Casio FX-9750GII
Guide for Introductory Statistics

Includes step-by-step instructions,
practice exercises, and links to video
tutorials. Covers all calculator features
needed for AP® Statistics Exam

Instructions excerpted from
Advanced High School Statistics,
available for FREE at openintro.org/ahss

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Summarizing data

Entering data

Casio fx-9750GII: Entering data

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. Optional: use the left or right arrows to select a particular list.
3. Enter each numerical value and hit EXE.

Calculating summary statistics and drawing a box plot

Casio fx-9750GII: Drawing a box plot and 1-variable statistics

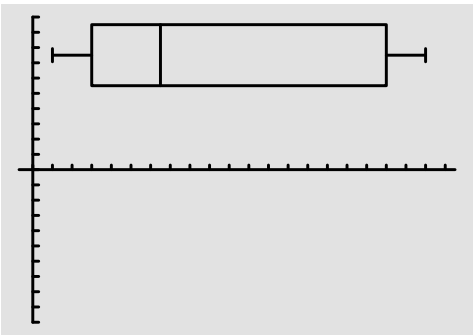
1. Navigate to STAT (MENU, then hit 2) and enter the data into a list.
2. Go to GRPH (F1).
3. Next go to SET (F6) to set the graphing parameters.
4. To use the 2nd or 3rd graph instead of GPH1, select F2 or F3.
5. Move down to Graph Type and select the ▷ (F6) option to see more graphing options, then select Box (F2).
6. If XList does not show the list where you entered the data, hit LIST (F1) and enter the correct list number.
7. Leave Frequency at 1.
8. For Outliers, choose On (F1).
9. Hit EXE and then choose the graph where you set the parameters F1 (most common), F2, or F3.
10. If desired, explore 1-variable statistics by selecting 1-Var (F1).

Calculating the summary statistics will return the following information. It will be necessary to hit the down arrow to see all of the summary statistics.

$\bar{x}$	Mean	minX	Minimum
Σx	Sum of all the data values	Q_1	First quartile
Σx^2	Sum of all the squared data values	Med	Median
σx	Population standard deviation	maxX	Maximum
n	Sample size or # of data points		

Practice exercises

⊙ **Guided Practice 0.1** Enter the following 10 data points into the first list on a calculator: 5, 8, 1, 19, 3, 1, 11, 18, 20, 5. Find the summary statistics and make a box plot of the data. The summary statistics should be $\bar{x} = 9.1$, $Sx = 7.475$, $Q1 = 3$, etc. The box plot should be as follows.



Probability

Computing the binomial coefficient

Casio fx-9750GII: Computing the binomial coefficient, $\binom{n}{k}$

1. Navigate to the RUN-MAT section (hit MENU, then hit 1).
2. Enter a value for n.
3. Go to CATALOG (hit buttons SHIFT and then 7).
4. Type C (hit the ln button), then navigate down to the bolded C and hit EXE.
5. Enter the value of k. Example of what it should look like: 7C3.
6. Hit EXE.

Binomial calculations

Casio fx-9750GII: Binomial calculations

1. Navigate to STAT (MENU, then hit 2).
2. Select DIST (F5), and then BINM (F5).
3. Choose whether to calculate the binomial distribution for a specific number of successes, $P(X = k)$, or for a range $P(X \leq k)$ of values (0 successes, 1 success, ..., k successes).
   - For a specific number of successes, choose Bpd (F1).
   - To consider the range 0, 1, ..., k successes, choose Bcd(F1).
4. If needed, set Data to Variable (Var option, which is F2).
5. Enter the value for x (k), Numtrial (n), and p (probability of a success).
6. Hit EXE.

Practice exercises

⊙ **Guided Practice 0.2** Find the number of ways of arranging 3 blue marbles and 2 red marbles.[1]

⊙ **Guided Practice 0.3** There are 13 marbles in a bag. 4 are blue and 9 are red. Randomly draw 5 marbles *with replacement*. Find the probability you get exactly 3 blue marbles.[2]

⊙ **Guided Practice 0.4** There are 13 marbles in a bag. 4 are blue and 9 are red. Randomly draw 5 marbles *with replacement*. Find the probability you get *at most* 3 blue marbles (i.e. less than or equal to 3 blue marbles).[3]

[1] Use $n = 5$ and $k = 3$ to get 10.
[2] Use $n = 5$, $p = 4/13$, and x $(k) = 3$ to get 0.1396.
[3] Use $n = 5$, $p = 4/13$, and $x = 3$ to get 0.9662.

Distribution of random variables

Finding area under the normal curve

Casio fx-9750GII: Finding area under the normal curve

1. Navigate to STAT (MENU, then hit 2).
2. Select DIST (F5), then NORM (F1), and then Ncd (F2).
3. If needed, set Data to Variable (Var option, which is F2).
4. Enter the Lower Z-score and the Upper Z-score. Set σ to 1 and μ to 0.
   - If finding just a lower tail area, set Lower to -12.
   - For an upper tail area, set Upper to 12.
5. Hit EXE, which will return the area probability (p) along with the Z-scores for the lower and upper bounds.

Find a Z-score that corresponds to a percentile

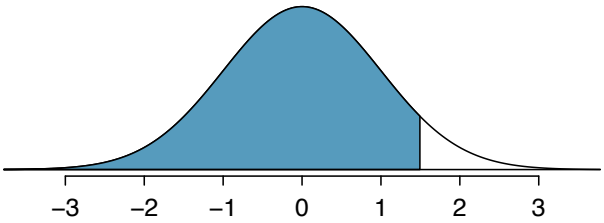
Casio fx-9750GII: Find a Z-score that corresponds to a percentile

1. Navigate to STAT (MENU, then hit 2).
2. Select DIST (F5), then NORM (F1), and then InvN (F3).
3. If needed, set Data to Variable (Var option, which is F2).
4. Decide which tail area to use (Tail), the tail area (Area), and then enter the σ and μ values.
5. Hit EXE.

Practice exercises

Example 0.5 Use a calculator to determine what percentile corresponds to a Z-score of 1.5.

Always first sketch a graph:[4]



To find an area under the normal curve using a calculator, first identify a lower bound and an upper bound. Theoretically, we want all of the area to the left of 1.5, so the left endpoint should be -∞. However, the area under the curve is nearly negligible when Z is smaller than -4, so we will use -5 as the lower bound when not given a lower bound (any other negative number smaller than -5 will also work). Using a lower bound of -5 and an upper bound of 1.5, we get $P(Z < 1.5) = 0.933$.

Guided Practice 0.6 Find the area under the normal curve to right of $Z = 2$. [5]

Guided Practice 0.7 Find the area under the normal curve between -1.5 and 1.5. [6]

Example 0.8 Use a calculator to find the Z-score that corresponds to the 40th percentile.

Letting Area be 0.40, a calculator gives -0.253. This means that $Z = -0.253$ corresponds to the 40th percentile, that is, $P(Z < -0.253) = 0.40$.

Guided Practice 0.9 Find the Z-score such that 20 percent of the area is to the right of that Z-score.[7]

[4] normalcdf gives the result without drawing the graph. To draw the graph, do 2nd VARS, DRAW, 1:ShadeNorm. However, beware of errors caused by other plots that might interfere with this plot.

[5] Now we want to shade to the right. Therefore our lower bound will be 2 and the upper bound will be +5 (or a number bigger than 5) to get $P(Z > 2) = 0.023$.

[6] Here we are given both the lower and the upper bound. Lower bound is -1.5 and upper bound is 1.5. The area under the normal curve between -1.5 and 1.5 = $P(-1.5 < Z < 1.5) = 0.866$.

[7] If 20% of the area is the right, then 80% of the area is to the left. Letting area be 0.80, we get $Z = 0.841$.

Inference for categorical data

1-proportion z-interval and z-test

Casio fx-9750GII: 1-proportion z-interval

1. Navigate to `STAT` (`MENU` button, then hit the `2` button or select `STAT`).
2. Choose the `INTR` option (`F4` button).
3. Choose the `Z` option (`F1` button).
4. Choose the `1-P` option (`F3` button).
5. Specify the interval details:
   - Confidence level of interest for `C-Level`.
   - Enter the number of successes, `x`.
   - Enter the sample size, `n`.
6. Hit the `EXE` button, which returns

`Left`, `Right`	ends of the confidence interval
$\hat{p}$	sample proportion
`n`	sample size

Casio fx-9750GII: 1-proportion z-test

The steps closely match those of the 1-proportion confidence interval.

1. Navigate to `STAT` (`MENU` button, then hit the `2` button or select `STAT`).
2. Choose the `TEST` option (`F3` button).
3. Choose the `Z` option (`F1` button).
4. Choose the `1-P` option (`F3` button).
5. Specify the test details:
   - Specify the sidedness of the test using the `F1`, `F2`, and `F3` keys.
   - Enter the null value, `p0`.
   - Enter the number of successes, `x`.
   - Enter the sample size, `n`.
6. Hit the `EXE` button, which returns
   - `z` Z-statistic
   - `p` p-value
   - `p̂` the sample proportion
   - `n` the sample size

Practice exercises

⊙ **Guided Practice 0.10** A candidate selects a random sample of size $n = 500$. The proportion of people in the sample that support her is 52%. Is there significant evidence that greater than 50% of the population support her? Use a calculator to find the p-value for a test with $H_A : p > 50\%$. [8]

⊙ **Guided Practice 0.11** What percent of Americans believe the Supreme Court is doing a good job? A random sample of $n = 976$ yields a sample percent of 44%. Use a calculator to find a 90% confidence interval for the percent of all Americans that believe the Supreme Court is doing a good job. [9]

[8] p-value = 0.19
[9] The interval is (0.414, 0.471) = (41.4%, 47.1%).

2-proportion z-interval and z-test

Casio fx-9750GII: 2-proportion z-interval

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. Choose the INTR option (F4 button).
3. Choose the Z option (F1 button).
4. Choose the 2-P option (F4 button).
5. Specify the interval details:
   - Confidence level of interest for C-Level.
   - Enter the number of successes for each group, x1 and x2.
   - Enter the sample size for each group, n1 and n2.
6. Hit the EXE button, which returns

Left, Right	the ends of the confidence interval
$\hat{p}1$, $\hat{p}2$	the sample proportions
n1, n2	sample sizes

Casio fx-9750GII: 2-proportion z-test

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. Choose the TEST option (F3 button).
3. Choose the Z option (F1 button).
4. Choose the 2-P option (F4 button).
5. Specify the test details:
   - Specify the sidedness of the test using the F1, F2, and F3 keys.
   - Enter the number of successes for each group, x1 and x2.
   - Enter the sample size for each group, n1 and n2.
6. Hit the EXE button, which returns

z	Z-statistic	$\hat{p}1$, $\hat{p}2$	sample proportions
p	p-value	$\hat{p}$	pooled proportion
		n1, n2	sample sizes

Practice exercises

⊙ **Guided Practice 0.12** Use the data in Table 1 and a calculator to find a 95% confidence interval for the difference in proportion of dogs with cancer that have been exposed to 2,4-D versus not exposed to 2,4-D.[10]

	cancer	no cancer
2,4-D	191	304
no 2,4-D	300	641

Table 1: Summary results for cancer in dogs and the use of 2,4-D by the dog's owner.

⊙ **Guided Practice 0.13** Use the data in Table 1 and a calculator to find the Z-score and p-value for one-sided test with H_A: dogs with cancer are more likely to have been exposed to 2,4-D than dogs without cancer, $p_c - p_n > 0$.[11]

[10] Correctly going through the calculator steps should lead to an interval of (0.01484, 0.11926). There is no value given for the pooled proportion since we do not pool for confidence intervals.

[11] Correctly going through the calculator steps should lead to a solution with $Z = 2.55$ and p-value $= 0.0055$. The pooled proportion is $\hat{p} = 0.342$.

Finding areas under the Chi-square curve

Casio fx-9750GII: Finding an upper tail area under the chi-sq. curve

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. Choose the DIST option (F5 button).
3. Choose the CHI option (F3 button).
4. Choose the Ccd option (F2 button).
5. If necessary, select the Var option (F2 button).
6. Enter the Lower bound (generally the chi-square value).
7. Enter the Upper bound (use a large number, such as 1000).
8. Enter the degrees of freedom, df.
9. Hit the EXE button.

Chi-square goodness of fit test

Casio fx-9750GII: Chi-square goodness of fit test

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. Enter the observed counts into a list (e.g. List 1) and the expected counts into list (e.g. List 2).
3. Choose the TEST option (F3 button).
4. Choose the CHI option (F3 button).
5. Choose the GOF option (F1 button).
6. Adjust the Observed and Expected lists to the corresponding list numbers from Step 2.
7. Enter the degrees of freedom, df.
8. Specify a list where the contributions to the test statistic will be reported using CNTRB. This list number should be different from the others.
9. Hit the EXE button, which returns

x^2	chi-square test statistic
p	p-value
df	degrees of freedom
CNTRB	list showing the test statistic contributions

Chi-square test for two-way tables

Casio fx-9750GII: Chi-square test of homogeneity and independence

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. Choose the TEST option (F3 button).
3. Choose the CHI option (F3 button).
4. Choose the 2WAY option (F2 button).
5. Enter the data into a matrix:
   - Hit ▷MAT (F2 button).
   - Navigate to a matrix you would like to use (e.g. Mat C) and hit EXE.
   - Specify the matrix dimensions: m is for rows, n is for columns.
   - Enter the data.
   - Return to the test page by hitting EXIT twice.
6. Enter the Observed matrix that was used by hitting MAT (F1 button) and the matrix letter (e.g. C).
7. Enter the Expected matrix where the expected values will be stored (e.g. D).
8. Hit the EXE button, which returns
   - x^2 chi-square test statistic
   - p p-value
   - df degrees of freedom
9. To see the expected values of the matrix, go to ▷MAT (F6 button) and select the corresponding matrix.

Practice exercises

⊙ **Guided Practice 0.14** Use a calculator to find the area to right of 5.1 for a chi-square distribution with 5 degrees of freedom, i.e. find the upper tail area using a cutoff of 5.1. [12]

⊙ **Guided Practice 0.15** Use the table below and a calculator to find the X^2 statistic, df, and p-value for chi-square goodness of fit test. [13]

Days	1	2	3	4	5	6	7+	Total
Observed values	1532	760	338	194	74	33	17	2948
Expected values	1569	734	343	161	75	35	31	2948

Table 2: Distribution of the waiting time until a positive trading day. The expected counts are based on a geometric model.

⊙ **Guided Practice 0.16** Use the table below and a calculator to find the expected values and the X^2 statistic, df, and p-value for the corresponding chi-square test. [14]

		Congress		
	Obama	Democrats	Republicans	Total
Approve	842	736	541	2119
Disapprove	616	646	842	2104
Total	1458	1382	1383	4223

Table 3: Pew Research poll results of a March 2012 poll.

[12] Using $df = 5$ and a *lower* bound of 5.1 for the tail, the upper tail area is 0.4038.

[13] You should find that $X^2 = 15.08$, $df = 6$, and p-value $= 0.0196$.

[14] First create a 2×3 matrix ith the data. The final summaries should be $X^2 = 106.4$, p-value $= 8.06 \times 10^{-24} \approx 0$, and $df = 2$. Below is the matrix of expected values:

	Obama	Congr. Dem.	Congr. Rep.
Approve	731.59	693.45	693.96
Disapprove	726.41	688.55	689.04

Inference for numerical data

1-sample t-test and t-interval

Casio fx-9750GII: 1-sample t-test

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. If necessary, enter the data into a list.
3. Choose the TEST option (F3 button).
4. Choose the t option (F2 button).
5. Choose the 1-S option (F1 button).
6. Choose either the Var option (F2) or enter the data in using the List option.
7. Specify the test details:
   - Specify the sidedness of the test using the F1, F2, and F3 keys.
   - Enter the null value, $\mu 0$.
   - If using the Var option, enter the summary statistics. If using List, specify the list and leave Freq values at 1.
8. Hit the EXE button, which returns

	alternative hypothesis	$\bar{x}$	sample mean
t	T statistic	sx	sample standard deviation
p	p-value	n	sample size

Casio fx-9750GII: 1-sample t-interval

1. Navigate to `STAT` (`MENU` button, then hit the `2` button or select `STAT`).
2. If necessary, enter the data into a list.
3. Choose the `INTR` option (`F3` button), `t` (`F2` button), and `1-S` (`F1` button).
4. Choose either the `Var` option (`F2`) or enter the data in using the `List` option.
5. Specify the interval details:
   - Confidence level of interest for `C-Level`.
   - If using the `Var` option, enter the summary statistics. If using `List`, specify the list and leave `Freq` value at `1`.
6. Hit the `EXE` button, which returns

`Left`, `Right`	ends of the confidence interval
`x̄`	sample mean
`sx`	sample standard deviation
`n`	sample size

Practice exercises

⊙ **Guided Practice 0.17** The average time for all runners who finished the Cherry Blossom Run in 2006 was 93.29 minutes. In 2012, the average time for 100 randomly selected participants was 95.61, with a standard deviation of 15.78 minutes. Use a calculator to find the T statistic and p-value for the appropriate test to see if the average time for the participants in 2012 is different than it was in 2006.[15]

⊙ **Guided Practice 0.18** Use a calculator to find a 95% confidence interval for the average run time for participants in the 2012 Cherry Blossum Run using the sample data: $\bar{x} = 95.61$ minutes, $s = 15.78$ minutes, and the sample size was 100.[16]

[15] Let μ_0 be 93.29. Choose $\neq$ to correspond to H_A. $T = 1.47$, $df = 99$, and p-value= 0.14.
[16] The interval is $(92.52, 98.70)$.

Matched pairs t-test and t-interval

Casio fx-9750GII: matched pairs t-test or confidence interval

1. Compute the paired differences of the observations.
2. Using the computed differences, follow the instructions for a 1-sample t-test or confidence interval.

Practice exercises

⊙ **Guided Practice 0.19** Use the first 7 values of the data set produced below and calculate the T score and p-value to test whether, on average, Amazon's textbook price is cheaper that UCLA's price.[17]

⊙ **Guided Practice 0.20** Use the same table below to calculate a 95% confidence interval for the average difference in textbook price between Amazon and UCLA.[18]

	dept	ucla	amazon
1	Am Ind	27.67	27.95
2	Anthro	40.59	31.14
3	Anthro	31.68	32.00
4	Anthro	16.00	11.52
5	Art His	18.95	14.21
6	Art His	14.95	10.17
7	Asia Am	24.7	20.06

Table 4: A partial table of the `textbooks` data.

[17] Create a list of the differences, and use the data or list option to perform the test. Let μ_0 be 0, and select the appropriate list. Freq should be 1, and the test sidedness should be $>$. $T = 3.076$ and p-value= 0.0109.

[18] Choose a C-Level of 0.95, and the final result should be (0.80354, 7.0507).

2-sample t-test and t-interval

Casio fx-9750GII: 2-sample t-test

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. If necessary, enter the data into a list.
3. Choose the TEST option (F3 button).
4. Choose the t option (F2 button).
5. Choose the 2-S option (F2 button).
6. Choose either the Var option (F2) or enter the data in using the List option.
7. Specify the test details:
   - Specify the sidedness of the test using the F1, F2, and F3 keys.
   - If using the Var option, enter the summary statistics for each group. If using List, specify the lists and leave Freq values at 1.
   - Choose whether to pool the data or not.
8. Hit the EXE button, which returns

$\mu 1$ __ $\mu 2$	alt. hypothesis	$\bar{x}1$, $\bar{x}2$	sample means
t	t statistic	sx1, sx2	sample standard deviations
p	p-value	n1, n2	sample sizes
df	degrees of freedom		

Casio fx-9750GII: 2-sample t-interval

1. Navigate to STAT (MENU button, then hit the 2 button or select STAT).
2. If necessary, enter the data into a list.
3. Choose the INTR option (F4 button).
4. Choose the t option (F2 button).
5. Choose the 2-S option (F2 button).
6. Choose either the Var option (F2) or enter the data in using the List option.
7. Specify the test details:
   - Confidence level of interest for C-Level.
   - If using the Var option, enter the summary statistics for each group. If using List, specify the lists and leave Freq values at 1.
   - Choose whether to pool the data or not.
8. Hit the EXE button, which returns

Left, Right	ends of the confidence interval
df	degrees of freedom
x̄1, x̄2	sample means
sx1, sx2	sample standard deviations
n1, n2	sample sizes

Practice exercises

Guided Practice 0.21 Use the data from the ESC experiment shown in Table 5 to find the appropriate degrees of freedom and construct a 90% confidence interval.[19]

Guided Practice 0.22 Use the data from this example to find an appropriate statistic, degrees of freedom, and p-value for a two-sided hypothesis test.[20]

	n	$\bar{x}$	s
ESCs	9	3.50	5.17
control	9	-4.33	2.76

Table 5: Summary statistics for the embryonic stem cell data set.

[19] The interval is $(4.3543, 11.307)$ with $df = 12.2$.
[20] $T = 4.008$, $df = 12.2$, and p-value= 0.00168.

Introduction to linear regression

Finding b_0, b_1, R^2, and r for a linear model

Casio fx-9750GII: finding b_0, b_1, R^2, and r for a linear model

1. Navigate to `STAT` (`MENU` button, then hit the `2` button or select `STAT`).
2. Enter the x and y data into 2 separate lists, e.g. x values in `List 1` and y values in `List 2`. Observation ordering should be the same in the two lists. For example, if $(5, 4)$ is the second observation, then the second value in the x list should be 5 and the second value in the y list should be 4.
3. Navigate to `CALC` (`F2`) and then `SET` (`F6`) to set the regression context.
   - To change the `2Var XList`, navigate to it, select `List` (`F1`), and enter the proper list number. Similarly, set `2Var YList` to the proper list.
4. Hit `EXIT`.
5. Select `REG` (`F3`), `X` (`F1`), and `a+bx` (`F2`), which returns:

`a`	b_0, the y-intercept of the best fit line
`b`	b_1, the slope of the best fit line
`r`	r, the correlation coefficient
`r`^{2}	R^2, the explained variance
`MSe`	Mean squared error, which you can ignore

   If you select `ax+b` (`F1`), the `a` and `b` meanings will be reversed.

Practice exercises

	fed_spend	poverty
1	6.07	10.6
2	6.14	12.2
3	8.75	25.0
4	7.12	12.6
5	5.13	13.4
6	8.71	5.6
7	6.70	7.9

⊙ **Guided Practice 0.23** The table contains values of federal spending per capita (rounded to the nearand percent of population in poverty for seven counties. This is a subset of a data set from Chapter 1. Use a calculator to find the equation of the least squares regression line for this partial data set.[21]

Linear regression t-test

Casio fx-9750GII: Linear regression t-test on β_1

1. Navigate to `STAT` (`MENU` button, then hit the `2` button or select `STAT`).
2. Enter your data into 2 lists.
3. Select `TEST` (`F3`), `t` (`F2`), and `REG` (`F3`).
4. If needed, update the sidedness of the test and the `XList` and `YList` lists. The `Freq` should be set to `1`.
5. Hit `EXE`, which returns:

`t`	t statistic	`b`	b_1, slope of the line
`p`	p-value	`s`	st. dev. of the residuals
`df`	degrees of freedom for the test	`r`	r, correlation coefficient
`a`	b_0, y-intercept of the line	`r²`	R^2, explained variance

[21] $a = 5.136$ and $b = 1.056$, therefore $\hat{y} = 5.136 + 1.056x$.