

Chapter 14 / Example 6

Two-tailed tests

The times taken by an athlete to run a circuit near his home can be modelled by a normal distribution with a mean of 15.4 minutes and a standard deviation of 0.62 minutes. The athlete's work takes him away from home for six months and on his return he is interested to see whether his average times have changed. He records his times over the first five days after his return and obtains the following times in minutes:

15.4, 15.5, 14.9, 15.2, 15.1



- Use the p -value to perform a test at the 5% significance level to see if his average time to complete the circuit has changed.
- Find the critical region for the test.

Press **MENU** 2 **STAT** to display the List Editor screen.

Type the times in the first column.

Press **EXE** after each number to move to the next cell.

Note: If the list contains other numbers, you can clear it by pressing **F4** DEL-ALL.

				
[Rad] [Norm1] [d/c] [Real]				
	List 1	List 2	List 3	List 4
SUB				
1	15.4			
2	15.5			
3	14.9			
4	15.2			
				15.2
[GRAPH] [CALC] [TEST] [INTR] [DIST] 				

$H_0: \mu = 15.4$, $H_1: \mu \neq 15.4$

Press **F3** TEST **F1** Z **F1** 1-SAMPLE

	Rad(Norm1)	d/c(Real)
1-Sample ZTest		
Data	:List	
μ	: $\neq \mu_0$	
μ_0	:0	
σ	:1	
List	:List1	
Freq	:1	
List	Var	

Choose Data: **F1** List

F1 $\mu \neq \mu_0$

$\mu_0 = 15.4$

$\sigma = 0.62$

List: List1

Press **EXE**.

	Rad(Norm1)	d/c(Real)
1-Sample ZTest		
Data	:List	
μ	: $\neq \mu_0$	
μ_0	:15.4	
σ	:0.62	
List	:List1	
Freq	:1	
List		

p -value = 0.516

$0.516 > 0.05$, not significant so no reason to reject H_0 that his average time is still 15.4 minutes.

	Rad(Norm1)	d/c(Real)
1-Sample ZTest		
μ	$\neq 15.4$	
Z	=-0.649181	
p	=0.51622137	
\bar{x}	=15.22	
sx	=0.23874672	
n	=5	

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To find the critical region, $\bar{X} \sim N\left(15.4, \frac{0.62^2}{5}\right)$

$$P\ a_1 < X < a_2 = 0.95$$

Press **EXIT** twice.

Press **F5** DIST **F1** NORM **F3** InvN

Select Data **F2** Var

Tail **F3** CENTRAL

area = 0.95

$$\sigma = 0.62 \div \sqrt{5}$$

$$\mu = 15.4$$

Use **▼** to navigate down to Execute and press **EXE**.

```

Rad(Norm1) d/c(Real)
Inverse Normal
Data      :Variable
Tail      :Central
Area      :0.95
σ         :0.27727242
μ         :15.4
Save Res:None
  
```

The critical region is $\bar{X} < 14.86, \bar{X} > 15.94$

```

Rad(Norm1) d/c(Real)
Inverse Normal
x1 Inv=14.856556
x2 Inv=15.943444
  
```