

Lab 08

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OBJECTIVE

To carry out the goodness of fit test using chi-square distribution.

Question-1: For example, we collected wild tulips and found that 71 were red, 40 were yellow and 29 were white. 1. Are these colors equally common? Find the expected values and residuals? 2. Suppose that, in the region where you collected the data, the ratio of red, yellow and white tulip is 4:3:1. Find the expected values and residuals?

Ans 1: H0: The colors are equally common H1: The colors are not equally common.

```
observed=c(71,40,29)
expected=c(1/3,1/3,1/3)
m=chisq.test(observed,p=expected)
m

##
##  Chi-squared test for given probabilities
##
## data:  observed
## X-squared = 20.329, df = 2, p-value = 3.852e-05
```

We get the chi-squared value as 20.329 p-value is very small and smaller than 0.05. Hence we can reject H0 and conclude that the colors are not equally common.

```
m$expected
## [1] 46.66667 46.66667 46.66667
```

the expected value for each colors is given above.

```
m$residuals
## [1] 3.5620353 -0.9759001 -2.5861352
```

Hence we obtain the residuals as 3.56, -0.97 and -2.58 for red, yellow and white tulips respectively.

Conclusion: Since p-value is less than 0.05, H0 should be rejected and we get the inference that the colors are not common.

Ans 2. H0: The sample aligns with the given ratio H1: The sample doesn't align with the given ratio

```
observed=c(71,40,29)
expected=c(4/8,3/8,1/8)
m=chisq.test(observed,p=expected)
m$expected
## [1] 70.0 52.5 17.5
```

The above values are the expected value for red, yellow and white tulips respectively.

```
m$residuals
## [1] 0.1195229 -1.7251639 2.7490258
```

The residuals for red, yellow and white tulips respectively is 0.119, -1.72, and 2.74.

Question -2: Avni is testing an octahedral die to see if it is biased. The observed results are given: 7 10 11 9 12 10 14 7

Test the hypothesis that the die is fair.

Ans

H0: The die is fair H1: The die is not fair

```
expected=c(1/8,1/8,1/8,1/8,1/8,1/8,1/8,1/8)
observed=c(7,10,11,9,12,10,14,7)
m=chisq.test(observed,p=expected)
m
##
## Chi-squared test for given probabilities
##
## data: observed
## X-squared = 4, df = 7, p-value = 0.7798
```

We obtain the chi-square value as 4. p-value is 0.779. as this value is greater than 0.05, we fail to reject H0. Hence the die is fair.

Conclusion: As the p-value is greater than 0.05, we can conclude that the die is fair.

Question- 3: When randomly selecting a card from a deck with replacement, are we equally likely to select a heart, diamond, spade, and club? I randomly selected a card from a standard deck 40 times with replacement. I pulled 13 hearts, 8 diamonds, 8 spades, and 11 clubs.

Ans H0: It is equally likely to get a heart, diamond, spade and a club. H1: It is not equally likely to get a heart, diamond, spade and a club.

```
expected=c(1/4,1/4,1/4,1/4)
observed=c(13,8,8,11)
m=chisq.test(observed,p=expected)
m

##
##  Chi-squared test for given probabilities
##
## data:  observed
## X-squared = 1.8, df = 3, p-value = 0.6149
```

We obtain the chi-square value as 1.8 and p-value as 0.614 as we get a high p-value which is greater than 0.05, we fail to reject H_0 . Hence it is equally like to get heart,diamond, spade and a club.

Conclusion: Since $p\text{-value} > 0.05$, we fail to reject H_0 . Hence it is equally like to get heart,diamond, spade and a club.