# Practice questions: Chi-square goodness of fit test

Test your knowledge of the chi-square goodness of fit test with these [practice questions](#_rhzoydocze6j). You can find the [answers and calculations](#_jvu0vfxjuuh1) here.

## Questions

### Question 1

After losing a board game, your friend believes she might have lost because of a problem with your dice. To find out, she rolls your dice 60 times and obtains the following frequencies:

|  |  |
| --- | --- |
| **Number** | **Frequency** |
| 1 | 8 |
| 2 | 11 |
| 3 | 6 |
| 4 | 9 |
| 5 | 12 |
| 6 | 14 |

Should she reject the null hypothesis that the dice lands on each number with equal probability (*p*1 = *p*2 = *p*3= *p*4 = *p*5= *p*6)?

1. She should reject the null hypothesis.
2. She should fail to reject the null hypothesis.

### Question 2

You work at a nut factory and you’re in charge of quality control. The nut factory produces a nut mix that’s supposed to be 50% peanuts, 30% cashews, and 20% almonds.

To check that the nut mix proportions are acceptable, you randomly sample 1000 nuts and find the following frequencies:

|  |  |
| --- | --- |
| **Nut** | **Frequency** |
| Peanuts | 621 |
| Cashew | 189 |
| Almonds | 190 |

Should you reject the null hypothesis that the nut mix has the desired proportions of nuts?

1. I should reject the null hypothesis.
2. I should fail to reject the null hypothesis.

## Answers

Here you can find the answers to the [practice questions](#_rhzoydocze6j).

### Answer 1

**Correct Answer = a -** She should fail to reject the null hypothesis.

**Step 1: Calculate the expected frequencies**

|  |  |  |
| --- | --- | --- |
| **Number** | **Observed** | **Expected** |
| 1 | 8 | 60 \* (1/6) = 10 |
| 2 | 11 | 10 |
| 3 | 6 | 10 |
| 4 | 9 | 10 |
| 5 | 12 | 10 |
| 6 | 14 | 10 |

**Step 2: Calculate chi-square**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Phenotype** | **Observed** | **Expected** | ***O* - *E*** | **(*O* - *E*)2** | **(*O* - *E*)2 / E** |
| 1 | 8 | 10 | -2 | 4 | 0.4 |
| 2 | 11 | 10 | 1 | 1 | 0.1 |
| 3 | 6 | 10 | -4 | 16 | 1.6 |
| 4 | 9 | 10 | -1 | 1 | 0.1 |
| 5 | 12 | 10 | 2 | 4 | 0.4 |
| 6 | 14 | 10 | 4 | 16 | 1.6 |

Χ2 = 0.4 + 0.1 + 1.6 + 0.1 + 0.4 + 1.6 = 4.2

**Step 3: Find the critical chi-square value**

Since there are six groups, there are five degrees of freedom.

For a test of significance at α = .05 and *df* = 5, the Χ2 critical value is 11.07.

**Step 4: Compare the chi-square value to the critical value**

Χ2 = 4.2

Critical value = 11.07

The Χ2 value is less than the critical value*.*

**Step 5: Decide whether the reject the null hypothesis**

The Χ2 value is greater than the critical value, so your friend should **fail to reject** the null hypothesis that the die lands on each number with equal probability. Based on the data, there’s no reason to think there’s a problem with the dice.

### Answer 2

**Correct Answer = a -** I should reject the null hypothesis.

**Step 1: Calculate the expected frequencies**

|  |  |  |
| --- | --- | --- |
| **Nut** | **Observed** | **Expected** |
| Peanuts | 621 | 1000 \* 0.5 = 500 |
| Cashew | 189 | 1000 \* 0.3 = 300 |
| Almonds | 190 | 1000 \* 0.2 = 200 |

**Step 2: Calculate chi-square**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Phenotype** | **Observed** | **Expected** | ***O* - *E*** | **(*O* - *E*)2** | **(*O* - *E*)2 / E** |
| Peanuts | 621 | 500 | 121 | 14 641 | 29.28 |
| Cashew | 189 | 300 | -111 | 12 321 | 41.07 |
| Almonds | 190 | 200 | -10 | 100 | 0.5 |

Χ2 = 29.28 + 41.07 + 0.5 = 70.85

**Step 3: Find the critical chi-square value**

Since there are three groups, there are two degrees of freedom.

For a test of significance at α = .05 and *df* = 2, the Χ2 critical value is 5.99.

**Step 4: Compare the chi-square value to the critical value**

Χ2 = 70.85

Critical value = 5.99

The Χ2 value is greater than the critical value*.*

**Step 5: Decide whether the reject the null hypothesis**

The Χ2 value is greater than the critical value, so you should **reject** the null hypothesis that the nut mix has the desired proportions of nuts. The data suggests that there’s a problem with the nut mix.