

1. a. H_0 : There is no association between an employee's department and their preferred training method.
 H_a : There is an association between an employee's department and their preferred training method.

b.

	Online Courses	In-person Workshops
Sales	22.89	24.11
Marketing	19.97	21.03
Finance	13.15	13.85

2. a. χ^2 test for homogeneity; 3 samples from 3 populations with one categorical variable recorded (location of injury).
- b. one-sample z -test for p : there is one sample and one claimed proportion for the population. Each of the 80 bloomed flowers can be classified as roses or not roses.
- c. χ^2 test for independence; 1 sample from 1 population with two categorical variables recorded (type of neighborhood and preferred mode of commuting)

3. CLASSIFY:

Type of study: Observational study

Variables: Interactions with neighbors (categorical), type of home (categorical)

CHOOSE:

χ^2 test for independence at $\alpha = 0.05$

H_0 : There is no association between home type and level of interaction with neighbors in this city.

H_a : There is an association between home type and level of interaction with neighbors in this city.

CHECK:

Random: random sample of 200 residents

10%: $200 \leq 0.10$ (all residents of the city)

Large Counts: all expected counts (65.34, 33.66, 66.66, 34.34) > 5

CALCULATE:

$$\chi^2 = \frac{(79 - 65.34)^2}{65.34} + \frac{(20 - 33.66)^2}{33.66} + \frac{(53 - 66.66)^2}{66.66} + \frac{(48 - 34.34)^2}{34.34}$$
$$= 2.856 + 5.544 + 2.799 + 5.434 = 16.632$$

$$df = 1$$

$$p\text{-value} = 0.000045$$

CONCLUDE:

Assuming H_0 is true (there is no association between home type and level of interaction with neighbors in this city), there is a 0.000045 probability of getting a χ^2 test statistic of 16.632 or greater purely by chance. Because $0.000045 < 0.05$, we reject H_0 and we do have convincing evidence that there is an association between home type and level of interaction with neighbors in this city. The largest component of the χ^2 test statistic is 5.54 because the number of apartment residents who frequently interact with their neighbors is much lower than expected. The second largest component of the χ^2 test statistic is 5.434 because the number of apartment residents who have limited interactions with their neighbors is much higher than expected.

4. a. The probability that the employee works on weekends is $\frac{36}{122} \approx 0.295$.
- b. Given that the employee works full-time, the probability that they work on weekends is $\frac{28}{100} = 0.28$.
- c. Given that the employee works part time, the probability that they work on weekends is $\frac{8}{22} \approx 0.364$.
- d. No, the events are not independent. The probability of working on weekends varies based on whether the employee works full-time or part-time. Part-time employees are more likely to work on weekends than full-time employees.
- e. p -value = 0.4361
- f. No, $0.4361 > 0.05$.
- g. Part (d) examines independence within the sample data, and our conditional probability calculations show that the events are not independent in this specific sample. Part (f), however, addresses whether we have convincing statistical evidence that the events are not independent in the population based on the data from the random sample. The chi-square test yielded a p-value of 0.4361, indicating there's a 0.4361 probability of observing our sample results (or more extreme) purely by chance if the null hypothesis of independence is true. Since $0.4361 > 0.05$, we fail to reject the null hypothesis that working full-time and working on weekends are independent in the population, despite the apparent lack of independence observed in our sample.
5. D
6. C