

TOPIC: HYPOTHESIS TESTS FOR MEAN

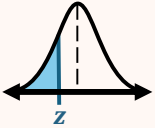
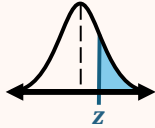

Standard Deviation (σ) Known

◆ Recall: To run a hypothesis test 1) Write Hypotheses, 2) Calc. Test Statistic, 3) Find P -Value, & 4) State Conclusion.

► In Step 2, when σ is **known**, we use the ___ test statistic.

EXAMPLE

A lighting company advertises their LED bulbs to last on average 25,000 hr. Past data shows the bulbs' lifespans have a normal dist. with $\sigma = 1,200$ hr. A separate agency suspects the lifespan is actually lower. From a random sample of 36 bulbs, they find $\bar{x} = 24,600$ hr. Use $\alpha = 0.10$ to test the claim that the true mean lifespan is 25,000 hr.

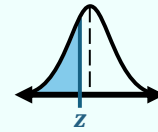
New		Hypothesis Tests for Mean (σ Known)	
1) Hyp	$H_0: \mu =$ _____	$H_a: \mu [< > \neq]$ _____	
2) Test Stat	σ Known $z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$	σ Unknown $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$	$\bar{x} =$ _____ $\sigma =$ _____ $n =$ _____ $z =$ _____
3) P -Value	Area "beyond" z		P -Value = _____
	If $H_a: \mu <$ 	If $H_a: \mu >$ 	If $H_a: \mu \neq$ 
4) Conclusion	Because P -value [< >] α , we [REJECT FAIL TO REJECT] H_0 . There is [ENOUGH NOT ENOUGH] evidence to suggest...		
Criteria	Random Samples? <input type="checkbox"/> X is Normal OR $n > 30$ <input type="checkbox"/>		

TOPIC: HYPOTHESIS TESTS FOR MEAN

EXAMPLE

Perform the hypothesis test using $\sigma = 6$, $n = 36$, and $\alpha = 0.10$. Test the claim that $\mu = 50$ using...

(A) Left-Tailed Test: $\bar{x} = 47$

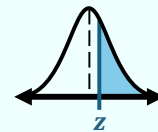


Recall

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

(σ Known)

(B) Right-Tailed Test: $\bar{x} = 51$



PRACTICE

Test the claim about the population mean μ at the given level of significance. Assume the population is normally distributed. Find the P -value and determine whether you should reject or fail to reject the null hypothesis.

Claim: $\mu \neq 1020$, $\alpha = 0.01$, $\sigma = 85$

Sample: $\bar{x} = 990$, $n = 40$

TOPIC: HYPOTHESIS TESTS FOR MEAN

PRACTICE

A university claims that the average SAT math score of its incoming freshmen is 600. A skeptical education researcher believes this might not be accurate. The researcher collects a random sample of 40 students and finds a sample mean SAT math score of 622. The population standard deviation is known to be 70. Using a significance level of $\alpha = 0.05$, test the researcher's claim.

TOPIC: HYPOTHESIS TESTS FOR MEAN

EXAMPLE

City officials claim that the average annual salary of all full-time workers in a particular city is \$51,000. A local labor expert believes that the average salary has increased since then. A random sample of 18 full-time workers is taken and the results are shown below. The population is approximately normal with a known standard deviation of \$4,500. Test this claim using a significance level of $\alpha = 0.05$.

48,000	52,100	50,500	53,000	54,200	51,300	55,000	52,700	50,900
51,800	53,100	49,500	52,300	51,100	50,700	53,200	54,000	52,400

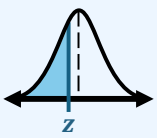
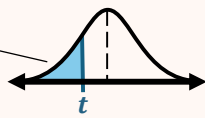
TOPIC: HYPOTHESIS TESTS FOR MEAN

Standard Deviation (σ) Unknown

◆ To run a hypothesis test when σ is **unknown**, use ___ instead of ___ & the **t distribution** instead of **normal**.

EXAMPLE

A tech company claims that the average battery life of their new smartphone model is 12 hr, but you suspect it might actually be less. Test this claim given a sample of 40 phones with mean battery life of 11.4 hr, standard deviation of 1.2 hr & significance level of 0.05.

Recall	σ Known	New	Hypothesis Tests for Mean (σ Unknown)
1) Hyp	$H_0: \mu = \#$ $H_a: \mu < > \neq \#$	$H_0: \mu = \underline{\hspace{2cm}}$	$H_a: \mu [< > \neq] \underline{\hspace{2cm}}$
2) Test Stat	$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$	$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$	$\bar{x} = \underline{\hspace{2cm}}$ $s = \underline{\hspace{2cm}}$ $n = \underline{\hspace{2cm}}$ $t = \underline{\hspace{2cm}}$
3) P-Value			$df = n - 1 = \underline{\hspace{2cm}}$ $P\text{-Value} = \underline{\hspace{2cm}}$
4) Conclusion	Because P-value...	Because P-value [< >] α , we [REJECT FAIL TO REJECT] H_0 . There is [ENOUGH NOT ENOUGH] evidence to suggest...	
Criteria	Random samples? <input type="checkbox"/> X is normal <input type="checkbox"/> OR $n > 30$? <input type="checkbox"/>	Random samples? <input type="checkbox"/> X is normal <input type="checkbox"/> OR $n > 30$? <input type="checkbox"/>	

TOPIC: HYPOTHESIS TESTS FOR MEAN

PRACTICE

Test the claim about the population mean μ at the given level of significance. Assume the population is normally distributed. Find the P -value and determine whether you should reject or fail to reject the null hypothesis.

Claim: $\mu > 52$, $\alpha = 0.10$

Sample: $\bar{x} = 53.1$, $s = 4.7$, $n = 20$

TOPIC: HYPOTHESIS TESTS FOR MEAN

EXAMPLE

A researcher claims that the average height of adult males in a particular city is 70 inches. To test this, she randomly samples 12 adult males. The sample mean height is 67.8 inches with a sample standard deviation $s = 2.1$ inches. At the $\alpha = 0.05$ significance level, test the claim that the average height is 70 inches.

TOPIC: HYPOTHESIS TESTS FOR MEAN

EXAMPLE

A fitness researcher claims that the average resting heart rate (in bpm) of yoga instructors is lower than the general adult population average of 72. To test this claim, they record the resting heart rates of 10 randomly selected individuals in the table below. Assuming the population is approximately normal, use a $\alpha = 0.05$ to test this claim.

Daily Revenue (\$1,000s)									
62	76	59	67	71	73	65	70	69	72

TOPIC: HYPOTHESIS TESTS FOR MEAN

Performing Hypothesis Tests: Mean Using TI-84

◆ To perform a Hyp. Test for a pop. mean using a calculator, use the **1: Z-Test** or **2: T-Test** function.

EXAMPLE

Do a Left-Tail Hyp. Test for $\mu = 16.7$ with $\alpha = 0.05$ using...

(A) $\bar{x} = 15.27$, $\sigma = 5.72$, $n = 150$,

H_0 : _____ H_a : _____ P -value: _____

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

(B)

Sample Data							
12.1	12.4	13.2	12.4	15.6	12.98	19.9	20.11
13.1	14.5	25.3	13.85	19.1	22.68	16.7	24.59

H_0 : _____ H_a : _____ P -value: _____

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



HOW TO: Hyp. Test for Mean On TI-84

1) If given data, enter in **L 1**

(**STAT**, **1: EDIT...**)

2) (**STAT**, **>**) **TESTS**

If given σ : **1: Z-Test**

If not given σ : **2: T-Test**

3) If given data: | If given \bar{x}_1, n_1, \dots :

DATA

STATS

μ_0 :

μ_0 :

σ : (*z-test only*)

σ OR **Sx1**:

List: L1

Freq: 1

\bar{x} :

n:

μ : **$\neq \mu_0$ < μ_0 > μ_0**

Calculate **Draw**

TOPIC: HYPOTHESIS TESTS FOR MEAN

PRACTICE

A nutritionist believes the average daily protein intake for adults is 50g. A random sample of 37 adults has a sample mean of 51g & sample standard deviation of 6g. Use $\alpha = 0.05$ to test whether the true mean of protein intake differs from 50 grams.

$$H_0: \underline{\hspace{2cm}} \quad H_a: \underline{\hspace{2cm}}$$

$$\bar{x} = \underline{\hspace{2cm}} \quad n = \underline{\hspace{2cm}} \quad s = \underline{\hspace{2cm}}$$

Because P -value = $\underline{\hspace{2cm}}$ [< | >] $\alpha = \underline{\hspace{2cm}}$,

we [**REJECT** | **FAIL TO REJECT**] H_0 , there is [**ENOUGH** | **NOT ENOUGH**] evidence to suggest...

PRACTICE

A fitness researcher believes a new workout program increases average treadmill endurance beyond 35 min. A sample of 16 adults who completed the program had the following endurance times. Test whether the data support the researcher's claim using $\alpha = 0.05$ & $\sigma = 2.16$.

Endurance Times (min)							
34	37	36	35	39	38	36	40
37	41	38	39	36	42	40	37

$$H_0: \underline{\hspace{2cm}} \quad H_a: \underline{\hspace{2cm}}$$

Because P -value = $\underline{\hspace{2cm}}$ [< | >] $\alpha = \underline{\hspace{2cm}}$,

we [**REJECT** | **FAIL TO REJECT**] H_0 , there is [**ENOUGH** | **NOT ENOUGH**] evidence to suggest...

HOW TO: Hyp. Test for Mean On TI-84

- 1) If given data, enter in **L1**
(**STAT**, **1: EDIT...**)
- 2) (**STAT**, **>**) **TESTS**
If given σ : **1: Z-Test**
If not given σ : **2: T-Test**
- 3) If given data: If given \bar{x}_1, n_1, \dots :

DATA	STATS
μ_0 :	μ_0 :
σ : (<i>z-test only</i>)	σ OR Sx1 :
List: L1	\bar{x} :
Freq: 1	n :

μ : $\neq \mu_0$ $< \mu_0$ $> \mu_0$

Calculate Draw