Z·Score· 0.78

p-value: 0.42

2 prop test

Warm-up

Use the calculator to find the z and p-value for the following hypothesis test

A random sample of n_o = 153 people ages 16 to 19 was taken from the island of Oahu, Hawaii, and 12 were found to be high school dropouts. Another random sample of n_s = 128 people ages 16 to 19 was taken from Sweetwater County, Wyoming, and 7 were found to be high school dropouts. Do these data indicate that the population proportion of high school dropouts on Oaho (p_o) is different (either way) from that of Sweetwater County (p_s)? Use a 1% significance.

$\neq$

- Check homework

- 2 proportions

Objectives

- **Content Objective: I will make connections between past learnings and the new chapter ideas.**

- **Social Objective: I will listen well and participate in class.**

- **Language Objective: I will listen well and take good notes so the reading assignment goes well.**

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Comparing Two Proportions

- Comparisons between two percentages are much more common than questions about isolated percentages. And they are more interesting.

- We often want to know how two groups differ, whether a treatment is better than a placebo control, or whether this year's results are better than last year's.
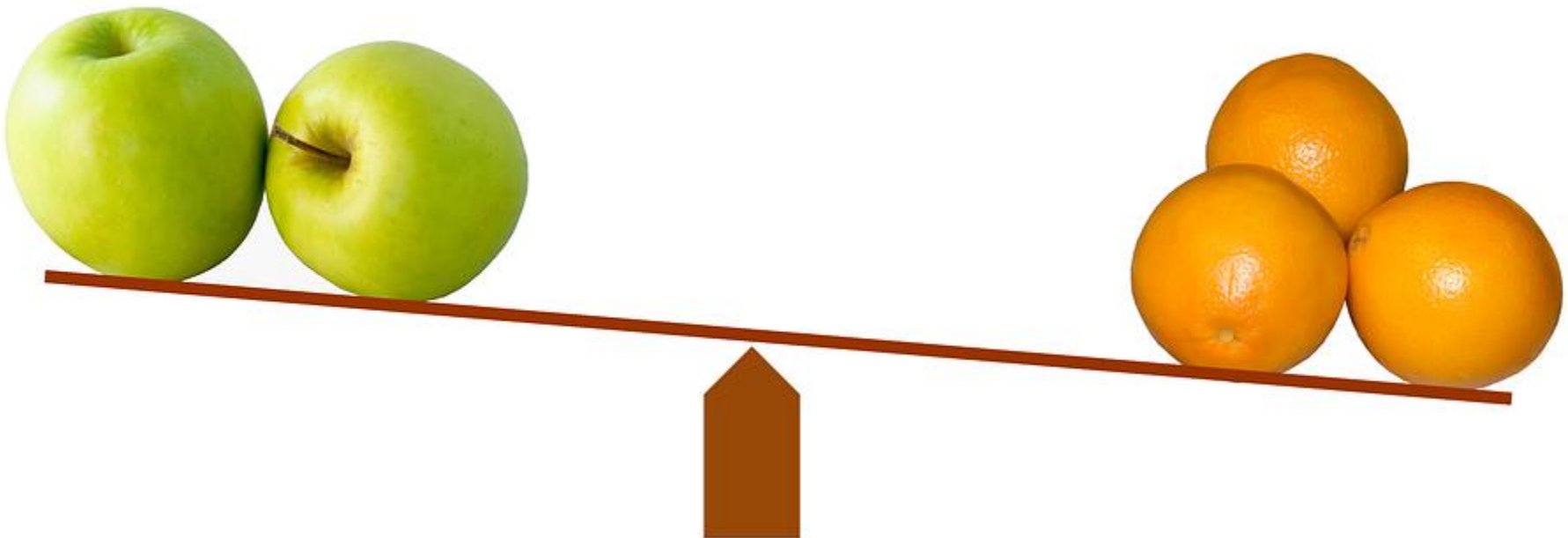
Assumptions and Conditions

- **<u>Independence Assumptions</u>**:
  - **Randomization Condition**: The data in each group should be drawn independently and at random from a homogeneous population or generated by a randomized comparative experiment.
  - **The 10% Condition**: If the data are sampled without replacement, the sample should not exceed 10% of the population.
  - **Independent Groups Assumption**: The two groups we're comparing must be independent *of each other*.

may need both groups
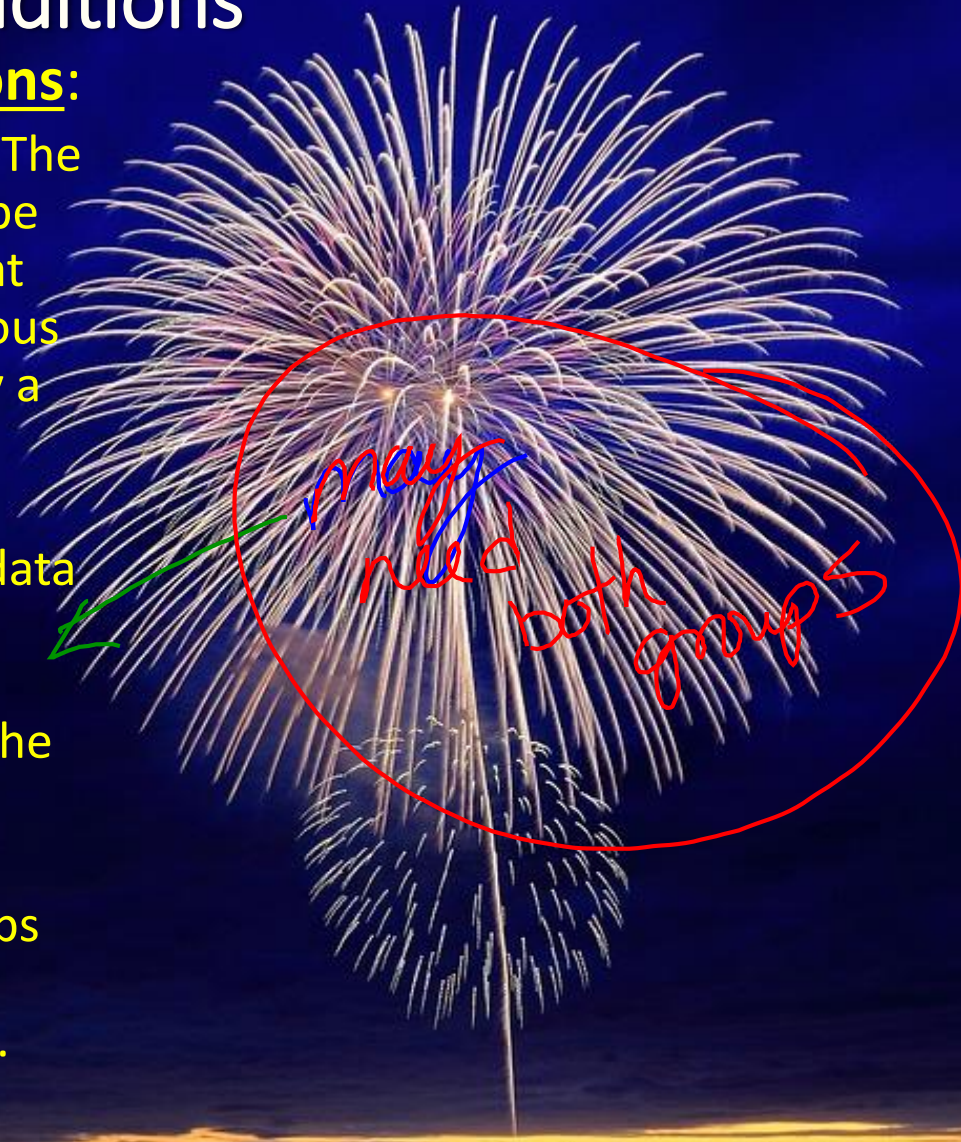
Assumptions and Conditions

- Sample Size Condition:
  - *Each* of the groups must be big enough...
  - Success/Failure Condition: Both groups are big enough that at least 10 successes and at least 10 failures have been observed in each.

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Does not
not meet conditions -
cannot proceed with
two-prop z test

random - stated in both
10% oahu
153 < 10% of
all 16 to 19's

10% Sweetwater
128 < 10% of
all 16 to 19's

Assume independent groups

Sample size
12 success ≥ 10
141 failures ≥ 10

Sample size
7 not
≥ 10

A research group asked voters "would you favor spending more federal tax money on the arts?" Of a random sample of n_c = 93 politically conservative voters, r_c = 21 responded yes. Another random sample of n_m = 83 politically moderate voters showed that r_m = 22 responded yes. Does this information indicate that the population proportion of conservative voters (p_c) inclined to spend more federal tax money on funding the arts is less than the proportion of moderate voters (p_m) so inclined? Use α = 0.05

Conditions

conservative

random - stated
10% → 93 < 10%
of all conserv.

21 ≥ 10 ⟩ success
93-21 ≥ 10 ⟩ fail

moderate

random - stated
10% → 83 <
10% mod. voters

22 ≥ 10 ⟩ success
83-22 ≥ 10 ⟩ fail

Assume independent groups

Proceed w/ 2 prop hyp. test

The Sampling Distribution

We already know that for large enough samples, each of our proportions has an approximately Normal sampling distribution.

The same is true of their difference.

Another Ruler

- In order to examine the difference between two proportions, we need another ruler—the standard deviation of the sampling distribution model for the difference between two proportions.

- Recall that standard deviations don't add, but variances do. In fact, *the variance of the sum or difference of two independent random quantities is the sum of their individual variances.*
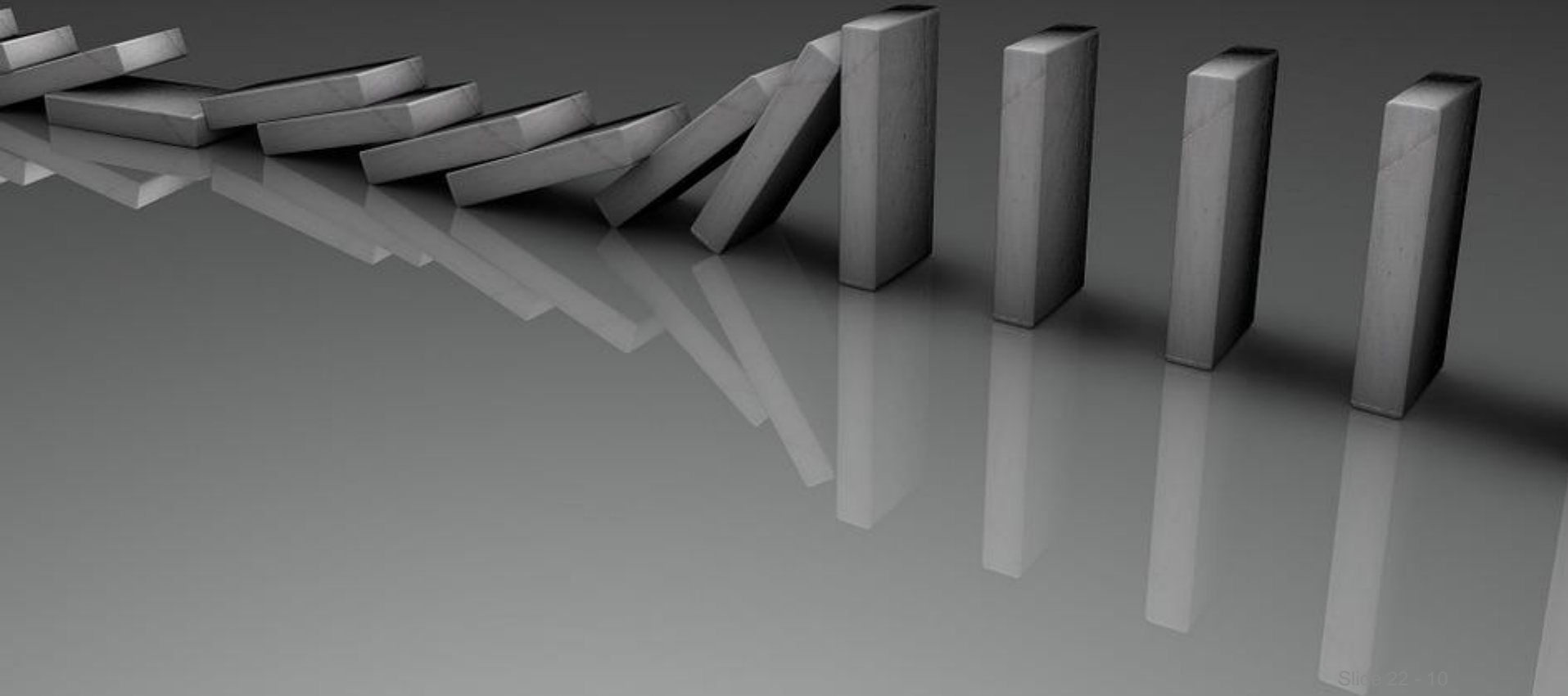
Provided that the sampled values are independent, the samples are independent, and the samples sizes are large enough, the sampling distribution of $\hat{p}_1 - \hat{p}_2$ is modeled by a Normal model with
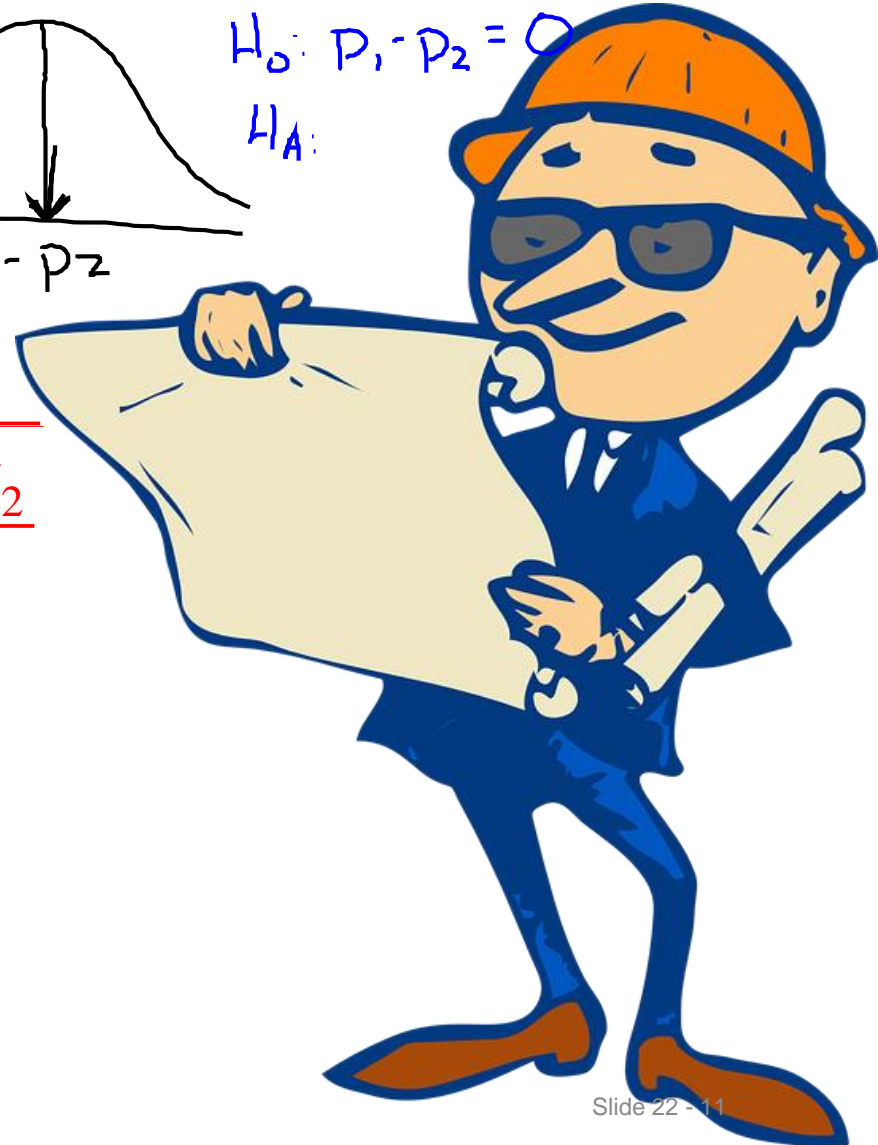
- **Mean:**

$$\mu = p_1 - p_2$$
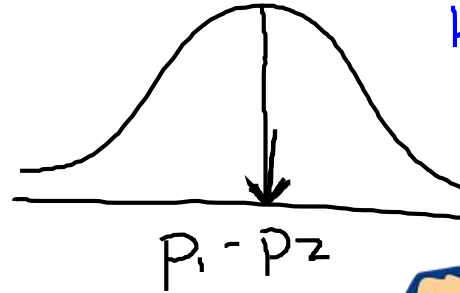
- **Standard deviation:**

$$SD(\hat{p}_1 - \hat{p}_2) = \sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}}$$

$H_0: p_1 - p_2 = 0$

$H_A:$

$p_1 - p_2$

A random sample of $n_o = 153$ people ages 16 to 19 was taken from the island of Oahu, Hawaii, and 12 were found to be high school dropouts. Another random sample of $n_s = 128$ people ages 16 to 19 was taken from Sweetwater County, Wyoming, and 7 were found to be high school dropouts. Do these data indicate that the population proportion of high school dropouts on Oaho (p_o) is different (either way) from that of Sweetwater County (p_s)? Use a 1% significance.

$H_O: \; p_o = p_s \quad p_o - p_s = 0$

$H_A: \; p_o \neq p_s \quad p_o - p_s \neq 0$

$\hat{p}_o = \dfrac{12}{153} = 0.078$

$\hat{p}_s = \dfrac{7}{128} = 0.054$

$\underline{}$

0.022

$\hat{p}_1 - \hat{p}_2$

$\mu = p_1 - p_2$

$SD(\hat{p}_1 - \hat{p}_2) = \sqrt{\dfrac{p_1 q_1}{n_1} + \dfrac{p_2 q_2}{n_2}}$

$Z = \dfrac{0.022 - 0}{\sqrt{\dfrac{(0.078)(0.922)}{153} + \dfrac{(0.054)(0.946)}{128}}}$
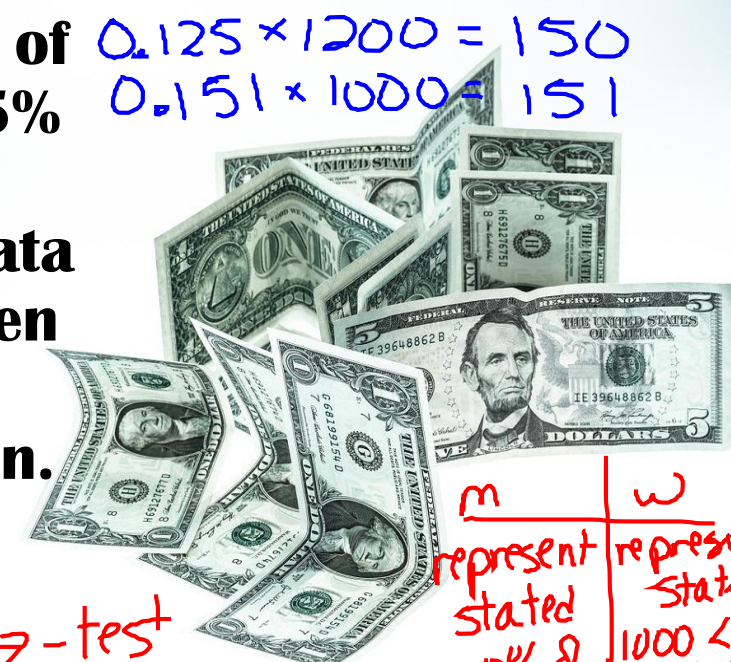
A research group asked voters "would you favor spending more federal tax money on the arts?" Of a random sample of n_c = 93 politically conservative voters, r_c = 21 responded yes. Another random sample of n_m = 83 politically moderate voters showed that r_m = 22 responded yes. Does this information indicate that the population proportion of conservative voters (p_c) inclined to spend more federal tax money on funding the arts is less than the proportion of moderate voters (p_m) so inclined? Use α = 0.05

USA Today reported that the percentage of U.S. residents living in poverty was 12.5% for men and 15.1% for women. These percentages were estimates based on data from large representative samples of men and women. Suppose the sample sizes were 1200 for men and 1000 for women. Is there sufficient evidence to conclude that a greater percentage of women are living in poverty than men?
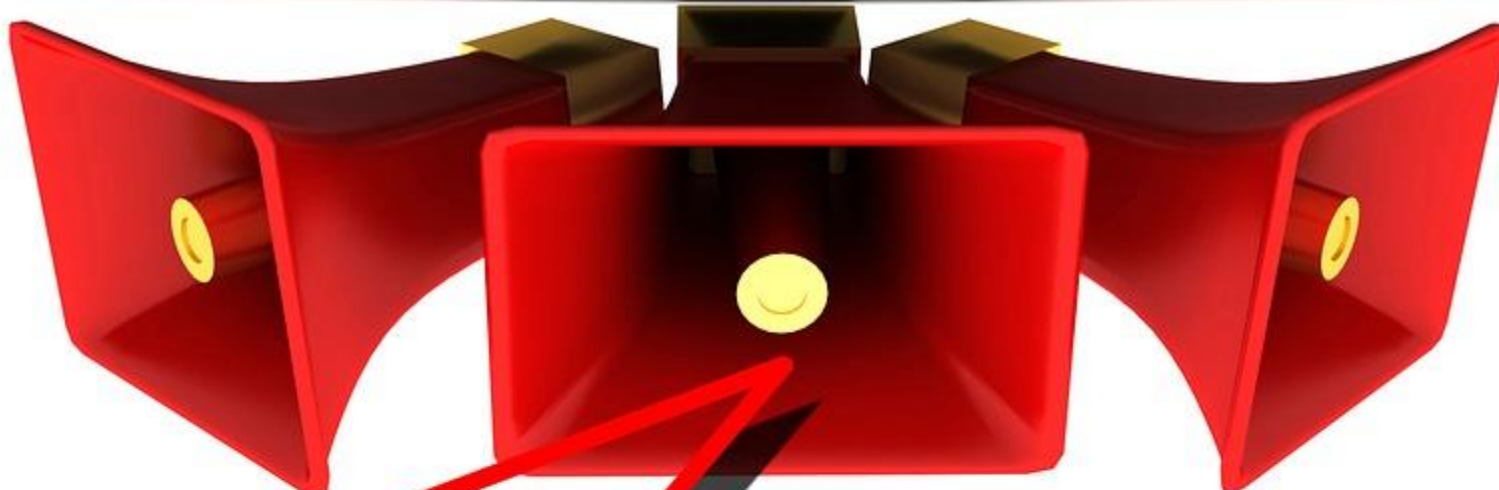
$0.125 \times 1200 = 150$
$0.151 \times 1000 = 151$

2 prop z-test

z-score: ~ -1.76
p-value: 0.038

m	w
represent stated	represent stated
1200 < 10% of all men	1000 < 10% of women

assume independ. groups

12.5% of 1200 ≥ 10
87.5% of 1200 ≥ 10

15.1% of 1000 ≥ 10
84.9% of 1000 ≥ 10

$H_0 : P_m = P_w \quad (P_m - P_w = 0)$

$H_A : P_m < P_w \quad (P_m - P_w < 0)$

Due to a low p-value of 0.038, we reject the null. There is sufficient evidence to conclude that a greater percentage of women are living in poverty than men.

Homework: p 520 (17, 18)