TI 83+ Calculator Tips for STA 2023
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I. Enter data in a list
STAT, EDIT, enter a value, press ENTER or the DOWN ARROW, after you've entered all your values, press 2nd QUIT.

II. Clear a list of data
One way to clear a list of data is to go to stat/edit where your data is, arrow up to the name of the list "L1" for example, and press CLEAR, DOWN ARROW.

III. Find numerical descriptive statistics
(x-bar, s, min, max, median, first and third quartiles)

A. Statistics from a list of data
After you've entered data into a list, for example List 1, L1, press STAT, CALC, ONE-VARIABLE STATISTICS, press ENTER once, press ENTER again, and the statistics appear.
*** If your data is in any other list besides L1, you must tell the calculator where it is located before you press ENTER for the second time:
STAT, CALC, ONE-VAR STATS, press ENTER once, 2nd L2, for example, press ENTER again, and the statistics appear.

B. Statistics from data already summarized in a frequency table
STAT, EDIT, enter class midpoints in L1, corresponding frequencies in L2,
STAT/CALC/ONE-VAR STATS
L1 comma L2 , enter
* the comma is located above 7 as a 2nd function
* the comma tells the calculator to consider the 2 lists as one distribution and not 2 separate variables

IV. Sort data in a list
STAT, EDIT, SORT A (to sort in ascending order) or SORT D (descending order).
*** Be careful not to sort paired data (X,Y) ordered pairs, or frequency table data (X,frequency) pairs, or probability distributions (X,P(X)) pairs. One list will sort and the accompanying pair will then be mismatched because it is not sorted along with the list you sorted.

V. Using the TI-83 calculator to select a random sample

A. Each of us must prepare our own calculator to "start" at a unique point.
(The function that generates random numbers is currently set "seeded" at the same point in all new calculators. Please do the following once. You will not have to do this again with your calculator.

Type in any number. Make it several digits in length. Example: 5396714. Make it a number you think will be different from everybody else's number. So, on your screen now is a number.

your number STO-> MATH PRB RAND ENTER ENTER

Now you are ready to take your own, unique random samples.
Notice how your population is numbered. Identify the smallest and largest numbers used to number your population. These are called "min" and "max" in this calculator function. These are not referring to the data values. This could be confusing when we study the range of the data values. The sample size, n, is how many random numbers you want to select.

MATH/PROB/#5 Random Integer enter
random int (min, max, n) enter

Example:
random int (1,100,5) enter
This selects 5 random numbers between 1 and 100 inclusive.

VI. Draw a histogram, specifying the measurement classes and class width of your choice

1. 2^{nd} , STAT PLOT, ENTER to choose plot 1, ENTER to choose plot 1 is 'On',
2. Select the type graph you want. The third one in the first row is the histogram.
3. The X List is where you indicate where your data has been entered, L1 or L2, etc.
4. Leave Freq = 1.
5. Press the ZOOM button on the top row of your calculator, #9 (STAT). The histogram should appear.

6. While looking at your histogram, you do not see any labels... press the TRACE button on the top row of your calculator. A * appears at the top of the first bar. That measurement class's boundaries appear and the frequency of data in that measurement class appears. Arrow right for rest of the measurement classes.

7. To get the histogram like you want it:
Press the WINDOW button on top row of your calculator for settings:
xmin = lower boundary of first measurement class
xmax = upper boundary of last measurement class
x scale = class width
y min = don't change
y max = increase value IF you can't see top of histogram bars
y scale = don't change
res = 1
then press the GRAPH button on the top row of your calculator
(If you press ZOOM #9 after making WINDOW changes, the changes do not appear.)

VII. Correlation and Regression

A. Scatterplot:

first enter X data into L1 and Y data into L2: STAT, EDIT, ENTER
scatter plot:
2nd statplot, enter, enter so that plot one is ON
type = 1st plot on first row
xlist = L1 and ylist = L2
mark = your choice
ZOOM, #9 which is zoom stat
TRACE for coordinates (trace jumps around, it's moving from ordered pair to ordered pair in the order you entered the data)

B. Compute the coefficients for the regression line

$\hat{y} = ax + b$

STAT, CALC, #4 LinReg (ax+b), enter, enter again IF your X,Y data is located in L1,L2, respectively. Otherwise, specify the location of X,Y data. For example L1,L3, then enter.

C. Graph regression line on scatter plot

STAT, TESTS, E: LinRegrTTest,
xlist = L1, ylist = L2 (or wherever your X,Y data is located)
RegEQ=Y1 * to get Y1 here, put cursor on entry spot for RegEQ= Then, press VARS, Y-Vars, #1: Function, #1: Y1 enter, press Calculate (test results come up, we're not covering this test, but running it seems to make the line get graphed on the scatter plot), then press either GRAPH or ZOOM #9

D. Compute r, the correlation coefficient and R^2, the coefficient of determination

The first time you do this, you might have to set the following to get r and R^2 to appear: From a clear screen, go to 2nd 0 (Catalog), scroll down to Diagnostic On, press ENTER twice. When it says done, the following commands should print out r and R^2 every time.
STAT, CALC, #4: LinReg (ax+b), location of X,Y data, enter

VIII. Discrete Probability Distributions

A. Finding the mean and standard deviation of a discrete probability distribution:

STAT/EDIT
Put X values in List 1 (L1)
Put corresponding probabilities P(X)s in List 2 (L2)
* Each P(X) must be to the right of its X value. Don't mix up the orders of these "pairs".
STAT/CALC/ONE VAR STATS/L1,L2 enter
* You must put the names of both lists in order, separated by a comma (above the number 7 on calculator). The comma is the key. It signals the calculator that these two lists contain paired data that must be treated as a probability distribution, not as two separate columns of data.

* Unfortunately, the display then gives the xbar symbol for the mean. Though the calculation is the same, the correct symbol is mu.
* Fortunately, the display only offers sigma, the standard deviation for the distribution, the same symbol used for the population standard deviation. Don't confuse it with s, the standard deviation of a sample of data.

B. Binomial probabilities

1. Binomial Probability for Individual Values of X: P(X = k)
When one X value's probability is needed, use
2nd Distribution/Binomialpdf
that's Pdf (It stands for probability density function)
Binomial pdf calls for three entries separated by commas and with a closing parenthesis:
Binomial pdf(n,p,x)
n is the number of trials in the experiment
p is the probability of success on any given trial
(success is just the event of interest happening - it's not always an event with a positive connotation - we could be counting defects in a batch or the occurrence of side effects from a drug)
x is the number of successes you're finding the probability of

2. Binomial Probability of several X values: P(X ≤ k), P(X > k), etc.
When you want the probability of several X values, convert them to an equivalent probability statement in terms of "less than or equal to", that's P(X ≤ k). The reason is that the TI-83 calculator's Binomialcdf function (cumulative density function) is programmed to find the P(X = 0)+ P(X = 1)+ P(X = 2) + and so on until it reaches the value of k that you give it. So, it starts with the smallest X value possible for the experiment, finds the probabilities of individual X values and adds them up (cumulative) for you.

Find P(X ≤ k) can be found with
2nd Distribution/Binomialcdf enter
Binomialcdf(n,p,x)

ex. If X is the number of free throws I make in basketball, n = 4 trials, p = .25, then the possible X values are 0, 1, 2, 3, 4.

If I want P(X ≤ 2), I'll use Binomialcdf(4,.25,2)
which equals .949

If I want P(X<2), that only includes X values 0 and 1, so I convert that statement:
P(X<2) = P(X ≤ 1) = Binomialcdf(4,.25,1) = .738

If I want P(X>2), that includes X values 3 and 4, which I notice is the complement of X=0,1,2.
So, P(X>2) = 1 - P(X ≤ 2) = 1-Binomialcdf(4,.25,2) = 1 - .949 = .051

If I want $P(X \geq 2)$, that includes X values 2,3,4, which is the complement of X=0,1.
So, $P(X \geq 2) = 1 - P(X \leq 1)$ = 1 - Binomialcdf(4,.25,1) = 1 - .738 = .262

IX. Normal Distributions
These problems give the mean, standard deviation, and a value or two values of the variable, X. You are asked to find a probability.

2nd Distributions/Normalcdf(that's #2)/ENTER

Normalcdf reqires 4 entries, separated by commas, in this order:

Lower endpoint (X-value or negative infinity) associated with the requested area under the curve,

Upper endpoint (X-value or positive infinity) associated with the requested area under the curve,

Mean of X,

Standard Deviation of X.

It will look like this, only with numerical entries:

Normalcdf(Lower,Upper,Mean,Standard Deviation)

* Normal probabilities are traditionally rounded to 4 decimal places.

* Remember, probability cannot be negative, nor can area under the curve. Values of the variable X can sometimes be negative (ex. checking account balance). Z-scores can be negative. Negative Z-scores represent values of the variable that are below the mean, "below average."

* To represent negative infinity, we will use a very small value, negative 1 times 10 to the 99^{th} power. This will be small enough for our purposes.
first find the "-" (that's the negative button under the "3" button, do not use the subtraction button),
then use - 2nd EE 99. (EE is above the comma.) It will show up on the calculator screen as -E99.
This produces -(1x10^99) , that's 1 times 10 to the 99th power. That will be a sufficient representation of negative infinity.

* To represent positive infinity, we will use a very large value, 1 times 10 to the 99^{th} power.
use 2nd EE 99. That produces 1 x 10^99.

* With all Normalcdf work (and Inverse Normal problems), your calculator will produce

slightly more accurate answers than the book prints in the answer section. The reason is that the book's answers are based on work done by hand, with Z-score equivalents of the given X-values, the Z-scores are rounded to two decimal places, and the probabilities are found using the Standard Normal Probability Table in the front cover of the book. Before the programmable calculator, the Z-table was the way to go! Anyway, I expect your answers will match to the hundredth's place. If your answer differs more than that, review your work or ask a question.

EXAMPLES:
Let X be test scores. Suppose X~Normal(mu=80,sigma=5).

1. Find the probability that a randomly selected student scored less than 70.
P(X < 70). Normalcdf(-EE99,70,80,5)=.0228

2. Find the probability that a randomly selected student scored at least 75.
P(X ≥ 75). Normalcdf(75,EE99,80,5)= .8413

3. Find the probability that a randomly selected student scored between 90 and 100.
P(90 < X < 100). Normalcdf(90,100,80,5)=.0227

Remember, for all continuous random variables, of which Normal distribution is one example,
P(X=a particular value) will be 0. Not because that value cannot occur, but because the model requires an area to find a probability.
Try it. Find P(X=90). Normalcdf(90,90,80,5)= 0.

X. Inverse Normal Distribution Problems

Here, you are given the mean, standard deviation, and a specified area under the curve (or probability or percentage) in the upper or lower tail, or between two values. You are asked to find the corresponding X-value(s). This is called the Inverse Normal Probability problem.

Re-read the Normal Distribution problems' mission: Given the X-value(s), find the probability. In the Inverse Normal problems, you're given the probability, and you find the X-value(s).

To accomplish this on the TI-83 calculator, use
2nd Distributions/Inverse Normal(that's #3)/ENTER.

Inverse Normal requires three entries, in order, separated by commas. They are:
1. the total area under the curve to the LEFT (always) of the X-value you want to find. The area has to be written in decimal form.
2. the mean
3. the standard deviation

So, it will look like this, only with numbers:
invNorm(area to left of desired X-value,mu,sigma)

EXAMPLES:
1.
Let X be test scores. Suppose X~Normal(mu=80,sigma=5)
Find the test score that separates the top 10% from the bottom 90% of the scores.
2nd Distr/invNorm/enter
invNorm(.90,80,5)= 86.4
(If you draw, label, and shade, you'll see where 86.4 belongs. This might help the problem make sense.)

2.
Let X be the time it took racers to run a race.
Suppose X~Normal(mu = 10 minutes, sigma = 1.2 minutes)
Find the time that distinguishes the FASTEST 5% of the runners. *Think carefully, FASTEST means what kind of times (what kind of X-values), small or large?
small
So, we find the X-value that separates 5% of the left tail of the distribution from the rest.
2nd Distributions/invNorm/enter
invNorm(.05,10,1.2)= 8.0
So, the FASTEST 5 % of the runners were the runners who finished the race in less than 8 minutes.
(Draw, label, shade might help you understand the whole picture.)

XI. Distribution of the Sample Mean, $\overline{x}$
Here, we are finding probabilities associated with the variable $\overline{x}$, not X. So, be careful with the standard deviation of $\overline{x}$.
Normalcdf(lower, upper, mean is mu, sigma divided by square root sample size)

EXAMPLE:
1. TV replacement times have a mean of 8.2 years and standard deviation of 1.1 years. If I randomly sample 50 TV's, what's the probability that they have a mean replacement time less than 7.5 years?
P($\overline{x}$<7.5)
= Normalcdf(-EE99,7.5,8.2,1.1/sqroot(50))
= 3.4 x 10^-6
= 0.0000034

XII. Confidence Intervals TI-83 Calculator Tips

A. Stat/tests/z-interval (that's #7)
If you will be entering statistics, choose input = stats by highlighting it (use arrows) and selecting it (press ENTER)
If you will be referring the calculator to a list of entered data, choose input = data by highlighting it and selecting it by pressing ENTER.

Fill in the rest of the given information.
Press calculate.

B. Stat/tests/t-interval (that's #8)
similar entries

C. Stat/tests/one-prop-z-int (that's # A after 0 to 9)
enter given information
* You need X: the number of occurrences leading to the proportion X/n. So, if $\hat{p}$ is given instead of X and n, separately, calculate X = ($\hat{p}$)(n). Enter X, n, and the desired confidence level.

XIII. Hypothesis Tests TI-83 Calculator Tips

A. Stat/tests/Z-test (that's #1)
Input: select stats or data
MUo: enter the numerical value in the null hypothesis
SIGMA: enter the standard deviation (you might use s, the sample standard deviation if sigma is unknown)
XBAR: enter the sample mean
n: enter the sample size
MU: select the correct alternative hypothesis, H1
It is imperative that you correctly select H1.
Press Calculate.
Check p-value. If the p-value is less than alpha, the significance level, then reject Ho. If not, don't reject Ho.

B. Stat/tests/t-test (that's #2)
same entries as z-test

C. Stat/tests/1-propZTest
Po: enter the numerical value from Ho
X: enter the number of occurrences of the variable being measured
(like 5 out of 20 students answered "yes", X=5)
n: enter the sample size
Prop: select the correct alternative hypothesis, H1.
It is imperative to select the correct H1.
Press Calculate.
Check the p-value. If the p-value is less than alpha, reject Ho. If not, don't reject Ho.