TI–83 Lab 14 for Statistics 503

Topics: correlation coefficient, r, simultaneous inference, Q–Q Plot, $e \vee \hat{y}$ Plot, $e \vee x$ Plot For Regression, Inference For Correlation Coefficient

Dataset(s): "pizza.dat" a table of the student population (x, in 1000's) versus the annual sales (y, in \$1000's) of Armand's pizzas

number students, x	2	6	8	8	12	16	20	20	22	26
pizza sales, y	58	105	88	118	117	137	157	169	149	202

Dataset(s): "reading.dat" Consider the following reading ability versus level of illumination data.

illumination, x	1	2	3	4	5	6	7	8	9	10
ability to read, y	70	70	75	88	91	94	100	92	90	85

Correlation Coefficient and Scatter plot Management of Armand's Pizza Parlors believes that the size of the student population on the nearby campus is related to the annual sales revenue. To evaluate the relationship between student population (x, in 1000's), and annual sales (y, in \$1000's), Armand's collected data from a sample of 10 of its restaurants located near college campuses.

- Type the (x, y) values of "pizza.dat" into the (L_1, L_2) lists.
- First set "Diagnostics" to On by entering CATALOG and then "arrowing" down "DiagnosticOn"; in other words,
  - 2nd CATALOG DiagnosticOn ENTER

  The calculator should return the word "Done".
- To determine the correlation coefficient of the scatter plot of data, key in:
  - STAT CALC 8: LinReg(a + bx) ENTER 2nd L_1 , 2nd L_2

  The calculator should return a number of calculated quantities, including, at the bottom, the correlation coefficient, r. In this case, $r \approx 0.95$.
- To display the scatter plot, remember to first turn off all the STAT PLOTs and Y = plots, and then press,
  - 2nd STAT PLOT ENTER
  - On ENTER

- Type: scatter plot figure first row, far left ENTER
- Xlist: L1 (for x values) ENTER
- Freq: L2 (for y values) ENTER

and then hitting ZOOM 9:ZoomStat. The TRACE key can be used to see the values of the various (x, y) points.

Simultaneous Inferences. Given the "reading.dat", calculate two simultaneous confidence intervals (Bonferroni and Working–Hotelling) and two prediction intervals (also Bonferroni and Working–Hotelling) for the expected response, $\hat{\mu}(x)$, at $x = 6.3$ (one of $k = 2$ CIs or PIs) with $m = 3$ future observations, where $\alpha = 0.05$.

- Type (x, y) into L_1, L_2.
- Type PRGM REGSCIPI ENTER
- Type 6.3 ENTER for the dependent value for which the CI/PI is required.
- Type 3 ENTER for the number of future sample values (M).
- Type 2 ENTER for the number of contrasts (K) under consideration.
- Type 0.05 for value of α.
- The program returns the following 95% CIs and 95% PIs:

Bonferroni CI	80.37	94.5
Working–Hotelling CI	79.76	95.11
Bonferroni PI	73.13	———
Working–Hotelling PI	64.26	110.61

Q–Q Plot, $e \vee \hat{y}$ Plot, $e \vee x$ Plot For Regression. Given the "reading.dat", calculate three plots (Q–Q Plot, $e \vee \hat{y}$ Plot, $e \vee x$ Plot) to check the assumptions necessary for linear regression and two plots (Q–Q Plot, $e \vee y$ Plot) used to check the assumptions necessary for quadratic regression.

- Type (x, y) into L_1, L_2.
- Type PRGM QQPLTREG ENTER to display a q–q plot, assuming a linear model.
- Type PRGM EVYPLOT ENTER to display a $e \vee \hat{y}$ plot, assuming a linear model.

- Type PRGM EVXPLOT ENTER to display a $e \vee x$ plot, assuming a linear (or, in fact, any) model.
- Type PRGM QQPLTQRG ENTER to display a q–q plot, assuming a quadratic model.
- Type PRGM EVYPLOT ENTER to display a $e \vee \hat{y}$ plot, assuming a quadratic model.

Inference For Correlation Coefficient.

1. Given the "reading.dat", test if $\rho = 0$ using exact sample at $\alpha = 0.05$.
   - Type (x, y) into L_1, L_2.
   - Type PRGM CORRZERO ENTER.
   - Type 0.05 for value of α.
   - The program returns the following:

OBSR	0.704
TCRT	2.306
TOBS	2.806
PVAL	0.023

   where OBSR is r, TCRT is the critical value of t, TOBS is the observed test statistic and PVAL is the p–value.

2. Given $r = 0.345$, and $n = 23$ test if $\rho = 0$ using exact sample at $\alpha = 0.05$.
   - Type (x, y) into L_1, L_2.
   - Type PRGM CORRZSTA ENTER.
   - Type 0.05 for the value of α.
   - Type 0.345 for the observed value of r.
   - Type 23 for the sample size n.
   - The program returns the following:

OBSR	0.345
TCRT	2.08
TOBS	1.04
PVAL	0.31

   where OBSR is r, TCRT is the critical value of t, TOBS is the observed test statistic and PVAL is the p–value.

3. Given the "reading.dat", test if $\rho = 0.7$ and also calculate the CI using Fisher's transformation at $\alpha = 0.05$.

   - Type (x, y) into L_1, L_2.
   - Type PRGM CORR ENTER.
   - Type 0.07 for value of hypothesized null value, ρ_0.
   - Type 0.05 for value of α.
   - The program returns the following:

OBSR	0.704
SE	0.378
ZCRT	1.96
ZOBS	0.023
PVAL	0.982
CI	0.134, 0.924

   where OBSR is r, SE is the standard error of the test statistic, ZCRT is the critical value of t, ZOBS is the observed test statistic, PVAL is the p–value and the CI is the confidence interval.

4. Given $r = 0.345$, and $n = 23$ test if $\rho = 0.7$ and also calculate a CI using Fisher's transformation at $\alpha = 0.05$.

   - Type (x, y) into L_1, L_2.
   - Type PRGM CORR ENTER.
   - Type 0.07 for the value of hypothesized null value, ρ_0.
   - Type 0.345 for the observed value of the correlation coefficient, r.
   - Type 23 for the sample size n.
   - Type 0.05 for the value of α.
   - The program returns the following:

OBSR	0.345
SE	0.224
ZCRT	-1.96
ZOBS	-2.27
PVAL	0.023
CI	-0.078, 0.663

   where OBSR is r, SE is the standard error of the test statistic, ZCRT is the critical value of t, ZOBS is the observed test statistic, PVAL is the p–value and the CI is the confidence interval.