TI–83 Lab 3 for Statistics 503

Topics: clearing histogram and other plots, histograms from raw data, histograms from distribution tables, stem and leaf plots, random numbers generator, summary statistics, box and whisker plots, sampling distributions, t–distribution probability and percentiles, chi–square distribution, F Distribution

Dataset(s): **Dataset**: "showerhead", a dataset of the maximum flow rates for 34

different shower heads:

2.9 2.8 2.0 3.6 2.7 2.5 2.6 2.9 2.7 2.8 2.5 2.8 2.2 2.5 2.5 2.8 1.8 2.7 2.7 4.7 2.8 2.7 3.1 2.9 3.4 2.6 2.6 2.7 2.4 2.5 5.4 4.9 2.8 2.5

Clearing Histograms and Other Plots You will learn how to turn off (clear) all the STAT PLOTs and Y = plots.

1. Turn off all the STAT PLOTs by keying:

   - 2nd STAT PLOT 4 ENTER

   The TI–83 should return with the cursor blinking beside "PlotsOff". After pressing ENTER, "Done" should be returned.

2. Turn off all the Y = plots by typing:

   - Y = CLEAR

   for every equation that appears in the list of equations. Press 2nd QUIT to return to the main screen.

Histogram From Raw Data. In this exercise, you will use the TI–83 to draw a histogram for the "showerhead.dat" dataset.

- Type the 34 data values in list L3.
- Turn off (clear) all the STAT PLOTs and Y = plots.
- Turn on one of the STAT PLOTs for the histogram by typing:

  – 2nd STAT PLOT ENTER

  Once at the "Plot1" screen, choose or type in the following options:

  – On

  - Type: histogram figure at far right
  - Xlist: L3 (for data points)
  - Freq: 1 (each data point counted once)

- To fit the histogram to the screen window of the calculator, press
  - ZOOM 9 ENTER

- Display the histogram by pressing either TRACE or GRAPH.

- By pressing TRACE, a histogram with information on it is displayed. A little box with a blinking "X" through it appears on the center top of the first vertical bar of the histogram. At the bottom of the histogram are three bits of information: "min = 1.8", "max < 2.4" and "n = 3". This tells you that three of the showerheads have flow rates in the interval greater than or equal to 1.8 and less than 2.4. By hitting the right arrow key, the little box with a blinking "X" through it moves to the center top of the second vertical bar of the histogram.

- A histogram without any information is obtained by pressing GRAPH.

- It is also possible to set up the screen window of the calculator to fit the histogram *manually* by pressing WINDOW and then choosing the following options:
  - Xmin = 2.4
  - Xmax = 6
  - Xscl = 5 (since the class width is 5 units)
  - Ymin = (-) 25 ÷ 4 (let Ymin = -Ymax/4, to leave room at the bottom of the screen for the display of histogram information)
  - Ymax = 25
  - Yscl = 5 (convenient space between tick marks on frequency axis of histogram)
  - Xres = 1 (plots at every pixel on the screen; 2 would plot at every 2nd pixel and so on–this option is *not* active when plotting histograms, though.)

Histogram From Distribution Table[1]**.** In this exercise, you will use the TI–83 to draw a histogram for the "age.dat" distribution table.

- Turn off (clear) all the STAT PLOTs and Y = plots.

- Type the class midpoints in L1 and the frequencies into L2.

[1] These instructions can also be used to construct a cumulative histogram.

- Turn on one of the STAT PLOTs for the histogram by typing:
  - 2nd STAT PLOT ENTER

  Once at the "Plot1" screen, choose or type in the following options:
  - On
  - Type: histogram figure at far right
  - Xlist: L1 (for midpoint values of each class)
  - Freq: L2 (for frequency values of each class)
- Display the histogram by pressing either TRACE or GRAPH.

Stem and Leaf Display. In this exercise, you will use the TI–83 to help build a stem and leaf display for the "showerhead.dat" dataset. After typing the data into list L1, move the cursor over and up to the title of list L2, and then copy the data from L1 over to L2 and sort L2 using the following commands:

- 2nd L1 ENTER
- STAT ∇ ENTER 2nd L2) ENTER STAT ENTER

You can now use the sorted data in list L2 to construct a stem and leaf plot.

Random Number Generator. To generate 20 numbers chosen at random from between 0 and 99, we must first store seed 7 in the random number generator. This essentially changes the "pointer" in the TI–83 to a different location in the random number list stored in the calculator. When everyone in the lab puts in seed 7, all calculators will generate the *same* sequence of random numbers. On the quiz or homework, a seed will be specified, so that everyone in the class uses the same random number sequence and so generates the same sampling distribution.

$$7 \text{ STO} \rightarrow \text{ MATH PRB rand ENTER}$$

The number 7 is returned.

The twenty random numbers between 0 and 99 are generated as follows:

$$\text{MATH PRB randInt}(\ 0, 99, 20)\ \text{ENTER}$$

The following sequence of random integer values is returned:

$$21, 99, 57, 28, 80, 59, 56, 35, 89, 85, 54, 64, 82, 41, 2, 49, 66, 41, 64, 67.$$

Summary Statistics. In this exercise, you will use the TI–83 to calculate summary statistics for the "showerhead" data. After typing the 34 values of "showerhead" into L_1 of your calculator, key in

- STAT CALC 1:1–Var Stats ENTER 2nd L_1 ENTER

The following summary statistics will then appear. Some of these summary statistics appear *below* the screen window; just arrow down, using the blue down arrow button, to view these summary statistics.

- mean: $\bar{x} = 2.88$
- sum: $\sum x = 98$
- sum of squares: $\sum x^2 = 301.02$
- sample standard deviation: $s_x = 0.75$
- population standard deviation: $\sigma_x = 0.739$
- sample size: $n = 34$
- minimum value: minX = 1.8
- lower quartile: $Q_1 = 2.5$
- median: Med = 2.7
- upper quartile: $Q_3 = 2.9$
- maximum value: maxX = 5.4

We will be interested in many of the statistics given here.

Box and Whisker Plots. We will create a box and whiskers plot from the 34 numbers in "showerhead.dat" dataset. After turning off all the STAT PLOTS and the Y = plots, do the following

- Turn on one of the STAT PLOTs for the histogram by typing:
  - 2nd STAT PLOT ENTER

  Once at the "Plot1" screen, choose or type in the following options:
  - On
  - Type: box and whiskers figure plot on second row, at the beginning
  - Xlist: L1 (for data values)
  - Freq: 1
  - Mark: + (or any of the three plot marks you like)

- To automatically fit the box and whiskers to the screen window of the calculator, press:

  – ZOOM 9 ENTER

  Then press either TRACE or GRAPH, depending on if you want information on the box and whiskers plot. In addition to the box and whiskers plot, outliers are also plotted outside the inner fences.

Simulating Sampling Distributions. Consider the following costs of 3 CDs bought at the "Great CD Store", along with their probability of purchase:

x	\$14	\$15	\$16
$P(X = x)$	0.1	0.3	0.6

Determine the sampling distribution of mean cost, $\bar{X}$, of *two* CDs (sampling with replacement and order matters) using 10 repetitions/simulations and seed 7 and the following procedure,

if random number	01,...,10	11,...,40	41,...,99,00
then "count" CD cost	\$14	\$15	\$16

to collect 10 *pairs* of costs (*twenty* numbers in all).

We must first store seed 7 in the random number generator[2]:

7 STO → MATH PRB rand ENTER

The number 7 is returned.

The twenty random numbers between 0 and 99 are generated as follows:

MATH PRB randInt($0, 99, 20$) ENTER

The following sequence of random integer values is returned:

$$21, 99, 57, 28, 80, 59, 56, 35, 89, 85, 54, 64, 82, 41, 2, 49, 66, 41, 64, 67.$$

Using the sampling procedure, since 21 corresponds to choosing the second CD with cost \$15 and 99 corresponds to choosing the third CD with cost \$16, the average of these two CDs is $\frac{15+16}{2} = \$15.5$. In a similar way, the approximate sampling distribution is constructed as given below:

[2]This essentially changes the "pointer" in the TI–83 to a different location in the random number list stored in the calculator. When everyone in the lab puts in seed 7, all calculators will generate the *same* sequence of random numbers. On the quiz or homework, a seed will be specified, so that everyone in the class uses the same random number sequence and so generates the same sampling distribution

first CD	\$15	\$16	\$16	\$16	\$16	\$16	\$16	\$14	\$16	\$16
second CD	\$16	\$15	\$16	\$15	\$16	\$16	\$16	\$16	\$16	\$16
mean cost	\$15.5	\$15.5	\$16	\$15.5	\$16	\$16	\$16	\$15	\$16	\$16

and so,

mean cost	\$14	\$14.5	\$15	\$15.5	\$16
proportion (out of 10)	$\frac{0}{10}$	$\frac{0}{10}$	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{6}{10}$

Graphing The t–distribution. To graph the t–distribution with 4 degrees of freedom and shade between -1 and 1.5, type

- WINDOW -3 3 1 -0.1 0.4 0.1
- Y = 2nd DISTR 4:tpdf(X , 4) GRAPH
- 2nd DRAW 1:ClrDraw ENTER
- 2nd DISTR DRAW 2:Shadet(-1 , 1.5 , 4) ENTER

Probability For t–distribution. To determine the probability the t–distribution is less than 2.31 at 18 degrees of freedom, type

- 5:tcdf(
- 2nd DISTR (−) EE 99 , 2.31 , 18) ENTER

A probability of 0.9835 is returned.

Percentile For t–distribution. To run the INVT program to determine the 95th percentile of the t–distribution at 18 degrees of freedom, first type in PRGM INVT ENTER and then:

- prgmINVT
- df=18
- P(T≤t)=0.95

A percentile of 1.734 is returned.

Graphing The Chi–Square Distribution. To graph the chi–square distribution with 4 degrees of freedom and shade between 0 and 3.9, type

- WINDOW 0 15 1 -0.1 0.3 0.1

- Y = 2nd DISTR 6:χ^2pdf(X , 4) GRAPH
- 2nd DISTR DRAW 3:Shadeχ^2(0 , 3.9 , 4) ENTER

Probability For Chi–Square Distribution. To determine the probability the chi–square distribution is between 1.23 and 2.31 at 18 degrees of freedom, type

- 7:χ^2cdf(
- 2nd DISTR 1.23 , 2.31 , 18) ENTER

A probability of 0.000003565 is returned.

Percentile For Chi–Square Distribution. To run the INVCHI2 program to determine the 95th percentile of the Chi–Square distribution at 5 degrees of freedom, first type in PRGM INVCHI2 ENTER and then:

- prgmINVCHI2
- df=5
- P($\chi \leq \chi^2$)=0.95

A percentile of 11.07 is returned.

Graphing The F Distribution. To graph the F distribution with (4,5) degrees of freedom and shade between 2 and 3, type

- WINDOW 0 8 1 -0.2 0.7 0.1
- Y = 2nd DISTR 8:Fpdf(X , 4 , 5) GRAPH
- 2nd DISTR DRAW 3:ShadeF(2 , 3 , 4 , 5) ENTER

Probability For F Distribution. To determine the probability the F distribution is between 1.23 and 2.31 at 18, 3 degrees of freedom, type

- 2nd DISTR 1.23, 2.31, 18, 3) ENTER

A probability of 0.2287... is returned.

Percentile For F Distribution. To run the INVF program to determine the 95th percentile of the Chi–Square distribution at 5, 8 degrees of freedom, type

- prgmINVCHI2

- df1=5
- df2=8
- P($R \leq t$)=0.95

A percentile of 3.687... is returned.