

Chi Square Test Practice Problems

Chi Square Example Handout

Step 1: Add numbers across columns and rows. Calculate total number in chart.

Unobtrusive Male Versus Female			
	Male	Female	
Full Stop	6	6	= 12
Rolling Stop	16	15	= 31
No Stop	4	3	= 7
	= 26	= 24	= 50

Step 2: Calculate expected numbers for each individual cell. Do this by multiplying row sum by column sum and dividing by total number. For example: using 1st cell in table (Male/Full Stop);

$$\frac{12 \times 26}{50} = 6.24$$

2nd cell in table (Female/Full Stop):

$$\frac{12 \times 24}{50} = 5.76$$

Step 3: Now you should have an observed number and expected number for each cell. The observed number is the number already in 1st chart. The expected number is the number found in the last step (step 2). Sometimes writing both numbers in the chart can be helpful.

	Male	Female	
Full Stop	6 (observed) 6.24 (expected)	6 (observed) 5.76 (expected)	= 12
Rolling Stop	16 (observed) 16.12 (expected)	15 (observed) 14.88 (expected)	= 31
No Stop	4 (observed) 3.64 (expected)	3 (observed) 3.36 (expected)	= 7
	= 26	= 24	= 50

Chi square test practice problems are essential for students and professionals who wish to deepen their understanding of statistical analysis. The chi-square test is a powerful tool in statistics used to determine whether there is a significant association between categorical variables. This article will delve into the concept of the chi-square test, provide practice problems, and discuss how to solve them step-by-step, making it easier to grasp this fundamental statistical method.

Understanding the Chi-Square Test

The chi-square test is primarily used in two scenarios:

1. Chi-Square Test of Independence

This test checks if there is a significant association between two categorical variables. For example, it might be used to examine whether gender is related to voting preference.

2. Chi-Square Goodness of Fit Test

This test determines if a sample distribution matches an expected distribution. An example could be assessing whether a die is fair based on the frequency of each outcome.

Key Terminology

Before diving into practice problems, it's crucial to understand some key terms associated with the chi-square test:

- **Observed Frequencies:** The actual count of occurrences in each category.
- **Expected Frequencies:** The counts you would expect if there were no association between the variables.
- **Degrees of Freedom (df):** A value based on the number of categories minus one.
- **Significance Level (α):** The threshold for determining statistical significance, commonly set at 0.05.

Chi-Square Test Formula

The chi-square statistic is calculated using the following formula:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where:

- O = Observed frequency
- E = Expected frequency

Practice Problems

Now, let's explore some chi-square test practice problems to solidify your understanding.

Problem 1: Chi-Square Test of Independence

A researcher wants to know if there is a relationship between smoking status (Smoker, Non-Smoker) and exercise frequency (Regular, Irregular). The following data was collected:

	Regular	Irregular	Total
Smoker	30	10	40
Non-Smoker	20	40	60
Total	50	50	100

Steps to Solve:

1. Formulate Hypotheses:

- Null Hypothesis (H_0): Smoking status and exercise frequency are independent.
- Alternative Hypothesis (H_1): Smoking status and exercise frequency are not independent.

2. Calculate Expected Frequencies:

- For Smokers who exercise regularly: $E = \frac{(40)(50)}{100} = 20$
- For Smokers who exercise irregularly: $E = \frac{(40)(50)}{100} = 20$
- For Non-Smokers who exercise regularly: $E = \frac{(60)(50)}{100} = 30$
- For Non-Smokers who exercise irregularly: $E = \frac{(60)(50)}{100} = 30$

3. Construct the Expected Frequency Table:

	Regular	Irregular	Total
Smoker	20	20	40
Non-Smoker	30	30	60
Total	50	50	100

4. Calculate Chi-Square Value:

$$\chi^2 = \frac{(30-20)^2}{20} + \frac{(10-20)^2}{20} + \frac{(20-30)^2}{30} + \frac{(40-30)^2}{30}$$
$$\chi^2 = \frac{100}{20} + \frac{100}{20} + \frac{100}{30} + \frac{100}{30} = 5 + 5 + 3.33 + 3.33 = 16.66$$

\]

5. Determine Degrees of Freedom:

- Degrees of Freedom (df) = (Rows - 1) (Columns - 1) = (2 - 1)(2 - 1) = 1

6. Compare with Critical Value:

- At df = 1 and $\alpha = 0.05$, the critical value is approximately 3.84.

- Since $16.66 > 3.84$, we reject the null hypothesis.

Conclusion: There is a significant association between smoking status and exercise frequency.

Problem 2: Chi-Square Goodness of Fit Test

A die is rolled 60 times, and the results are as follows:

Face	1	2	3	4	5	6
Observed	10	12	8	15	7	8

Steps to Solve:

1. Formulate Hypotheses:

- Null Hypothesis (H_0): The die is fair.

- Alternative Hypothesis (H_1): The die is not fair.

2. Calculate Expected Frequencies:

- Since the die is fair, each face should appear 10 times (60 rolls / 6 faces).

3. Calculate Chi-Square Value:

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$$\chi^2 = \sum \frac{(O - E)^2}{E} = \frac{(10-10)^2}{10} + \frac{(12-10)^2}{10} + \frac{(8-10)^2}{10} + \frac{(15-10)^2}{10} + \frac{(7-10)^2}{10} + \frac{(8-10)^2}{10}$$

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$$\chi^2 = 0 + \frac{4}{10} + \frac{4}{10} + \frac{25}{10} + \frac{9}{10} + \frac{4}{10} = 0 + 0.4 + 0.4 + 2.5 + 0.9 + 0.4 = 4.6$$

\]

4. Determine Degrees of Freedom:

- Degrees of Freedom (df) = Number of categories - 1 = 6 - 1 = 5

5. Compare with Critical Value:

- At df = 5 and $\alpha = 0.05$, the critical value is approximately 11.07.

- Since $4.6 < 11.07$, we fail to reject the null hypothesis.

Conclusion: There is not enough evidence to suggest that the die is unfair.

Conclusion

Practicing chi-square test problems is crucial for mastering statistical analysis techniques. By understanding how to formulate hypotheses, calculate expected frequencies, and interpret chi-square values, you will build a strong foundation in statistical reasoning. Whether you're preparing for an exam or applying statistical methods in your job, these concepts will be invaluable. Keep practicing with various scenarios to enhance your skills and confidence in using the chi-square test effectively.

Frequently Asked Questions

What is a chi-square test used for?

A chi-square test is used to determine if there is a significant association between categorical variables.

What are the two main types of chi-square tests?

The two main types of chi-square tests are the chi-square test of independence and the chi-square goodness-of-fit test.

How do you calculate the chi-square statistic?

The chi-square statistic is calculated using the formula: $\chi^2 = \sum ((O - E)^2 / E)$, where O is the observed frequency and E is the expected frequency.

What are the assumptions of the chi-square test?

The assumptions include that the data must be categorical, the observations should be independent, and the expected frequency in each category should be at least 5.

What does a high chi-square value indicate?

A high chi-square value indicates a greater difference between observed and expected frequencies, suggesting a potential association between variables.

When should you use a chi-square goodness-of-fit test?

You should use a chi-square goodness-of-fit test when you want to determine if a sample distribution matches an expected probability distribution.

What is the purpose of the degrees of freedom in

chi-square tests?

Degrees of freedom determine the distribution of the chi-square statistic and are calculated as (number of categories - 1) for goodness-of-fit tests or (rows - 1) (columns - 1) for tests of independence.

What is the critical value in a chi-square test?

The critical value is the threshold against which the chi-square statistic is compared to determine whether to reject the null hypothesis.

How can you interpret the p-value in a chi-square test?

The p-value indicates the probability of observing a chi-square statistic as extreme as, or more extreme than, the one calculated if the null hypothesis is true; a low p-value (typically < 0.05) suggests rejecting the null hypothesis.

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Chi Square Test Practice Problems

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Chavas Mexican Grill, Jasper - Menu, Reviews (68), Photos (25 ...

Jun 11, 2023 · Chavas Mexican Grill offers a delightful dining experience with its authentic Mexican cuisine. The restaurant boasts spacious parking and seating, a clean and well ...

The Best 10 Mexican Restaurants near Jasper, IN 47546 - Yelp

Amazing food, excellent service and really good drinks. The atmosphere has a cool retro vibe and a fun outside dining area and a nice dining area in the bar.

Mi Jalisco Mexican Restaurant in Germantown Shopping Square - Jasper ...

Mi Jalisco Mexican Restaurant in Germantown Shopping Square, address and location: Jasper, Indiana - 3605 N. Newton St, Jasper, Indiana - IN 47546. Hours including holiday hours and ...

Mexican Restaurant Menu | Jasper, IN - retromexico.com

Explore the diverse menu at Retro Mexican Cuisine in Jasper, IN. Enjoy fresh appetizers, lunch specials, salads, quesadillas, nachos, and more. Click here!

Retro Mexican Cuisine, Jasper - Restaurant menu, prices and ...

May 12, 2025 · Explore the world of Mexican cuisine here. Try nicely cooked birria, shrimp tacos and

steaks. Make a change from your traditional meal and try good key lime pie at this ...

Retro Mexican Cuisine | Jasper IN - Facebook

This Saturday (May 17th) at 3:00pm I will be at Retro Mexican Cuisine in Jasper, IN to take on their Titan burrito challenge. This burrito is anything but ordinary!

THE 8 BEST Mexican Restaurants in Jasper, IN - 2025 Restaurantji

We've gathered up the best restaurants in Jasper that serve Mexican food. The current favorites are:

1: Retro Mexican Cuisine, 2: Miranda's Restaurant, 3: El Maguey Grill, 4: Chavas Mexican ...

Retro Mexican Cuisine, Jasper - Menu, Reviews (217), Photos (26 ...

6 days ago · Retro Mexican Cuisine offers a delightful dining experience in Jasper, Indiana. With its tasty food, lively atmosphere, and friendly staff, the restaurant has become a local favorite.

Best Mexican Restaurants near Jasper, IN 47546 - Yelp

I think we passed 3 Mexican restaurants on our way, and we were hungry, but this place was terrific. I tried the carnitas, al pastor, asada, and barbacoa tacos.

THE BEST 10 NAIL SALONS in SEATTLE, WA - Updated 2025 - Yelp

Best Nail Salons in Seattle, WA - Last Updated 2025 - Urban Nail Box, Ascend Nail Lounge, Leila Klein, Tri Organic Spa, Pink Polish, Roosevelt Nails Bar, Sarah's Nail & Spa, Marigold Nail ...

25 Best Nail Salons Near Seattle, WA - 2025 BestProsInTown

Find the best nail salons in Seattle with the latest reviews and photos. Get directions, hours and phone numbers.

Seattle's Best Nail Salons [Updated 2025]

Oct 17, 2024 · I've scoured the city and reviewed 12 standout salons, each with its unique charm and specialties. From eco-friendly options that prioritize sustainability to trendy spots that ...

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22 Best nail salons in Seattle Near Me

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Home - Nail Salon 98112 | NINA NAILS & SPA | SEATTLE, WA ...

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Diva Nail Lounge - Best Nail Salon in Seattle

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Queen Anne Nails and Spa | Nail Salon in Seattle, WA 98109

Nestled in the heart of Seattle, Queen Anne Nails & Spa has been a haven for beauty and relaxation. What began as a dream to create a space where self-care meets artistry has ...

Best Nail Salons Near Me - Yelp

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