

Sample questions for the Chi-square goodness-of-fit test

Q1: We want to see whether a dice is fair or not. We roll the dice 60 times and we obtain the following frequencies:

Ei= 60/6 =10

| Number | Frequency (Oi) | Ei | (Oi - Ei) | ((Oi-Ei)) ² | (Oi-Ei) ² /Ei |
|--------|----------------|----|-----------|------------------------|--------------------------|
| 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 |

 $X^2 = 4.2$

Chi-square tables for $\alpha = 0.05$ and v = (6-1) = 5

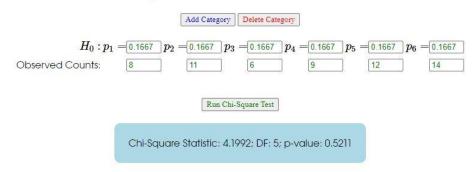
Critical value on table X^2 0.05,5 = 11.070

 $4.2 < 11.071 \rightarrow do not reject H0$

there isn't sufficient evidence to conclude that the die is not fair

P=1/6 = 0,1667

Chi-Square Goodness-of-Fit Test



Interpretation: Assuming that null hypothesis is true, the probability of seeing a chi-square statistic of 4.1992 or greater is 0.5211.

That is, if the probabilities claimed by H_0 are true, then 52.1% of similarly collected samples will have a chi-square statistic of 4.1992 or greater.

Q2: A 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, we randomly sample 1000 nuts and find the following frequencies:

| Nut | Frequency (Oi) | Ei | (Oi - Ei) | ((Oi-Ei)) ² | (Oi-Ei) ² /Ei |
|---------|----------------|-----|-----------|------------------------|--------------------------|
| Peanuts | 621 | 500 | 121 | 14641 | 29.282 |
| Cashew | 189 | 300 | -111 | 12321 | 41.07 |
| Almonds | 190 | 200 | -10 | 100 | 0.5 |

 $X^2 = 70.852$

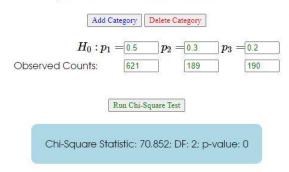
Chi-square tables for $\alpha = 0.05$ and v = (3-1) = 2

Critical value on table : X^2 0.05,2 = 5.991

 $70.852 > 5.991 \rightarrow \text{reject the H0}$

The nut mixture does not contain the required proportions of nuts

Chi-Square Goodness-of-Fit Test



Interpretation: Assuming that null hypothesis is true, the probability of seeing a chi-square statistic of 70.852 or greater is 0. That is, if the probabilities claimed by H_0 are true, then 0% of similarly collected samples will have a chi-square statistic of 70.852 or greater.

Q3: You're hired by a dog food company to help them test three new dog food flavors. You recruit a random sample of 75 dogs and offer each dog a choice between the three flavors by placing bowls in front of them. You expect that the flavors will be equally popular among the dogs, with about 25 dogs choosing each flavor

| Flavor | Frequency (Oi) | Ei | (Oi - Ei) | ((Oi-Ei)) ² | (Oi-Ei) ² /Ei |
|--------------|----------------|----|-----------|------------------------|--------------------------|
| With beef | 22 | 25 | -3 | 9 | 0.36 |
| With chicken | 30 | 25 | 5 | 25 | 1 |
| With fish | 23 | 25 | -2 | 4 | 0.16 |

$$X^2 = 1.52$$

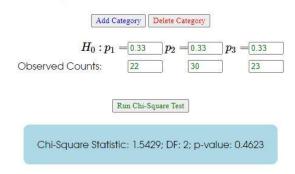
Chi-square tables for $\alpha = 0.05$ and v = (3-1) = 2

Critical value on table : X^2 0.05,2 = 5.991

 $1.52 < 5.991 \rightarrow \text{ not reject the HO}$,

There is not enough evidence to conclude that dog food flavors are unevenly popular among dogs.

Chi-Square Goodness-of-Fit Test



Interpretation: Assuming that null hypothesis is true, the probability of seeing a chi-square statistic of 1.5429 or greater is 0.4623.

That is, if the probabilities claimed by H_0 are true, then 46.2% of similarly collected samples will have a chi-square statistic of 1.5429 or greater.