TOPIC: TWO MEANS - KNOWN VARIANCES

Performing Hypothesis Tests on Means with Known Variances

◆ If you are given the population variances, you can use a ____-test for 2 means.

EXAMPLE

A grocery chain wants to see if self-checkout lanes have a shorter checkout time than cashier lanes, so they take a random, independent sample of 35 times from each & find $\overline{x_1} = 4.5$ for self-checkout & $\overline{x_2} = 6.4$ for cashier lanes. Prior data suggests $\sigma_1 = 1.1$ & $\sigma_2 = 1.4$. Test the claim that self-checkout times are shorter with $\alpha = 0.05$.

New — Hypothesis Tests for 2 Means: σ_1, σ_2 Known

1) Hyp

$H_0: \mu_1 = \mu_2$ $H_a: \mu_1$ **[< | > | ≠]** μ_2

2) Test Stat

$\overline{x_1} =$ ______ $\sigma_1 =$ ______ $n_1 =$ ______

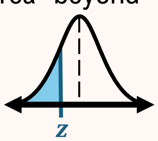
$\overline{x_2} =$ ______ $\sigma_2 =$ ______ $n_2 =$ ______

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}}$$

$z =$ ______

3) P-Value

Area "beyond" z



P-Value = ______

4) Conclusion

Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0, there is **[ENOUGH | NOT ENOUGH]** evidence to suggest…

Criteria

Independent, Random Samples? ☐

X is Normal ***OR*** $n_1 > 30$ & $n_2 > 30$ ☐

HOW TO: Do Hyp. Test 2 Means, σs Known

1) STAT > **TESTS**

```
3: 2-SampZTest
```

2) DATA **STATS**

```
σ1:          σ2:
x̄1:          n1:
x̄2:          n2:
μ1: ≠μ2 <μ2 >μ2
Calculate   Draw
```

TOPIC: TWO MEANS - KNOWN VARIANCES

PRACTICE

For $\overline{x_1} = 40, \sigma_1 = 8.3, n_1 = 40, \overline{x_2} = 39, \sigma_2 = 5.8,$ & $n_2 = 50$, perform a hypothesis test to test the claim that $\mu_1 > \mu_2$, for $\alpha = 0.05$.

HOW TO: Do Hyp. Test 2 Means, σs Known

1) STAT > **TESTS**

   3: 2-SampZTest

2) DATA **STATS**

   σ_1: σ_2:

   $\overline{x}$1: n1:

   $\overline{x}$2: n2:

   μ1: ≠μ2 <μ2 **>μ2**

   Calculate Draw

EXAMPLE

A gym is interested in adding new classes to their schedule. So far, they suspect their yoga classes are more well-attended than their weightlifting courses, so they collect attendance samples from each type and get the statistics below:

Weightlifting: $\overline{x_1} = 20.4, n_1 = 32$
Yoga: $\overline{x_2} = 21.3, n_2 = 32$

$(\boldsymbol{A})$ For $\alpha = 0.1$, perform a hypothesis test to see if there is evidence that Yoga classes are more well-attended. For the test, the gym uses prior information, which suggests $\sigma_1 = 3.6$ and $\sigma_2 = 4.2$.

$(\boldsymbol{B})$ Based on the results of the hypothesis test, does the gym have enough evidence to add more yoga classes than weightlifting classes?

TOPIC: TWO MEANS - KNOWN VARIANCES

EXAMPLE

A call center is interested in determining if call frequencies differ based on the time of the day. They sample hours in the morning and afternoon to check the average number of calls received. They get the following statistics:

Morning: $\overline{x_1} = 19.6$, $n_1 = 90$
Afternoon: $\overline{x_2} = 15.3$, $n_2 = 80$

$(\boldsymbol{A})$ For $\alpha = 0.01$, perform a hypothesis test to see if there is evidence that the number of calls differs between the morning and afternoon. For the test, the call center uses prior information, which suggests $\sigma_1 = 7.6$ and $\sigma_2 = 6.5$.

$(\boldsymbol{B})$ The call center is planning on hiring more agents. If they get the same number of calls on average throughout the day, they will spread the new employees' shifts evenly throughout the day; otherwise, they will increase staffing at their busiest times. Using the results of the test, what should they do?

HOW TO: Do Hyp. Test 2 Means, σs Known

1) STAT > **TESTS**

3: 2-SampZTest

2) DATA **STATS**

σ_1:	σ_2:
$\bar{x}$1:	n1:
$\bar{x}$2:	n2:

μ1: **≠μ2** <μ2 >μ2

Calculate Draw