10.3.1: Exercises

The Pew Research Center studies many different groups in the United States. One of the center's projects is the Pew Internet and American Life Project. In this project, the research center learns how people in the United States use computers and technology.

In one study, researchers asked people, "Do you use a computer at your workplace, at school, at home, or anywhere else on at least an occasional basis?" The possible responses to this question were "Yes" and "No". Researchers also recorded information about each respondent's urbanity, that is whether the respondent lived in an "Urban" area (a city), a "Suburban" area (a neighborhood outside city limits), or a "Rural" area (not in a neighborhood).

Researchers obtained the following results, based on a sample of 8,296 individuals:

		Urbanity		
		Urban	Suburban	Rural
Response	Yes	1946	3533	943
("Do you use a computer?")	No	537	835	502

Do these data support the claim that there is a relationship between a person's response to the question about computer use and the person's urbanity? Execute a complete chi-square test for independence for this case. Use a significance level of $\alpha = 0.01$.

1. Step 1: What are the appropriate hypotheses for this test?

2. Step 2: Collect the Data

   The table below displays the row, column and grand totals, and the expected frequencies for all but one cell. Compute and enter in the missing expected frequency. Round the value to two decimal places.

Computer Usage	Urban	Suburban	Rural	Totals
Yes		3381.30	1118.59	6422
No	560.89	986.70	326.41	1874
Totals	2483	4368	1445	8296

3. Step 3: Assess the Evidence

a. Each pair of observed and expected frequencies are provided in the table below. Compute the missing contribution to the χ^2 test statistic. Round the values to two decimal places.

Pairings of Values	O = Observed Frequency	E = Expected Frequency	$\frac{(O-E)^2}{E}$
Urban / Yes	1946		
Urban / No	537	560.89	1.02
Suburban / Yes	3533	3381.30	6.81
Suburban / No	835	986.70	23.32
Rural / Yes	943	1118.59	27.56
Rural / No	502	326.41	94.46

b. All expected frequencies are greater than 5, so we can proceed with the hypothesis test. What is the value of the χ^2 test statistic? Write the value to two decimal places.

c. Use the desmos graph https://www.desmos.com/calculator/bjohldwaym to determine the P-value.

4. Step 4: Make a Decision

At the 1% significance level, write an appropriate conclusion.