Lecture Topic 7: Chapter 10

Statistical Inference about Means and Proportions with Two Populations

10.1 Inference about the Difference between Two Population Means: σ_1 and σ_2 Known

- Let μ_1 equal the mean of population 1 and μ_2 equal he mean of population 2
- We will focus on inferences about the difference between the means: $\mu_1 - \mu_2$
- To estimate $\mu_1 - \mu_2$, select a random sample of size n_1 from population 1 and of size n_2 from population 2
- The two samples, taken separately and independently are referred to as <u>independent simple random samples.</u> (p.395)
- As with other point estimators, the point estimator $\bar{x}_1 - \bar{x}_2$ has a standard error that describes the variation in the sampling distribution
- If both populations are normally distributed or if the central limit theorem applies we can conclude that the sampling distribution of $\bar{x}_1$ and $\bar{x}_2$ can be approximated by a normal distribution
- Interval estimates are given by a point estimate ± margin of error

Hypothesis Test about $\mu_1 - \mu_2$

- Use D_0 to denote the hypothesized difference between μ_1 and μ_2
- We use the same steps described in Chapter 9 to conduct hypothesis testing
    - Choose a level of significance
    - Compute the value of the test statistic
    - Find the p-value to determine whether the null hypothesis should be rejected

10.2 Inference about the Difference between Two Population Means: σ_1 and σ_2 Unknown

- In this case we use the sample standard deviations s_1 and s_2 to estimate the unknown population standard deviations
- When we use the sample standard deviation the interval estimation and hypothesis testing procedures are based on a t distribution

Hypothesis Tests about $\mu_1 - \mu_2$

- Use D_0 to denote the hypothesized difference between μ_1 and μ_2

10.3 Inferences About the Difference Between Two Population Means: Matched Samples

- With a <u>matched sample design</u> each sampled item provides a pair of data values
- This design often reduces sampling error because variation between sampled items is eliminated.

10.4 Inferences About the Difference Between Two Population Proportions

- Let p_1 denote the proportion for population 1 and p_2 denote the proportion for population 2
- Select two independent random samples consisting of n_1 units from population 1 and n_2 units from population 2
- The point estimator has a sampling distribution that reflects the possible values of $\overline{p}_1 - \overline{p}_2$
- If the sample sizes are large enough that n_1p_1, $n_1(1 - p_1)$, n_2p_2, and $n_2(1- p_2)$ are all greater than or equal to 5, the sampling distribution of $\overline{p}_1 - \overline{p}_2$ can be approximated by a normal distribution
- Interval estimates are given by a point estimate ± margin of error

Hypothesis Test about $p_1 - p_2$

- All hypotheses considered use 0 as the difference of interest