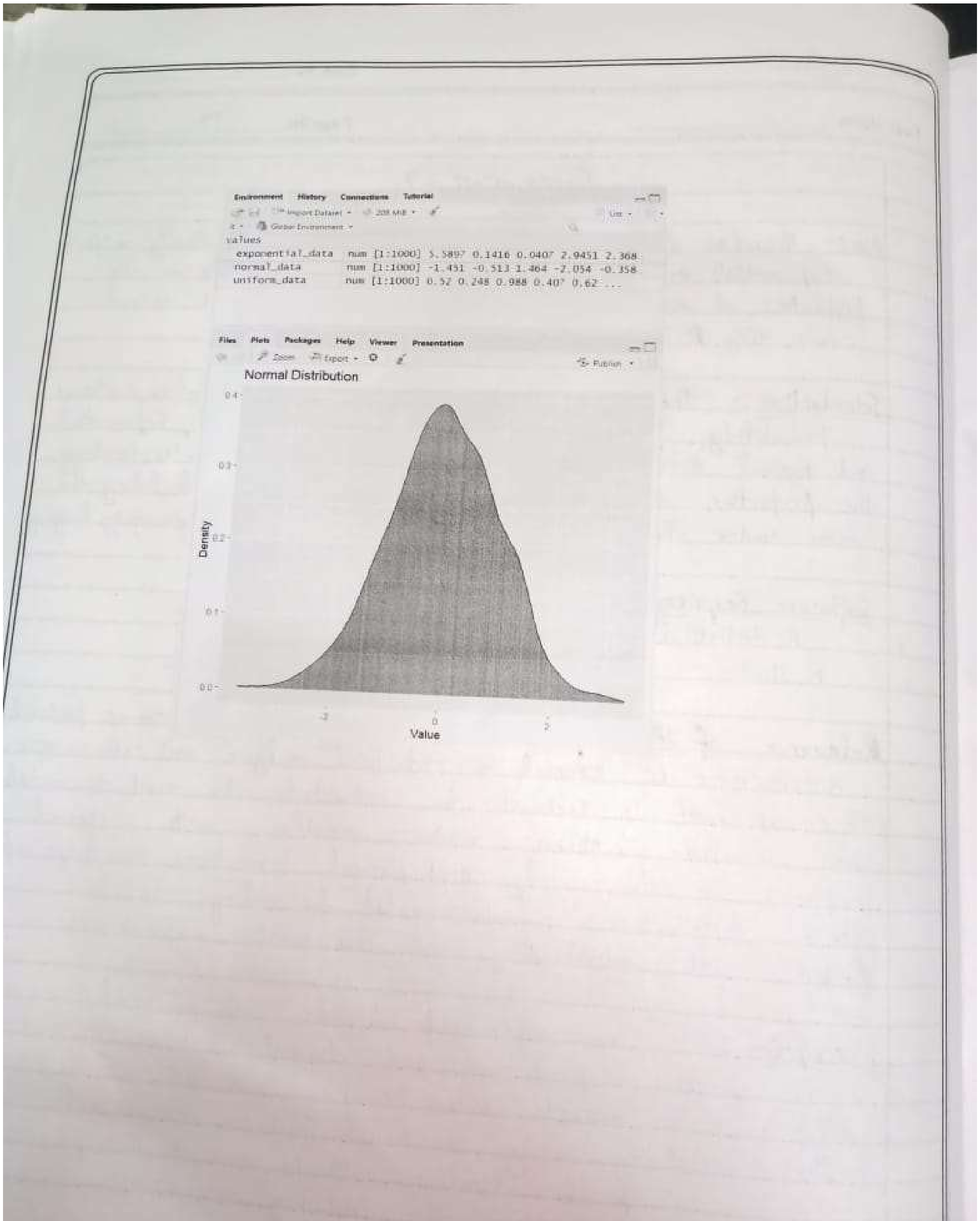
Teacher's Signature:



SCREENSHOTS:

Prac 3.R | Prac 6.R | Prac 7.R | Prac 2.R | Exp 1 SMUR Lab.R

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# Simulate Normal distribution
normal_data <- rnorm(1000, mean = 0, sd = 1)

# Plot density plots
ggplot(data.frame(x = uniform_data), aes(x = x)) +
  geom_density(fill = "black", alpha = 0.5) +
  labs(title = "Uniform Distribution", x = "Value", y = "Density")

ggplot(data.frame(x = exponential_data), aes(x = x)) +
  geom_density(fill = "cyan", alpha = 0.5) +
  labs(title = "Exponential Distribution", x = "Value", y = "Density")

ggplot(data.frame(x = normal_data), aes(x = x)) +
  geom_density(fill = "red", alpha = 0.5) +
  labs(title = "Normal Distribution", x = "Value", y = "Density")
```

Environment | History | Connections | Tutorial

Import Dataset | 208 MiB | List

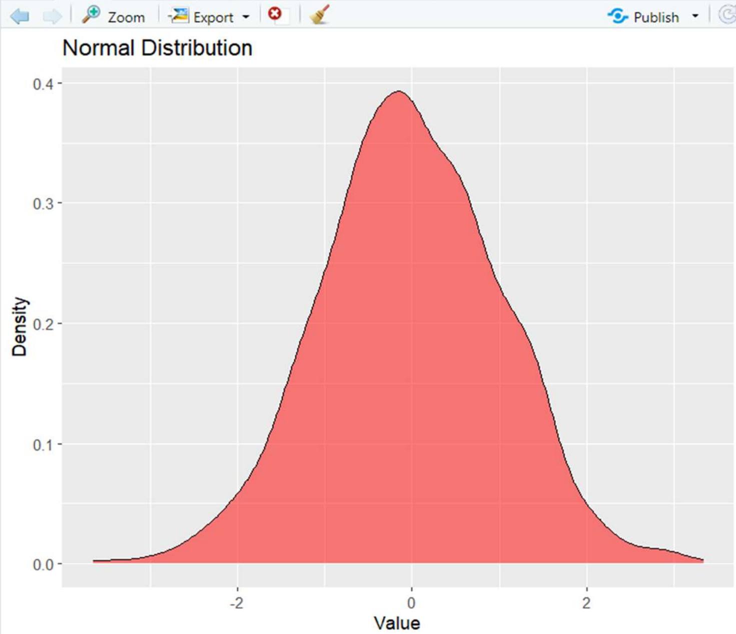
R | Global Environment

Values

exponential_data	num [1:1000] 5.5897 0.1416 0.0407 2.9451 2.368…
normal_data	num [1:1000] -1.451 -0.513 1.464 -2.054 -0.358…
uniform_data	num [1:1000] 0.52 0.248 0.988 0.407 0.62 ...

Files | Plots | Packages | Help | Viewer | Presentation

Zoom | Export | Publish



```
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