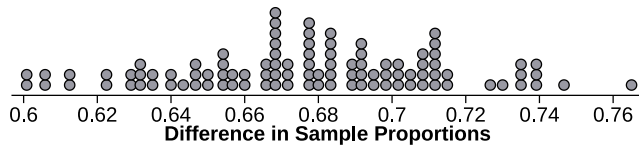


1. French is the first language for 88% of the population in France and for 20% of the population in Canada. Suppose a random sample of 200 people in France is selected, and the proportion in the sample who speak French as the first language is calculated ($\hat{p}_1$). A separate random sample of 300 people in Canada is selected, and the proportion in the sample who speak French as the first language is calculated ($\hat{p}_2$). Here is a simulated sampling distribution of $\hat{p}_1 - \hat{p}_2$.



- What does the dot at about 0.747 represent?
- What is the shape of the sampling distribution of $\hat{p}_1 - \hat{p}_2$? Justify.
- What is the mean of the sampling distribution of $\hat{p}_1 - \hat{p}_2$? Interpret.
- What condition must be met to use the formula for standard deviation? Check the condition.
- What is the standard deviation of the sampling distribution of $\hat{p}_1 - \hat{p}_2$? Interpret.

2. Sports cars have often been associated with the color red, but is this really the color of choice for famous sports car companies? According to the Italian sports car company Ferrari, 40% of Ferraris are ordered in red, while it is only 16% for German sports car company Porsche. A curious car enthusiast used an online database to select random samples of Ferraris and Porsches that are registered in the United States.
- For a random sample of 100 Ferraris, the car enthusiast calculated the proportion of the sample that is red ($\hat{p}_1$). What are the mean and standard deviation of the sampling distribution of $\hat{p}_1$?
 - For a random sample of 200 Porsches, the car enthusiast calculated the proportion of the sample that is red ($\hat{p}_2$). What are the mean and standard deviation of the sampling distribution of $\hat{p}_2$?
 - What are the mean and standard deviation of the sampling distribution of $\hat{p}_1 - \hat{p}_2$?
3. The United States and China are the top two countries for producing revenue from video games. A recent survey found that for people aged 16-24, 82.9% in the United States and 72.1% in China are playing video games. Assume this claim is true. Suppose a random sample of 100 people aged 16-24 are selected from the United States and the proportion who are playing video games is calculated ($\hat{p}_1$). A separate random sample of 100 people aged 16-24 are selected from China and the proportion who are playing video games is calculated ($\hat{p}_2$).
- Describe the shape, center (mean), and variability (standard deviation) of the sampling distribution of $\hat{p}_1 - \hat{p}_2$.
 - What is the probability that the proportion of the sample from the United States is at least 10% greater than the proportion of the sample from China?

4. A recent report claims that adults binge-watch streaming video more than teenagers. According to the report, 70% of adults aged 30-44 are binge watchers and 60% of teenagers aged 13-17 are binge-watchers. Assume this claim is true.

Suppose a random sample of 80 of these adults are selected and the proportion who are binge-watchers is calculated ($\hat{p}_A$). A separate random sample of 50 of these teenagers is selected and the proportion who are binge-watchers is calculated ($\hat{p}_T$).

- a. What is the probability that the sample of adults has a lower proportion of binge-watchers than the sample of teenagers? Show your work.
- b. Suppose the two samples revealed exactly the same proportion who are binge-watchers for each age group. Does this result provide convincing evidence that the report's claim is not true? Justify.

5. A random sample of 30 registered voters aged 35 and older is selected, where 43 percent plan to vote for a candidate running for mayor. A separate random sample of 50 registered voters aged 34 and younger is selected, where 15 percent plan to vote for the candidate running for mayor. A political analyst considers the sampling distribution of the difference in sample proportions.

Is the distribution approximately normal according to the large counts condition?

- A) Yes. Both sample sizes are large enough.
- B) No. Neither sample size is large enough.
- C) No. The sample size for the older group is large enough, but the sample size for the younger group is not.
- D) No. The sample size for the younger group is large enough, but the sample size for the older group is not.

6. A study found that 19 percent of financial transactions in the year 2000 were made by writing a check. In the year 2023, the percent of financial transactions made by writing a check was 4 percent. Based on these percentages, which of the following is closest to the probability that the difference in proportions between a random sample of 100 transactions from 2000 and a random sample of 250 transactions from 2023 (2000 minus 2023) is greater than 18 percent?

A) 0.2329

B) 0.2707

C) 0.7292

D) 0.7671