Worksheet – Sections 8.4

Hypothesis test to compare two population proportions:

- Null hypothesis $H_0: p_1 = p_2$
- Alternative hypothesis $H_a: p_1 < p_2$ or $H_a: p_1 > p_2$ (one-sided) or $H_a: p_1 \neq p_2$ (two-sided)

If the conditions for *Central Limit Theorem* are satisfied, the difference $p_1 - p_2$ is normally distributed:

- Mean = 0
- Standard deviation = $\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$, where $\hat{p}$ is the sample proportion when two samples are merged together (called the *pooled estimate for sample proportion*).

StatCrunch: Stat → Proportion Stats → Two Sample → With Summary

1) An agricultural researcher wants to determine whether a new fertilizer increases the proportion of plants that survive to maturity. He considers two treatment groups and observes the following:

	Survived to maturity	Did not survive
New fertilizer	112	13
Standard fertilizer	103	27

a) Find the sample percentage of plants that survived to maturity in each treatment group.

b) Let the first sample be the plants treated with the new fertilizer and the second sample be the plants treated with the standard fertilizer. If the researcher wants to determine whether the new fertilizer increases the survival rate, state the null and alternative hypotheses.

c) Find the pooled estimate for the sample proportion and the standard error (SE) for $p_1 - p_2$.

d) Describe the event as extreme as or more extreme than the observed event.

e) Draw the p-value graph and find the p-value.

f) Using a significance level of 0.01, determine whether there is sufficient evidence to support the claim that the proportion of plants surviving to maturity is greater for the new fertilizer than for the standard fertilizer.

g) Find z-test statistic and p-value using StatCrunch.

2) A university researcher investigates whether there is an association between sleep habits and academic performance among undergraduate students. Students were classified according to whether they reported getting at least 8 hours of sleep per night on average. The researcher then recorded whether each student had a GPA of 3.5 or higher. Here is what he found:

	GPA $\geq$ 3.5	GPA < 3.5
At Least 8 Hours	84	96
Less Than 8 Hours	62	138

a) Find the sample percentage of students with a GPA of at least 3.5 in each sleep group.

b) Suppose the researcher wants to determine whether the proportion of students with a GPA of at least 3.5 differs between the two groups. State the null and alternative hypotheses.

c) Find the pooled estimate for the sample proportion and the standard error (SE) for $p_1 - p_2$.

d) Describe the event as extreme as or more extreme than the observed event.

e) Find the p-value.

f) With significant level 0.05, will you reject or not the null hypothesis.