Time Frame: 50 minutes

Subject Matter: Chi Square

TELL ME

Objective: TSWBAT test a distribution for goodness of fit, using chi square.

Standards: DA – 3.8

 Materials: TI 83 Calculator and Worksheets

SHOW ME

Presentation of Information

Try this

In a recent study the following percentages of U.S. retail car sales based on size were reported: 28.1% small, 47.8% midsize, 7% large, and 17.1% luxury. A recent study of retail sales in a particular county indicated that of 100 cars sold, 25 were small, 50 were midsize, 10 were large, and 15 were luxury cars. At $α=0.05$, is there sufficient evidence to conclude that the proportions differ from those stated in the report?

Solution:

d.f. = 4 categories minus 1 = 3

Observed Frequency (O)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency | Small | Midsize | Large | Luxury |
| Observed | 25 | 50 | 10 | 15 |
| Expected | 28.1 | 47.8 | 7 | 17.1Expected Frequency(E) |

$0.281×100$
$$0.478×100$$

$$0.07×100$$

$$0.171×100$$

The total number of cars is 100.

* State the hypotheses:

$H\_{0}:$ The retail car sales based on size are distributed as follows:

* 28.1% small
* 47.8% midsize
* 7% large
* 17.1% luxury

$H\_{1}:$ The distribution is not the same as stated in the null hypothesis.

* Find the critical value:

Use table G

* Compute the test value:

Observed Frequency (O)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency | Small | Midsize | Large | Luxury |
| Observed | 25 | 50 | 10 | 15 |
| Expected | 28.1 | 47.8 | 7 | 17.1Expected Frequency(E) |

$$χ^{2}=∑\frac{\left(O-E\right)^{2}}{E}$$

$χ^{2}=\frac{\left(25-28.1\right)^{2}}{28.1}$ + $\frac{\left(50-47.8\right)^{2}}{47.8}+\frac{\left(10-7\right)^{2}}{7}+\frac{\left(15-17.1\right)^{2}}{17.1}$

$χ^{2}=\frac{\left(-3.1\right)^{2}}{28.1}$ + $\frac{\left(2.2\right)^{2}}{47.8}+\frac{\left(3\right)^{2}}{7}+\frac{\left(-2.1\right)^{2}}{17.1}$

$$χ^{2}=0.34+0.10+1.29+0.26$$

Compare this to the critical value

$$χ^{2}=1.99$$

* Make the decision:

Accept $H\_{0}$ since the computed value is less than the critical value.

* Summarize the result:

The retail car sales based on size are distributed as follows:

* 28.1% small
* 47.8% midsize
* 7% large
* 17.1% luxury

Classwork

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: April 13, 2011

1. According to a recent census report, 68% of families have two parents present, 23% have only a mother present, 5% have only the father present, and 4% have no parent present. A random sample of families from a large school district revealed these results:

Two parents Mother only Father only No parent

 120 40 30 10

At $α=0.05$, is there sufficient evidence to conclude that the proportions of families by type of parent(s) present differ from those reported by the census?

1. An ABC News poll asked adults whether they felt genetically modified food was safe to eat. 35% felt it was safe, 52% felt it was not safe, and 13% had no opinion. A random sample of 120 adults was asked the same question at a local county fair. 40 people felt that genetically modified food was safe, 60 felt it was not safe, and 20 had no opinion. At $α=0.025$ , is there sufficient evidence to conclude that the proportions differ from those reported in the survey?

# 1

Solution:

d.f. = 4 categories minus 1 = 3

Observed Frequency (O)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency | Two parents | Mother only | Father only | No parents |
| Observed | 120 | 40 | 30 | 10 |
| Expected | 136 | 46 | 10 | 8Expected Frequency(E) |

$0.68×200$
$$0.23×200$$

$$0.05×200$$

$$0.04×200$$

The total number of respondents is 200

* State the hypotheses:

$H\_{0}:$ The U.S. census reports:

* 68% families have two parents
* 23% have mother only
* 5% have father only
* 4% have no parents

$H\_{1}:$ The distribution is not the same as stated in the null hypothesis.

* Find the critical value:

Use table G

* Compute the test value:

Observed Frequency (O)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency | Two parents | Mother only | Father only | No parents |
| Observed | 120 | 40 | 30 | 10 |
| Expected | 136 | 46 | 10 | 8Expected Frequency(E) |

$$χ^{2}=∑\frac{\left(O-E\right)^{2}}{E}$$

$χ^{2}=\frac{\left(120-136\right)^{2}}{136}$ + $\frac{\left(40-46\right)^{2}}{46}+\frac{\left(30-10\right)^{2}}{10}+\frac{\left(10-8\right)^{2}}{8}$

$χ^{2}=\frac{\left(-16\right)^{2}}{10}$ + $\frac{\left(-6\right)^{2}}{46}+\frac{\left(20\right)^{2}}{10}+\frac{\left(2\right)^{2}}{8}$

$χ^{2}=25.6$ + 0.78$ +40+0.50$

Compare this to the critical value

$χ^{2}=$ 66.88

* Make the decision:

Accept $H\_{1}$ since the computed value is greater than the critical value.

* Summarize the result:

The distribution is not the same as stated in the null hypothesis.

# 2

Solution:

d.f. = 3 categories minus 1 = 2

Observed Frequency (O)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Safe | Not safe | No opinion |
| Observed | 40 | 60 | 20 |
| Expected | 42 | 62.4 | 15.6Expected Frequency(E) |

$0.35×120$
$$0.52×120$$

$$0.13×120$$

The total number of respondents is 120

* State the hypotheses:

$H\_{0}:$ ABS News has the following reports on genetically modified food:

* 35% felt it was safe to eat
* 52% felt it was not safe
* 13% had no opinion

$H\_{1}:$ The distribution is not the same as stated in the null hypothesis.

* Find the critical value:

Use table G

* Compute the test value:

Observed Frequency (O)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Safe | Not safe | No opinion |
| Observed | 40 | 60 | 20 |
| Expected | 42 | 62.4 | 15.6Expected Frequency(E) |

$$χ^{2}=∑\frac{\left(O-E\right)^{2}}{E}$$

$χ^{2}=\frac{\left(40-42\right)^{2}}{42}$ + $\frac{\left(60-62.4\right)^{2}}{62.4}+\frac{\left(20-15.6\right)^{2}}{15.6}$

$χ^{2}=\frac{\left(-2\right)^{2}}{42}$ + $\frac{\left(-2.4\right)^{2}}{62.4}+\frac{\left(4.4\right)^{2}}{15.6}$

$$χ^{2}=0.10+0.09+1.24$$

Compare this to the critical value

$χ^{2}=$ 1.43

* Make the decision:

Accept $H\_{0}$ since the computed value is less than the critical value.

* Summarize the result:

ABS News has the following reports on genetically modified food:

* 35% felt it was safe to eat
* 52% felt it was not safe
* 13% had no opinion