Chapter 5 Group Work

Sample Means and Sample Proportions

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Formulae:

Sample Means:

$\mu_{\bar{X}} = \mu$ $\qquad$ $\mu_{\bar{X}-\bar{Y}} = \mu_{\bar{X}} - \mu_{\bar{Y}}$

$\sigma_{\bar{X}} = \dfrac{\sigma}{\sqrt{n}}$ $\qquad$ $\sigma_{\bar{X}-\bar{Y}} = \sqrt{\left(\sigma_{\bar{X}}\right)^2 + \left(\sigma_{\bar{Y}}\right)^2} = \sqrt{\dfrac{\left(\sigma_1\right)^2}{n_1} + \dfrac{\left(\sigma_2\right)^2}{n_2}}$

Sample Proportions:

$\mu_{\hat{p}} = p$ $\qquad$ $\mu_{\hat{p}_1-\hat{p}_2} = p_1 - p_2$

$\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}}$ $\qquad$ $\sigma_{\hat{p}_1-\hat{p}_2} = \sqrt{\dfrac{p_1(1-p_1)}{n_1} + \dfrac{p_2(1-p_2)}{n_2}}$

1. A polling agency is investigating the voter support for a ballot measure in an upcoming city election. The agency will select a random sample of 500 voters from one region, Region A, of the city. Assume that the population proportion of voters who would support the ballot measure in Region A is 0.47.
    a. Is the sampling distribution for $\hat{p}_A$ approximately normal? Show the work that leads to this conclusion.

    b. What is the probability that the proportion of voters in Region A is greater than 0.50?

The polling agency will take another sample from a different region, Region B, of the city. The agency plans to select a random sample of 400 voters. Assume that the population proportion of voters who would support the ballot measure in Region B is 0.51.

c. Describe the sampling distribution of the difference in sample proportions (Region B minus Region A). Include an analysis of whether this distribution is normal, the value of $\mu_{\hat{p}_B - \hat{p}_A}$, and the value of $\sigma_{\hat{p}_B - \hat{p}_A}$.

d. What is the probability that the sample proportion for Region A will be greater than that of Region B?

2. The distribution of pH levels for all community swimming pools in a large county is approximately normal with mean 7.5 and standard deviation 0.4. According to swimming pool studies, the safest pH levels for water in swimming pools are between 7.3 and 7.8.
    a. What is the chance that a randomly selected pool has a pH in the safest level (that is, between 7.3 and 7.8)?

    b. If you take random samples of 6 swimming pools in the community and create a sampling distribution, will the distribution be approximately normal? What are the mean and standard deviation of the distribution?

    c. What is the probability that a given sample has a mean pH between 7.3 and 7.8?

3. Some people seem to believe you can fix anything with duct tape. Even so, many were skeptical when researchers announced that duct tape may be a more effective and less painful alternative to liquid nitrogen, which doctors routinely use to freeze warts. A study was conducted at the Madigan Army Medical Center where patients with warts were randomly assigned to either the duct tape treatment or the more traditional freezing treatment. Those in the duct tape group wore duct tape over the wart for 6 days, then removed the tape, soaked the area in water, and used an emery board to scrape the area. This process was repeated for a maximum of 2 months or until the wart was gone. Data consistent with values in the study are summarized in the following table:

Treatment	n	Number with Wart Successfully Removed
Liquid nitrogen freezing	100	60
Duct Tape	104	88

a. Find the mean and standard deviation of the distribution of the difference between the proportions of warts removed with duct tape and those removed with freezing.

b. Assuming that this distribution is approximately normal, what is the probability that the difference between two proportions would be less than 0.2?

4. Referring to the Unit 5-5 Homework, student heights were collected at the time of freshmen registration at SI from 2016 to 2021. The proportion of girls who are 5 foot 6 or taller is 0.32 while the proportion of boys who are 5 foot 6 or taller is 0.66 and both distributions are approximately normal. The total number of girls surveyed was 852 and the total number of boys surveyed was 837.
    a. If samples of 40 boys and 40 girls are collected, will the sampling distributions of each sample proportion be normal? Explain.

    b. What would the mean and standard deviation of each proportion be?

    c. What is the probability that the difference between any two samples would be more than a proportion of 0.38? Less than 0.28? Show the work that leads to your conclusions.