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SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Symbiosis International (Deemed University)

(Established under section 3 of the UGC Act, 1956)

Re-accredited by NAAC with 'A' grade (3.58/4) | Awarded Category – I by UGC

Founder: Prof. Dr. S. B. Mujumdar, M. Sc., Ph. D. (Awarded Padma Bhushan and Padma Shri by President of India)

Assignment No. 08

Subject:	
Name of Student	Antriksh Sharma
PRN No.	**20070122021**
Branch	CS
Class	**A**
Academic Year & Semester	2023-24 _ 7th semester
Date	**4th October**
Title of Lab Assignment	**REGRESSION MODEL FOR PREDICTION**

Theory:

Linear Regression

Linear regression is a statistical method that models the relationship between a dependent variable and one or more independent variables by fitting a linear equation to observed data. The steps to perform linear regression

- *Design Matrix: This matrix contains all the independent variables. For categorical data like 'State', you'd typically use one-hot encoding to convert it into numerical values.*
- *Fitting the Model: The coefficients of the equation are estimated based on the given data. In simple terms, the aim is to find the best-fitting line (in case of multiple regressions, it's a hyperplane) that represents the relationship between the variables.*
- *Prediction: Once the model is trained, you can input the features of a new dataset and get predictions for the dependent variable (in this case, 'Profit').*

Descriptive Statistics

Descriptive statistics provide a summary or description of the main aspects of the data:

- *Mean: Represents the average value. It's calculated by summing up all the values and dividing by the count of values.*
- *Mode: Represents the value that appears most frequently in the dataset.*
- *Median: It's the middle value of a dataset when sorted in order. For an even number of data points, it's the average of the two middle numbers.*
- *Interquartile Range (IQR): Represents the range within which the middle 50% of values lie. It's calculated as the difference between the third quartile (Q3) and the first quartile (Q1).*

Answer:

```
# Load required libraries
install.packages(c("readr", "dplyr", "caret", "lmtest", "Metrics"))
library(readr)
library(dplyr)
library(caret)
library(lmtest)
library(Metrics)

# Load the data
data <- read_csv("/Users/takshitha/Downloads/50_Startups.csv")

# Convert the 'State' column into dummy variables
data <- model.matrix(~ . + 0, data) %>% as.data.frame()

# Split the data into training and test sets
set.seed(123)
train_index <- createDataPartition(data$Profit, p = 0.8, list = FALSE)
train_data <- data[train_index, ]
test_data <- data[-train_index, ]

# Fit a linear regression model
model <- lm(Profit ~ ., data = train_data)

# Predict on test set
predictions <- predict(model, newdata = test_data)

# Calculate RMSE for accuracy
accuracy <- rmse(test_data$Profit, predictions)

# Descriptive statistics
mean_val <- mean(data$Profit)
mode_val <- as.numeric(names(sort(table(data$Profit), decreasing = TRUE)[1]))
median_val <- median(data$Profit)
iqr_val <- IQR(data$Profit)

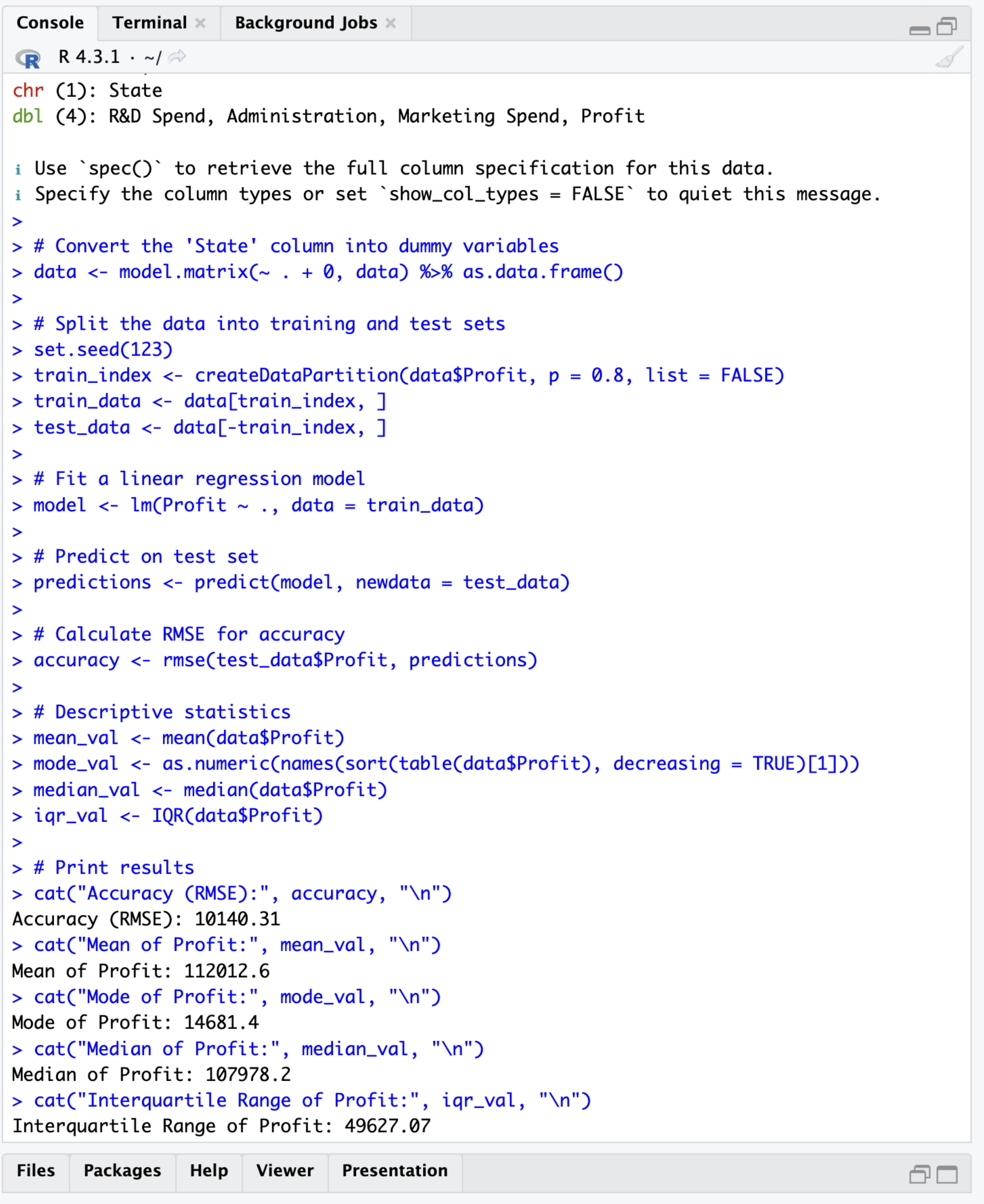
# Print results
cat("Accuracy (RMSE):", accuracy, "\n")
cat("Mean of Profit:", mean_val, "\n")
cat("Mode of Profit:", mode_val, "\n")
cat("Median of Profit:", median_val, "\n")
cat("Interquartile Range of Profit:", iqr_val, "\n")

# Again, Precision, Recall, Entropy, and Information gain are relevant for classification and not
regression.
```

Output:

Answer:

```
# Print results
> cat("Accuracy (RMSE):", accuracy, "\n")
Accuracy (RMSE): 10140.31
> cat("Mean of Profit:", mean_val, "\n")
Mean of Profit: 112012.6
> cat("Mode of Profit:", mode_val, "\n")
Mode of Profit: 14681.4
> cat("Median of Profit:", median_val, "\n")
Median of Profit: 107978.2
> cat("Interquartile Range of Profit:", iqr_val, "\n")
Interquartile Range of Profit: 49627.07
```



```
chr (1): State
dbl (4): R&D Spend, Administration, Marketing Spend, Profit

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
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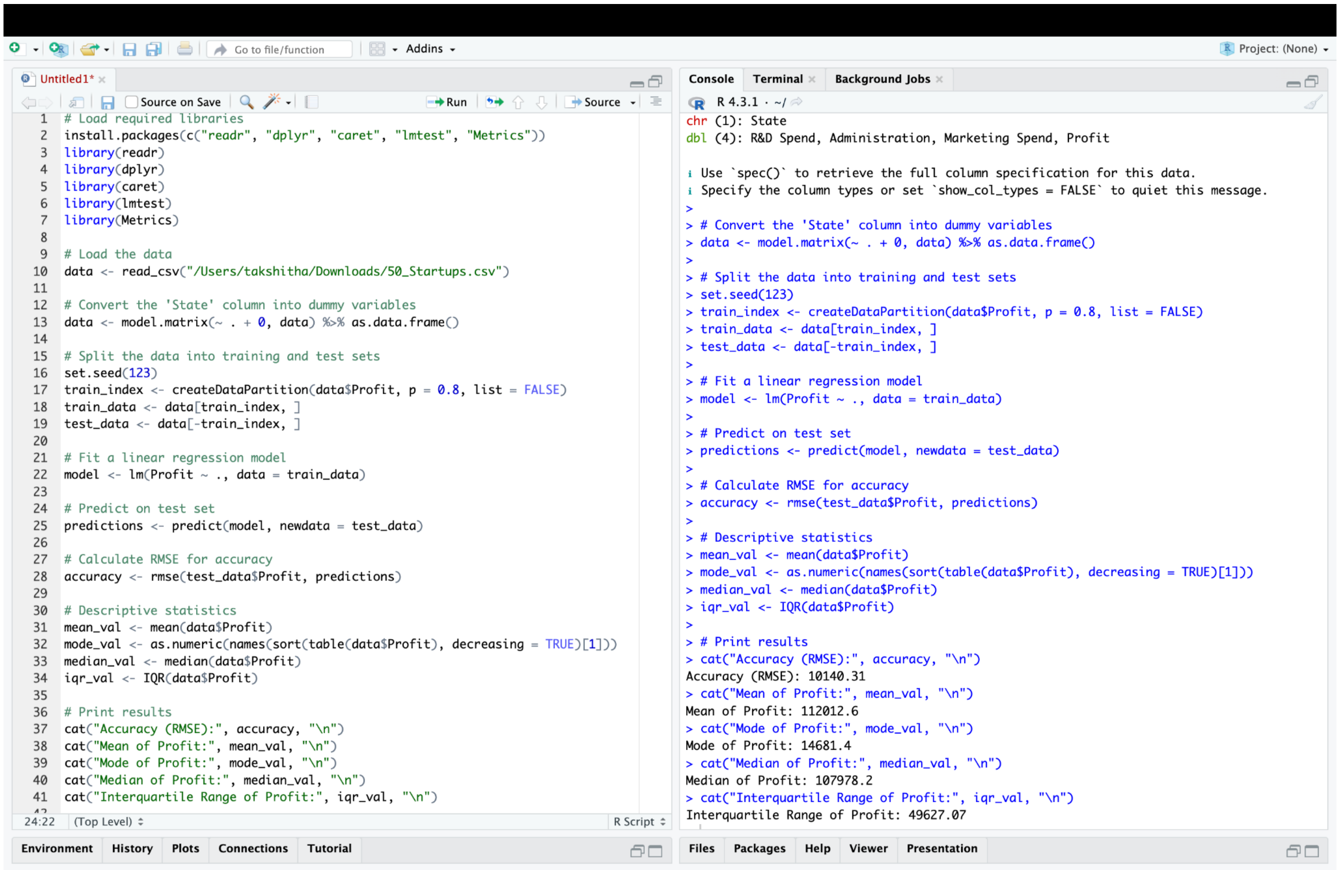
[redacted]

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Conclusion: *The experiment aimed to analyze how different financial strategies and the state of operation impact the profit of startups. Through linear regression, we quantified the relationship between profit and spendings in different departments. Descriptive statistics provided insights into the general distribution of profits across the startups. The RMSE indicated how well the model performed.*