# Tests of Homogeneity and Independence

## Lecture 51
## Sections 14.4 - 14.5

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# Outline

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# TI-83 - Test of Homogeneity or Independence

- Now we will perform the test on the TI-83.
- One problem: The tables in these examples are not lists, so we can't use the lists in the TI-83.
- Instead, the tables are matrices.

# TI-83 - Test of Homogeneity or Independence

- Now we will perform the test on the TI-83.
- One problem: The tables in these examples are not lists, so we can't use the lists in the TI-83.
- Instead, the tables are matrices.
- That's ok. The TI-83 can handle matrices.

# TI-83 - Test of Homogeneity or Independence

## TI-83 Test of Homogeneity or Independence

- To enter the observed counts into a matrix:
  - Press `MATRIX`.
  - Select the `EDIT` menu.
  - Use the arrow keys to select the matrix to edit, e.g., `[A]`.
  - Press `ENTER` to edit that matrix.
  - Enter the number of rows and columns. (Press `ENTER` to advance.)
  - Enter the observed counts in the cells.
  - Press `2nd Quit` to exit the matrix editor.

# TI-83 - Test of Homogeneity or Independence

## TI-83 Test of Homogeneity or Independence

- To perform the test of homogeneity.
  - Select `STATS > TESTS >` $\chi^2$`-Test...`
  - Press `ENTER`.
  - Use the `MATRIX` button to enter the name of the matrix of observed counts.
  - Enter the name, e.g., `[E]`, of a matrix of the expected counts. These will be computed for you by the TI-83.
  - Select `Calculate`.
  - Press `ENTER`.

# TI-83 - Test of Homogeneity or Independence

## TI-83 Test of Homogeneity or Independence

- The window displays:
  - The title $\chi^2$-Test.
  - The value of $\chi^2$.
  - The *p*-value.
  - The number of degrees of freedom.

# TI-83 - Test of Homogeneity or Independence

## TI-83 Test of Homogeneity or Independence

- To see the matrix of expected counts:
  - Press `MATRIX`.
  - Select matrix `[E]`.
  - Press `ENTER`.

# Outline

# The Political Affiliation Example

## Example (The Political Affiliation Example)

- The mortality data data are shown below.
- Do the distributions appear to be different?

| | Approve | Disapprove | Neutral |
|---|---|---|---|
| Conservative | 10 | 50 | 20 |
| Liberal | 20 | 10 | 10 |
| Moderate | 20 | 30 | 30 |

- Test the hypotheses at the 5% level.
- Show the expected counts.

# The Political Affiliation Example

## Example (The Political Affiliation Example)

(1) $H_0$ : The populations are homogeneous.
$H_1$ : The populations are not homogeneous.

(2) $\alpha = 0.05$.

(3) $\chi^2 = \dfrac{(O-E)^2}{E}$

# The Political Affiliation Example

## Example (The Political Affiliation Example)

- Now use $\chi^2$Test to compute the expecteds and the value of $\chi^2$.

# The Political Affiliation Example

## Example (The Political Affiliation Example)

(4)

| | Approve | Disapprove | Neutral |
|---|---|---|---|
| Conservative | 10 | 50 | 20 |
| | (20) | (36) | (24) |
| Liberal | 20 | 10 | 10 |
| | (10) | (18) | (12) |
| Moderate | 20 | 30 | 30 |
| | (20) | (36) | (24) |

$\chi^2 = 27.5$

# The Political Affiliation Example

## Example (The Political Affiliation Example)

(5) $p$-value $= \chi^2\texttt{cdf(27.5,E99,46)} = 1.575 \times 10^{-5}$

(6) Reject $H_0$.

(7) The different groups have different opinions of the president's performance.

# Outline

# The Ultrasound Example

## Example (The Ultrasound Example)

- Are the variables sex and opinion about ultrasound requirement independent?
- Does the value of one variable appear to influence the proportions of the other variable?
- Test the hypotheses at the 5% level.
- Show the expected counts.

| | Support | Oppose | No Opinion |
|---|---|---|---|
| Male | 204 | 318 | 78 |
| Female | 144 | 220 | 36 |

# The Life-at-Conception Example

## Example (The Life-at-Conception Example)

(1) $H_0$ : The variables are independent.
$H_1$ : The variables are dependent.

(2) $\alpha = 0.05$.

(3) $\chi^2 = \dfrac{(O-E)^2}{E}$

# The Political Affiliation Example

## Example (The Political Affiliation Example)

- Now use $\chi^2$Test to compute the expecteds and the value of $\chi^2$.

# The Political Affiliation Example

## Example (The Political Affiliation Example)

(4)

| | Support | Oppose | No Opinion |
|---|---|---|---|
| Male | 204 | 318 | 78 |
| | (208.8) | (322.8) | (68.4) |
| Female | 144 | 220 | 36 |
| | (139.2) | (215.2) | (45.6) |

$\chi^2 = 3.828.$

# The Political Affiliation Example

## Example (The Political Affiliation Example)

(5) $p$-value $= \chi^2$`cdf(3.828,E99,2)` $= 0.1479$.

(6) Accept $H_0$.

(7) The variables are independent.

# The Political Affiliation Example

## Example (The Political Affiliation Example)

(5) $p$-value $= \chi^2\texttt{cdf(3.828,E99,2)} = 0.1479$.

(6) Accept $H_0$.

(7) The variables are independent.

(8) It also implies that the populations (male, female) are homogeneous on this issue.

# Outline

# Assignment

## Homework

- Read Section 14.4, pages 940 - 947.
- Let's Do It! 14.4, 14.5.
- Exercises 17 - 22, page 948.