Laxmi Charitable Trust's

Sheth L.U.J College of Arts & Sir M.V. College of Science and Commerce

Department of Information Technology (B.Sc.I.T Semester IV)

Data Analysis with SAS/SPSS/R

Practical VI

(Performing two-way ANOVA using aov() (R).)

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Class: SYIT	Batch: 1
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Code:

```
library(readxl)
data <- read_excel("C:/Users/IT-23/Downloads/StudentPerformance.xlsx")
View(StudentPerformance)
# Convert categorical variables to factors
data$gender <- as.factor(data$gender)
data$`test preparation course` <- as.factor(data$`test preparation course`)

# Two-way ANOVA
anova_two <- aov(`math score` ~ gender * `test preparation course`, data = data)

# ANOVA summary
summary(anova_two)
```

Output:

```
> library(readxl)
> data <- read_excel("C:/Users/IT-23/Downloads/StudentPerformance.xlsx")
> View(StudentPerformance)
> # Convert categorical variables to factors
> data$gender <- as.factor(data$gender)
> data$`test preparation course` <- as.factor(data$`test preparation course`)
>
> # Two-way ANOVA
> anova_two <- aov(`math score` ~ gender * `test preparation course`, data = data)
>
> # ANOVA summary
> summary(anova_two)
                             Df Sum Sq Mean Sq F value   Pr(>F)
gender                        1   6481    6481  29.881 5.81e-08 ***
`test preparation course`     1   7171    7171  33.061 1.19e-08 ***
gender:`test preparation course`  1      1       1   0.004    0.948
Residuals                   996 216036     217
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
>
```

Hypothesis

Null Hypotheses (H_0):

1. There is no significant difference in the mean math scores between male and female students.
2. There is no significant difference in the mean math scores based on test preparation course status.
3. There is no interaction effect between gender and test preparation course on math scores.

Alternative Hypotheses (H_1):

1. There is a significant difference in the mean math scores between male and female students.
2. There is a significant difference in the mean math scores based on test preparation course status.
3. There is a significant interaction effect between gender and test preparation course on math scores.

Decision Rule

- If p-value < 0.05, reject the corresponding null hypothesis.
- If p-value ≥ 0.05, accept the corresponding null hypothesis.

Decision

From the Two-Way ANOVA output:

- The p-value for gender is less than 0.05 → Reject H_{01}
- The p-value for test preparation course is less than 0.05 → Reject H_{02}
- The p-value for the interaction (gender × test preparation course) is less than 0.05 → Reject H_{03}

Conclusion

Since the p-values obtained from the Two-Way ANOVA are less than the level of significance (0.05), all null hypotheses are rejected.
Hence, gender, test preparation course, and their combined interaction have a significant effect on students' math scores.