1. **Probability:** Ex. A jury list contains the names of all individuals who may be called for jury duty. The proportion of the available jurors on the list who are women is .53. If a jury of size 12 is selected at random from the list of available jurors, a. Find the probability that no women are selected: \( P(0 \text{ women}) = (0.47)^{12} = 0.0012 \)

b. Find the probability that exactly one woman is selected: \( P(1 \text{ woman}) = \binom{12}{1} (0.53)^1 (0.47)^{11} = 0.0016 \)

c. Find the probability that at most one woman is selected: \( P(0 \text{ or } 1 \text{ woman}) = (0.47)^{12} + \binom{12}{1} (0.53)^1 (0.47)^{11} = 0.00172 \)

d. Find the probability that at most two women are selected: \( P(0 \text{ or } 1 \text{ or } 2 \text{ women}) = (0.47)^{12} + \binom{12}{1} (0.53)^1 (0.47)^{11} + \binom{12}{2} (0.53)^2 (0.47)^{10} = 0.01147 \)

e. Find the expected value and SD of the # of women selected: \( E(X) = n \pi = 12 \times 0.53 = 6.36, V(X) = 12 \times (0.53)(0.47) = 2.89 \)

2. **Sample sizes for proportions:** They decided to use a sample size such that \( n/\pi \geq 40 \), the error wouldn’t exceed \( .04 \).

3. **Hypothesis testing:** proportions

For a random sample of 1600 Canadians taken in January, 880 people indicate approval of the prime minister. A similar poll a month later of a separate random sample of 1600 Canadians has a favorable rating by 944 people. Let \( H_0: \pi = 0.53 \).

- \( n_1 = 1600 \), \( n_2 = 1600 \), \( \pi_1 = 0.55 \), \( \pi_2 = 0.59 \)

\[ z = \frac{\hat{p}_1 - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} = \frac{0.55 - 0.53}{\sqrt{\frac{0.53(1-0.53)}{1600}}} = 1.26 \]

\[ \hat{\sigma}_{\pi_1-\pi_2} = \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}} = \sqrt{\frac{0.55(1-0.55)}{1600} + \frac{0.59(1-0.59)}{1600}} = 0.056656 \]

\[ P\text{-value} = P(\hat{z} \geq 1.26) = 0.111 \]

- \( n = \frac{\pi(1-\pi)}{\hat{z}^2} = \frac{0.53(1-0.53)}{1.26^2} = 2.58 \)

4. **mean income and \( \sigma \) of two independent groups \( \rightarrow \) \( \bar{Y}_1 \neq \bar{Y}_2 \) \( \pi \rightarrow \) variance \( \sigma \)

For a random sample of ten college freshmen takes a mathematics aptitude test both before and after the test. The score for each student is \( Y \), and their anxiety level is measured after for student 2.

5. **Difference**

\[ \bar{Y}_1 - \bar{Y}_2 \]

\[ \hat{\sigma}_{\bar{Y}_1-\bar{Y}_2} = \sqrt{\frac{\sigma^2}{n_1} + \frac{\sigma^2}{n_2}} = \sqrt{\frac{2.47^2}{10} + \frac{2.47^2}{3}} = 2.47 \]

- \( \hat{\sigma}_{\bar{Y}_1-\bar{Y}_2} = \frac{\hat{\sigma}_{\bar{Y}_1-\bar{Y}_2}}{z} = \frac{2.47}{2.58} \approx 0.96 \)

\[ P\text{-value} = P(\hat{z} \geq 0.96) = 0.17 \]

6. **Expected mean and \( \hat{\sigma} \) if you’re given a normal sampling or told the pop. is normal, the means stay the same. \( \hat{\sigma} = \sqrt{\frac{\sigma^2}{n}} \)

7. **Construct a 95% confidence interval for \( \pi \)**

- For the difference between the mean political ideology in 1994 and 1978. Interpret. Because the confidence interval does not include 0, it is not plausible with in 95% confidence interval the means are equal, meaning there has been a statistically significant change in political ideology from 1978-1994.

8. **Test the hypothesis that the mean population mean political ideology was equal in 1978 and 1988. Report the P-value, and interpret.**

H_0: \( \mu_1 = \mu_2 \); Ha: \( \mu_1 \neq \mu_2 \)

- \( |\hat{\sigma}_{\bar{Y}_1-\bar{Y}_2}| = \sqrt{\frac{\hat{\sigma}_{\bar{Y}_1}^2}{n_1} + \frac{\hat{\sigma}_{\bar{Y}_2}^2}{n_2}} = \sqrt{\frac{2.47^2}{10} + \frac{2.47^2}{3}} = 2.47 \)

\[ \hat{\sigma}_{\bar{Y}_1-\bar{Y}_2} = \frac{\hat{\sigma}_{\bar{Y}_1-\bar{Y}_2}}{z} = \frac{2.47}{2.58} \approx 0.96 \]

- \( P\text{-value} = P(\hat{z} \geq 0.96) = 0.17 \)

9. **Sample-methods:** The property values for two homes selected at random in the Forest Ridge subdivision are (in thousands of dollars) 110, 120, 130. The property values for two homes selected at random in the Hermitage subdivision are 180, 200. **Confidence interval:** 90% confidence interval for the difference in mean property values between the Hermitage and for Forest Ridge subdivisions. 

\[ \bar{Y}_H - \bar{Y}_F = \frac{110 + 120 + 130}{3} - \frac{180 + 200}{2} = 10.54 \]

- \( \hat{\sigma}_{\bar{Y}_H-\bar{Y}_F} = \sqrt{\frac{\hat{\sigma}_{\bar{Y}_H}^2}{n_H} + \frac{\hat{\sigma}_{\bar{Y}_F}^2}{n_F}} = \sqrt{\frac{2.47^2}{10} + \frac{2.47^2}{3}} = 2.47 \)

- \( P\text{-value} = P(\hat{z} \geq 10.54) = 0.00012 \)

10. **Matched Pairs:** Each of a random sample of ten college freshmen takes a mathematics aptitude test both before and after undergoing an intensive training course designed to improve such test scores. Then, the scores for each student are paired.

**Hypothesis**

- \( P\text{-value} = P(\hat{z} \geq 1.26) = 0.111 \)

**Confidence interval:** \( df = 9; t\text{-value} \approx 1.833; (7\pm 1.833(\sqrt{\frac{2.47^2}{10}})) = (4.17, 4.42) \)

10b. **Matched Pairs:** A short questionnaire measuring anxiety is given to a random sample of two students taken from a large introductory statistics class. Anxiety is measured both before and after the students take a midterm exam in statistics. The scores are 91 before and 80 after for student 1 and 69 before & 60 after for student 2.

\[ E(X) = 11(9)+10(2) = 120; n = 2; df = 1; s = \text{square root of } V(X) = \text{square root 2} \]

\[ V(X) = (\text{sum of column}) = 2 \]