

Inference for Regression

Calculator Note 11A: Generating Random Values from a Normal Distribution

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

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

```
randNorm(0,2,1,1
)
(-2.433205314)
```

Calculator Note 11B: Augmenting a List

The `augment` command can speed up your work on Activity 11.1b. For example, for Case 1 in Activity 11.1b, first define list L_1 as $\{0, 0, 0, 0, 1, 1, 1\}$. Define list L_2 as `randNorm(10,3,4)`—four random values from a normal distribution with mean 10 and standard deviation 3. Similarly define list L_3 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	5.141	11.045	
0	13.328	11.262	
1	-----	-----	
1			
1			

L1()=0

Now move the values in list L_3 to the bottom of list L_2 using the `augment(` command, found by pressing `[2nd] [LIST]`, arrowing over to `OPS`, and selecting `9:augment(`. Your command will be `augment(L2,L3)→L2`. This stores the results back into list L_2 .

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

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

L1	L2	L3	1
0	13.011	10.195	
0	10.261	8.8429	
0	5.141	11.045	
0	13.328	11.262	
1	10.195	-----	
1	8.8429		
1	11.045		

L1()=0

You can now perform a linear regression, calculate the slope, and make a scatterplot using lists L_1 and L_2 .

Calculator Note 11C: Checking Conditions for a Significance Test for a Slope

The TI-83 Plus and TI-84 Plus can help check conditions for a significance test for a slope. As explained in Calculator Note 3I, 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.

Calculator Note 11D: Computing Values for a Significance Test for a Slope LinRegTTest

The TI-83 Plus and TI-84 Plus conduct a significance test for a slope with the command LinRegTTest. You find this command by pressing $\overline{\text{STAT}}$, arrowing over to TESTS, and selecting E:LinRegTTest. At the prompts, enter the lists containing the data and select the two-sided or the appropriate one-sided 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 are the computations for the price versus horsepower example from pages 759–760 of the student book.

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

```
↑b=.1255613121
s=4.448401335
r2=.7206988104
r=.8489398155
```

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 that $s_{b_1} = \frac{b_1}{t}$, 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 $\overline{\text{VAR}}$, selecting 5:Statistics from the VARS menu, then arrowing over to EQ and selecting 3:b. Find t by pressing $\overline{\text{VAR}}$, selecting 5:Statistics from the VARS menu, then arrowing over to TEST and selecting 3:t.

```
b/t
.0216792203
```

Calculator Note 11E: Computing a Confidence Interval Estimate for the True Slope LinRegTInt

The TI-83 Plus and TI-84 Plus compute a confidence interval for the true slope with the command LinRegTInt. You find this command by pressing $\boxed{\text{STAT}}$, arrowing over to TESTS, and selecting G:LinRegTInt. At the prompts, enter the lists containing the data and the desired confidence interval. At RegEQ you may specify a function in which the regression equation will be stored; this is optional. Select Calculate to get the confidence interval; the degrees of freedom, df; the slope 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 are the computations for the price versus horsepower example from page 763 of the student book.

```
EDIT CALC TESTS
B12-PropZInt...
C:X²-Test...
D:X²GOF-Test...
E:2-SampFTest...
F:LinRegTInt...
G:LinRegTInt...
H:ANOVA<
```

```
LinRegTInt
Xlist:01
Ylist:L2
Freq:1
C-Level:.95
RegEQ:
Calculate
```

```
LinRegTInt
y=a+bx
(.07873,.1724)
b=.1255613121
df=13
s=4.448401335
a=-1.543914712
```

```
r²=.7206988104
r=.8489398155
```