

CHAPTER 11 INFERENCE FOR REGRESSION

Section 11.1 ■ Variation in the Estimated Slope

Activity 11.2 What Affects the Variation in b_1 ?

```
MATH NUM CPX PRB
1:rand
2:nPr
3:nCr
4:!
5:randInt(
6:randNorm(
7:randBin(
```

Use the TI-83 and TI-83 Plus's `randNorm(` command to generate the values from the normal, conditional distributions listed in each case. You find the `randNorm(` command by pressing `MATH` PRB 6:`randNorm(`. You generate n random numbers from a normal distribution with mean μ and standard deviation σ with an expression in the form `randNorm(μ , σ , n)`.

For example, for Case 1 in Activity 11.2, first define list L1 as $\{0, 0, 0, 0, 1, 1, 1, 1\}$. Define list L2 as `randNorm(10,3,4)`—four random values from a normal distribution with mean 10 and standard deviation 3. Similarly define list L3 as `randNorm(12,3,4)`.

```
randNorm(10,3,4)
→L2
(13.01127394 10...
randNorm(12,3,4)
→L3
(10.19485015 8...
```

L1	L2	L3	1
0	13.011	10.195	
0	10.261	8.8429	
0	5.0141	11.045	
0	13.328	11.262	
1	-----	-----	
1			
1			
L1(D)=0			

Now move the values in list L3 to the bottom of list L2 using the `augment(` command, found by pressing `2nd` [LIST] OPS 9:`augment(`. Store the results back in list L2.

```
NAMES OPS MATH
3:dim(
4:Fill(
5:seq(
6:cumSum(
7:ΔList(
8:Select(
9:augment(
```

```
augment(L2,L3)→L
2
(13.01127394 10...
```

L1	L2	L3	1
0	13.011	10.195	
0	10.261	8.8429	
0	5.0141	11.045	
0	13.328	11.262	
1	10.195	-----	
1	8.8429		
1	11.045		
L1(D)=0			

You can now perform a linear regression, calculate the slope, and make a scatterplot using lists L1 and L2.

Section 11.2 ■ Making Inferences About Slopes

Significance Test for a Slope

Check Conditions

The TI-83 and TI-83 Plus can help check conditions for a significance test for a slope. As explained in Chapter 3 of this Calculator Guide, the calculator automatically calculates residuals and stores them in the list RESID after performing a regression. Therefore, you can easily make a residual plot, check that the residuals stay about the same size across all values of x , and make a univariate plot of the residuals to see if it's reasonable to assume that they came from a normal distribution.

Section 11.2 ■ Making Inferences About Slopes (continued)

Compute Values STAT TESTS E:LinRegTTest

The TI-83 and TI-83 Plus conduct a significance test for a slope with the command LinRegTTest. You find this command by pressing STAT TESTS E:LinRegTTest. At the prompts, enter the lists containing the data and select two-tailed or the appropriate one-tailed test. At RegEQ you may specify a function in which the regression equation will be stored; this is optional. Select Calculate to get the test statistic, t ; the P -value, p ; the degrees of freedom, df ; the coefficients of the regression equation, a and b ; the standard error, s ; and the correlation coefficient and the coefficient of determination, r and r^2 . Here's the price-versus-horsepower example from pages 647–649 of the *Statistics in Action* student text.

```

EDIT CALC TESTS
9:1-2-SampZInt...
0:2-SampTInt...
A:1-PropZInt...
E:2-PropZInt...
C:X2-Test...
D:2-SampFTest...
▶LinRegTTest...
    
```

```

LinRegTTest
Xlist:L1
Ylist:L2
Freq:1
B & P: EQ <0 >0
RegEQ:Y1
Calculate
    
```

```

LinRegTTest
y=a+bx
B≠0 and P≠0
t=5.791781722
p=6.25992E-5
df=13
a=-1.543914712
    
```

```

LinRegTTest
y=a+bx
B≠0 and P≠0
tb=.1255613121
s=4.448401335
r2=.7206988104
r=.8489398155
    
```

```

b/t
.0216792203
    
```

Note that the calculator's output does not include the standard error of the slope, s_{b_1} . However, because the null hypothesis is $\beta_1 = 0$, the formula for the test statistic is $t = \frac{b_1}{s_{b_1}}$. This means $s_{b_1} = \frac{b_1}{t}$, and the calculator does give you b_1 (called b) and t . So, to calculate s_{b_1} , divide b/t . Find b by pressing VARS VARS 5:Statistics EQ 3:b. Find t by pressing VARS VARS 5:Statistics TEST 3:t.

Section 11.3 ■ Transforming for a Better Fit

Review Section 3.5 on pages 31–32 of this Calculator Guide for information about transformations to achieve linearity.