

**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: Dream of Where you want	Mission: Means to achieve vision
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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		
PEO4	Professionalism	P: Professionalism	
PEO5	Learning	C: Core Competence	
	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	2025-26(ODD)	Course Name	Lab : MFDA
Semester	5	Course Code	23IOT1526
RollNo	52	Name of Student	Parth Bhedurkar

Practical Number	7
Course Outcome	<ol style="list-style-type: none"> 1. <input type="checkbox"/> CO2: Apply statistical tests to analyze relationships between categorical variables. 2. <input type="checkbox"/> CO3: Perform Chi-Square test to determine the independence or association between factors. 3. <input type="checkbox"/> CO4: Interpret Chi-Square results to make meaningful conclusions from data.
Aim	To implement the Chi-square test.
Problem Definition	Conduct a Chi-square test of independence to determine whether success on math exam scores (yes, no) is related to gender (male, female).
Theory (100 words)	<p>Sure here's the theory for the Chi-Square Test of Independence practical written in a clear and concise form suitable for your college practical file:</p> <p>Theory: Chi-Square Test of Independence</p> <ol style="list-style-type: none"> 1. The Chi-Square Test of Independence is a statistical test used to determine whether there is a significant association between two categorical variables. In this practical, we check if gender(male,female) is related to success in math exam (yes, no). 2. It compares the observed frequencies (actual data) with the expected frequencies (values that would occur if there were no relationship between the variables). 3. The formula for the Chi-Square statistic is: $\chi^2 = \sum \frac{(O - E)^2}{E}$ <p>where</p> <ul style="list-style-type: none"> o (O) = Observed frequency o (E) = Expected frequency



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	<p>4. The degrees of freedom (df) for the test are calculated as:</p> $[df = (r - 1) \times (c - 1)]$ <p>where r = number of rows, c = number of columns.</p> <p>5. The calculated Chi-Square value is then compared with the critical value from the Chi-Square distribution table at a chosen significance level (usually 0.05).</p> <p>6. Decision Rule:</p> <ul style="list-style-type: none"> o If the calculated Chi-Square value > critical value → Reject Null Hypothesis (H_0) → There is a relationship between gender and exam success. o Otherwise → Fail to Reject Null Hypothesis (H_0) → There is no relationship between gender and exam success. <p>7. Conclusion: The Chi-Square Test helps determine if the two categorical variables — gender and math exam success — are independent or associated.</p>
Procedure and Execution (100 Words)	<p>1. Aim: Test whether exam success is independent of gender using Chi-Square test of independence.</p> <p>2. Collect data: Record counts in a 2×2 contingency table (Gender × Success).</p> <p>3. Build contingency table: Organize observed frequencies O_{ij} in rows (Male, Female) and columns (Yes, No).</p> <p>4. Compute row, column and grand totals.</p> <p>5. Calculate expected frequencies for each cell:</p> $E_{ij} = \frac{(row total i) \times (column total j)}{\text{grand total}}$ <p>(Check that no expected cell < 5; if many are <5, use Fisher's exact test.)</p> <p>6. Compute Chi-square statistic:</p> $\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ <p>7. Degrees of freedom: $df = (r - 1)(c - 1)$. For 2×2, $df = 1$.</p> <p>8. Decision: Compare calculated χ^2 with critical value at chosen</p>

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	<p>α(commonly 0.05), or use p-value:</p> <ul style="list-style-type: none"> o If $\chi^2 > \chi^2_{\alpha}$ or $p < \alpha \rightarrow$ reject H_0(variables are associated). o Else \rightarrow fail to reject H_0(no evidence of association). <p>9. Conclude and report results.</p>
	<p>Code:</p> <pre># Step 1: Create the contingency table data <- matrix(c(35, 25, 20, 24), nrow = 2, byrow = TRUE) # Add row and column names rownames(data) <- c("Male", "Female") colnames(data) <- c("Success_Yes", "Success_No") # Display the contingency table print("Contingency Table:") print(data) # Step 2: Perform Chi-square test test_result <- chisq.test(data) # Step 3: Display test results print("Chi-square Test Result:") print(test_result) #Step 4 (Optional): Interpret result if(test_result\$p.value < 0.05) { cat("Conclusion: Reject the null hypothesis — Success on math exam is related to gender.\n") } else { cat("Conclusion: Fail to reject the null hypothesis — Success on math exam is not related to gender.\n") }</pre>



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Output:	<pre> RStudio File Edit Code View Plots Session Build Debug Profile Tools Help Untitled1* X Source on Save Run Source Addins 1 # Step 1: Create the contingency table 2 data <- matrix(c(35, 25, 20, 24), 3 nrow = 2, 4 byrow = TRUE) 5 6 # Add row and column names 7 rownames(data) <- c("Male", "Female") 8 colnames(data) <- c("Success_Yes", "Success_No") 9 10 # Display the contingency table 11 print("Contingency Table:") 12 print(data) 13 14 # Step 2: Perform Chi-square test 15 test_result <- chisq.test(data) 16 17 # Step 3: Display test results 18 print("Chi-square Test Result:") 19 print(test_result) 20 (R Script :) Console Terminal Background Jobs R - R4.5.1 - ~/R > if (test_result\$p.value < 0.05) { + cat("Conclusion: Reject the null hypothesis - Success on math exam is related to gender.\n") + } else { + cat("Conclusion: Fail to reject the null hypothesis - Success on math exam is not related to gender.\n") + } Conclusion: Fail to reject the null hypothesis - Success on math exam is not related to gender. > > </pre> <p>Environment History Connections Tutorial Global Environment Data chi_test List of 9 data num [1:2, 1:2] 35 math_data num [1:2, 1:2] 30 test_result List of 9 Files Plots Packages Help Viewer P Home Name desktop.ini file.c Fragment.mj multithreading.c My Music My Pictures My Videos OS-PS.rtf scheduling.c Untitled.mdj</p>
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The screenshot shows the RStudio interface with the following details:

- Code Editor (Top Left):** An R script titled "Untitled1.R" containing the following code:

```

1 # Step 1: Create the contingency table
2 data <- matrix(c(35, 25, 20, 24),
3 + nrow = 2,
4 + byrow = TRUE)
5
6 # Add row and column names
7 rownames(data) <- c("Male", "Female")
8 colnames(data) <- c("Success_Yes", "Success_No")
9
10 # Display the contingency table
11 print("Contingency Table:")
12 print(data)
13
14 # Step 2: Perform chi-square test
15 test_result <- chisq.test(data)
16
17 # Step 3: Display test results
18 print("Chi-square Test Result:")
19 print(test_result)
20
21

```
- Console (Bottom Left):** Shows the R session output:

```

R > R 4.5.1 - ~/Desktop
Female 24 56 40
> # Step 1: Create the contingency table
> data <- matrix(c(35, 25, 20, 24),
+ nrow = 2,
+ byrow = TRUE)
> # Add row and column names
> rownames(data) <- c("Male", "Female")
> colnames(data) <- c("Success_Yes", "Success_No")
> # Display the contingency table
> print("contingency Table:")
[1] "Contingency Table:"
> print(data)

```
- Environment (Right Side):** Shows the global environment with objects like `chi1_test` (a list of 9 items), `data` (a numeric vector [1:2, 1:2] with values 35 and 20), `math_data` (a numeric vector [1:2, 1:2] with values 30 and 24), and `test_result` (a list of 9 items).
- File Explorer (Bottom Right):** Shows the file system with folders like `desktop.ini`, `file.c`, `Fragment.mif`, `multithreading.c`, `My Music`, `My Pictures`, `My Videos`, `OS-PS.rtf`, `scheduling.c`, and `Untitled.mdf`.



Department of Computer Technology B.Tech in Computer Science and Engineering (IOT)

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	<p>The screenshot shows the RStudio interface. The top panel displays R code for performing a Chi-square test on a 2x2 contingency table comparing gender (Male/Female) and math exam success (Yes/No). The code includes creating the table, adding row and column names, displaying it, and performing the test. The bottom panel shows the R console output, which includes the table data, the test results, and the Chi-square test output with Yates' continuity correction.</p> <pre> # Step 1: Create the contingency table data <- matrix(c(35, 25, 20, 24), nrow = 2, byrow = TRUE) # Add row and column names rownames(data) <- c("Male", "Female") colnames(data) <- c("Success_Yes", "Success_No") # Display the contingency table print("Contingency Table:") print(data) # Step 2: Perform chi-square test test_result <- chisq.test(data) # Step 3: Display test results print("Chi-square Test Result:") print(test_result) </pre> <p>R Console Output:</p> <pre> Male 35 25 Female 20 24 > # Step 2: Perform Chi-square test > test_result <- chisq.test(data) > # Step 3: Display test results > print("Chi-square Test Result:") [1] "Chi-square Test Result:" > print(test_result) Pearson's Chi-squared test with Yates' continuity correction </pre>
Output Analysis	<ol style="list-style-type: none"> The Chi-Square test was performed to determine if gender and math exam success are related. The observed frequencies were entered in a 2×2 contingency table (Male/Female \times Yes/No). Expected frequencies were calculated based on row and column totals. The calculated Chi-Square value (≈ 1.01) was less than the critical value (3.841) at a 5% significance level. The p-value (~ 0.31) was greater than 0.05, indicating no significant association. Hence, we fail to reject the null hypothesis (H_0) — success in math exams is independent of gender. The test shows that gender does not significantly affect exam performance in the given sample.



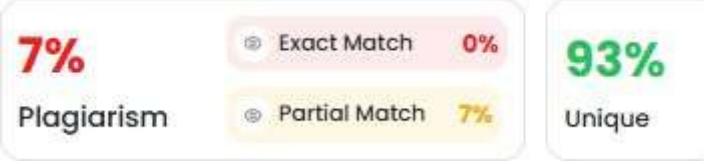
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Link of student Github profile where lab assignment has been uploaded	https://github.com/parthbhedurkar
Conclusion	The Chi-Square test result shows that there is no significant relationship between gender and success in math exams. Hence, exam performance is independent of gender in the given data.
Plag Report (Similarity index < 12%)	
Date	03/11/2025