Lesson 8.3.2

8-50. a.

	Apples	No Apples
Oranges	80	40
No Oranges	80	50

b.

	Apples	No Apples
Oranges	0.5	0.444
No Oranges	0.5	0.556

c. Answers may vary. There is a difference, but it is not huge; whether it is big enough is a question you cannot answer yet for sure!

8-51. a. $P(O \mid A)$ and $P(O \mid \bar{A})$. If these two are equal, then that means the probability of orange-buying does not change based on apple-buying, which is the definition of independence!

b. H_0: $p_A - p_N = 0$

c. H_A: $p_A - p_N \neq 0$

d. These proportions could theoretically change independently of one another so the independent samples condition is met. The counts are all well above 10, so the large counts condition is met. You can assume that the population of apple-buyers is greater than $10 \cdot 160$ and that the population of all non-apple-buyers is greater than $10 \cdot 90$, satisfying the independent trials condition. Finally, the context mentions that this came from a random sample.

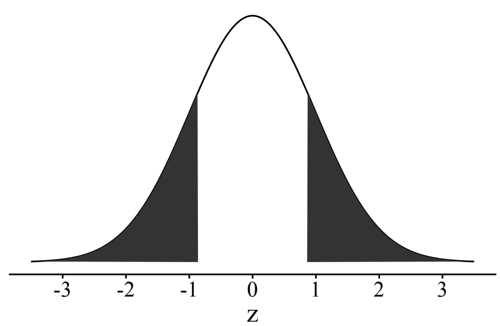
e. The formula requires both proportions. The null hypothesis does not provide those values, only their difference.

8-52. a. $\frac{120}{250} = 0.48$

b. $SE_{\hat{p}_1 - \hat{p}_2} = \sqrt{\frac{\hat{p}_P(1-\hat{p}_P)}{n_1} + \frac{\hat{p}_P(1-\hat{p}_P)}{n_2}} \approx \sqrt{\frac{0.48(0.52)}{160} + \frac{0.48(0.52)}{90}} \approx 0.06583$

c. The sample's z-score is 0.851. See diagram at right for standard curve. The p-value is 0.395.

d. No. The p-value is quite high, so the variables could easily be independent; you cannot reject the null hypothesis.



8-53. a. Yes. 27.6% of Cable-finity's customers are satisfied, but 23.5% of Comcable's are satisfied.

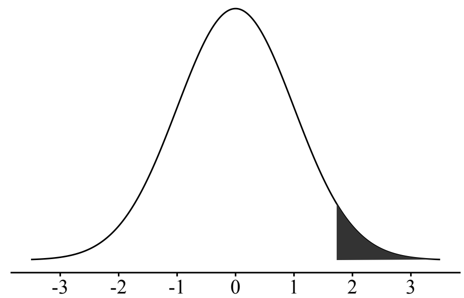
b. Let p_1 be the proportion of satisfied Cable-finity subscribers and p_2 be the proportion of satisfied Comcable subscribers. H_0: $p_1 - p_2 = 0$; H_A: $p_1 - p_2 > 0$, Sample evidence for H_A: $0.276 - 0.235 = 0.041$

c. The samples are both random, there are millions of subscribers for each company, so independent trials is satisfied, and there were well more than 10 satisfied and dissatisfied customers in each sample. Independent samples must be assumed.

d. The pooled proportion $\hat{p}$ is $\frac{373}{1500} = 0.2487$. The standard error is 0.0237.

e. z-score is 1.73. See diagram at right. The p-value is 0.042.

f. Yes. Since the p-value is less than α, they have sufficient evidence to accept the alternative hypothesis and can run their ad.

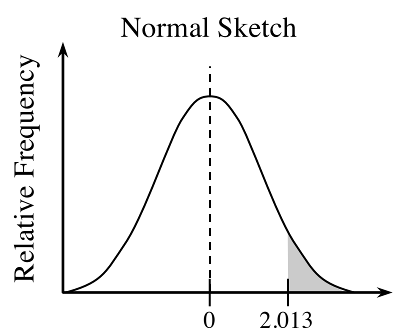


8-54. Identify: Given $p_1 = 0.7409, x_1 = 326, n_1 = 440, p_2 = 0.6693, x_2 = 170, n_2 = 254, \alpha = 0.03$. Perform a two-proportion z-test where p_1 is Claire's city's proportion of people having a hybrid car and p_2 is Anna's city's proportion. H_0: $p_1 - p_2 = 0$, H_A: $p_1 - p_2 > 0$, Sample evidence for H_A : $0.7409 - 0.6693 = 0.0716$, which is > 0.
Check conditions: Independent samples: it is unlikely that car sales between the cities are connected. Random selection, to avoid bias: a sampling technique using randomness was mentioned in the problem description. Independent trials for an accurate σ: it must be assumed that the populations of interest are larger than ten times the sample sizes of 440 and 254 respectively. Large counts, so the sampling distribution ≈ normal:
[Claire] $np = 326$, $n(1-p) = 114$ and [Anna] $np = 170$, $n(1-p) = 84$, which are all at least 10.
Calculate: $p(\text{pooled}) = \frac{326+170}{440+254} = 0.7147$,

$$SE = \sqrt{\frac{0.7147(1-0.7147)}{440} + \frac{0.7147(1-0.7147)}{254}} \approx 0.0356,$$

$$z = \frac{0.7409-0.6693}{0.0356} = 2.013,$$

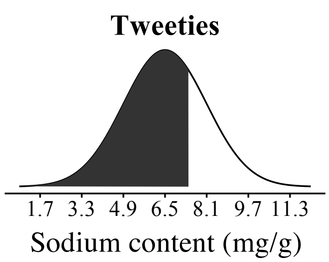
p-value = normalcdf(2.013, E99, 0, 1) = 0.0221. See diagram at right.
Conclude: Because the p-value is less than the significance level of the test, you can reject the null hypothesis and demonstrate Claire's city population proportion of people with a hybrid car is greater than Anna's city population proportion.



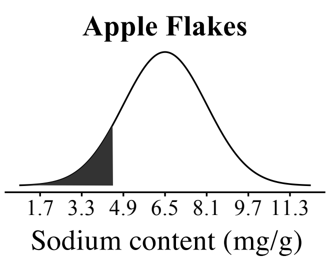
8-55. a. An observational study would be best to answer this question since you simply need to observe where the cereal is located in the grocery store.

b. Example: The subjects in this study would be the grocery stores. It would be difficult to obtain a simple random sample, so some kind of multi-stage sample could be taken. Consider all grocery stores in the United States to be the population and the states to be clusters. Begin by randomly selecting 10 clusters, or states. Within each state, take a simple random sample of 5 cities. Obtain a list of all grocery stores in those 50 cities and randomly select 2 from each. These 100 grocery stores would make up the sample.

8-56. a. $P(X < 7.4)$ = normcdf(–10^99, 7.4, 6.5, 1.6) = 0.713; 71% of cereals have less sodium than Tweeties. See diagram below.



b. $P(X < 4.5)$ = normcdf(–10^99, 4.5, 6.5, 1.6) = 0.106; 11% of cereals have less sodium than Apple Flakes. See diagram below.



c. $P(X < 3.9)$ = normcdf(–10^99, 3.9, 6.5, 1.6) = 0.052; 5% of cereals have less sodium than Korn Crispies. See diagram below.