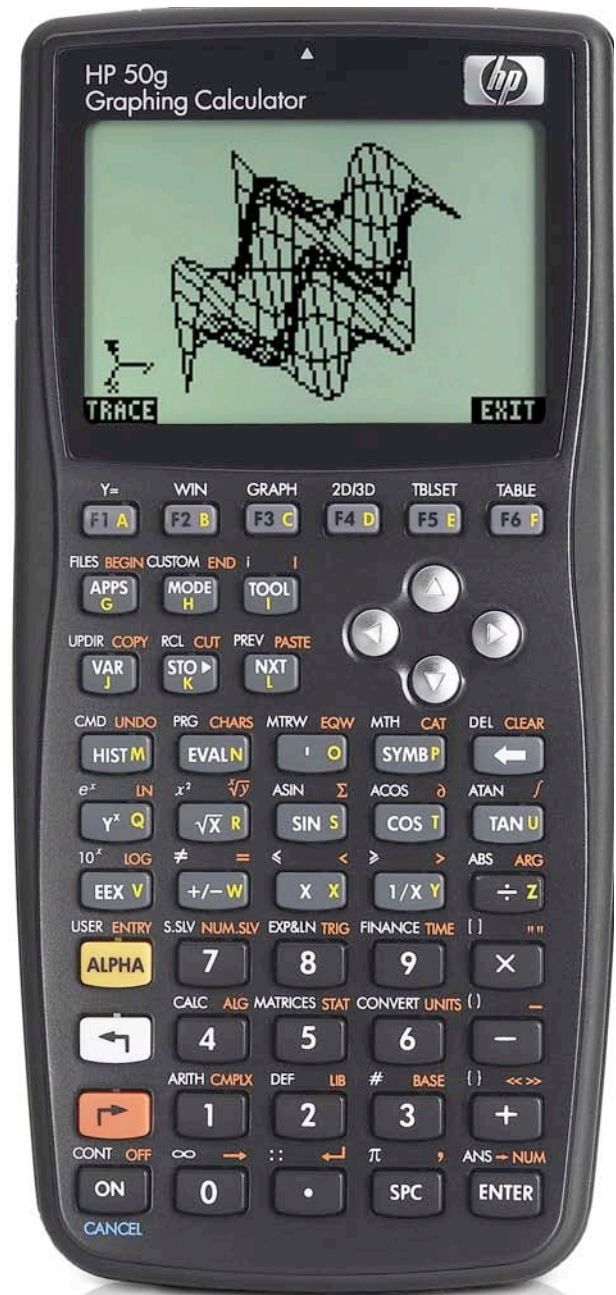**hp calculators**

HP 50g Confidence Intervals

The STAT menu

Confidence Intervals

Practice finding confidence intervals for the population mean

The STAT menu

The Statistics menu is accessed from the ORANGE shifted function of the $\boxed{5}$ key by pressing $\boxed{\rightarrow}$ $\underline{STAT}$. When pressed, a CHOOSE box is displayed with a number of problem areas within statistics where the HP 50g can be applied.

Figure 1

The first choice deals with calculating many values related to the statistics of a single variable, such as the average, standard deviation and others. The second choice deals with placing data within bins or classes and is useful when dealing with frequency distributions or when there is a need to summarize data within a histogram. The third choice, Fit Data.. is used to compute trend lines. The fourth choice allows for the computation of summary statistics from a data set, such as the sum of all X values, the sum of all the Y values squared, and others. The fifth choice allows for the evaluation of many different hypothesis tests and the sixth choice allows for the construction of confidence intervals around a sample mean.

To determine a confidence interval, press $\boxed{6}$ $\boxed{ENTER}$ to immediately choose the Conf. interval function.

Confidence Intervals

The next screen displays the choices for the different types of confidence intervals the HP 50g can evaluate.

Figure 2

The first choice is for a sample confidence interval for the population mean with either a known population variance or for a large sample (usually more than 30) with an unknown population variance. It uses the sample mean as the midpoint of the interval. It is frequently used to estimate the average of the entire population from the mean of a sample.

The second choice is for a sample confidence interval for the difference between two population means with either a known population variance or for a large sample (usually over 30) if the population variance is unknown. The resulting interval is the range within which there is the specified confidence level that the difference in the population means would fall. If zero is not included in this interval, the population means are not considered equal, at the given level of confidence. If zero is included, then it is not possible to deny that the actual population averages are equal.

The third and fourth choices are similar to the first two choices, except that they are applied to proportions.

The first four choices use the normal probability distribution.

The fifth and sixth choices are similar to the first two choices, except they deal specifically with situations where small sample sizes are present and the population variances and standard deviations are unknown. These use the Student's t probability distribution.

When chosen, each confidence interval displays an input form where the necessary information to construct the confidence interval is entered, including the sample averages, population or sample standard deviations, size of the sample(s), and the level of confidence desired for the interval. The level of confidence relates to the desired level of assurance that the population mean (or other parameter) would fall into the range of the confidence interval. There is a potential trap here, since to be 100% confident that the population mean is within the interval range, the interval would have to be infinite in size. Otherwise, there would always be a

small chance the population parameter would be outside the range. That is why one often sees confidence intervals of 90%, 95%, etc.

The resulting interval can be displayed either in a text/formula view or in a graphical view.

Practice finding confidence intervals

Example 1:   A sample of 40 boxes of cereal was taken from the production line. The average weight of the contents was 11.8 ounces and had a standard deviation of 0.5 ounces. Construct a 90% confidence interval for the population mean for the contents of all cereal boxes. If the boxes are to have 12 ounces in them, does the confidence interval contain the population mean?

Solution: Since the sample size is over 30, we can use the first confidence interval even though the population variance and population standard deviation are not known.

Figure 3

Figure 4

Figure 5

Figure 6

Answer: The 90% confidence interval is the range of 11.67 to 11.93. This means there is a 90% confidence that the population mean falls within this range. If the boxes are to have 12 ounces in them, it would not be in this range. This may indicate a problem with the equipment that fills these boxes.

Example 2:   A sample of 20 boxes of cereal was taken from the production line. The average weight of the contents was 11.9 ounces and had a standard deviation of 0.3 ounces. Construct a 95% confidence interval for the population mean for

the contents of all cereal boxes. If the boxes are to have 12 ounces in them, does the confidence interval contain the population mean?

Solution: Since the sample size is under 30, we must use the fifth confidence interval using the Student's t distribution.
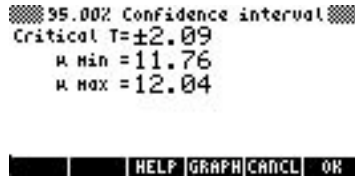
→ STAT 6 ENTER 5 ENTER 1 1 • 9 ENTER 0 • 3 ENTER 2 0 ENTER
0 • 9 5 ENTER

```
▓▓▓CONF. INT.: 1 μ, UNKNOWN σ▓▓▓
x: 11.90
Sx: 0.30
n: 20.00
c: 0.95
Sample mean
 EDIT |      | HELP |     |CANCL| OK
```
Figure 7

▓OK▓

```
▓▓▓95.00% Confidence interval▓▓▓
Critical T=±2.09
   μ min =11.76
   μ max =12.04



          | HELP |GRAPH|CANCL| OK
```
Figure 8

▓GRAPH▓

```
                   0
      -2.09 +Crit. T+ 2.09
   11.76 + 95.00% CI + 12.04
            11.90
          | HELP | TEXT |CANCL| OK
```
Figure 9

▓OK▓

```
RAD XYZ HEX R= 'X'
{HOME}
5:
4:
3:
2: Critical T:{-2.09 2.▶
1: Interval:{11.76 12.0▶
EDIT |VIEW | RCL |STO▶|PURGE|CLEAR
```
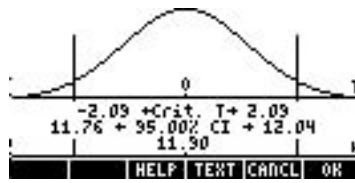Figure 10

Answer: The 95% confidence interval is the range of 11.76 to 12.04. This means there is a 95% confidence that the population mean falls within this range. If the boxes are to have 12 ounces in them, it would be in this range. There does not appear, based on this data, that there is a problem with the equipment.

Example 3:   A sample of 50 voters was taken and they were asked if they supported the incumbent representative. The percentage indicating support was 46%, which was 23 voters of the original sample. What is the 95% confidence interval for the population percentage supporting the incumbent? At this time, does it appear the incumbent would lose the election?

Solution: The third confidence interval is used for means from proportions.

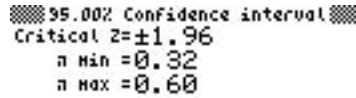→ STAT 6 ENTER 3 ENTER 2 3 ENTER 5 0 ENTER 0 • 9 5 ENTER

```
▓▓▓▓▓▓▓ CONF. INT.: 1 P ▓▓▓▓▓▓
x:▓23.00▓▓▓▓▓▓▓▓▓▓▓▓▓▓
n:50.00
c:0.95

Sample success count
 EDIT |   | HELP |   |CANCL| OK
```
Figure 11

▓▓OK▓▓

```
▓▓▓ 95.00% Confidence interval ▓▓▓
Critical Z=±1.96
     π min =0.32
     π max =0.60


        | HELP |GRAPH|CANCL| OK
```
Figure 12

▓▓GRAPH▓▓

```
        -1.96 ← Crit. Z → 1.96
        0.32 ← 95.00% CI → 0.60
                   0.46
        | HELP | TEXT |CANCL| OK
```
Figure 13

▓▓OK▓▓

```
RAD XYZ HEX R= 'X'
{HOME}
5:
4:
3:
2: Critical Z:{-1.96 1.▶
1:  Interval:{0.32 0.60}
EDIT |VIEW | RCL |STO▶|PURGE|CLEAR
```
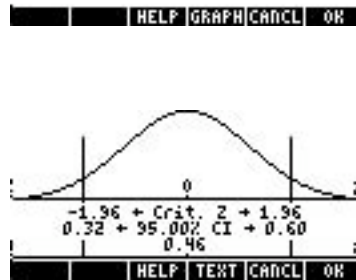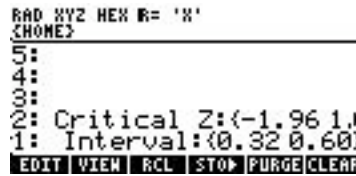Figure 14

Answer: The 95% confidence interval is the range of 0.32 to 0.60. This means there is a 95% confidence that the population mean percentage falls within this range. If all of the voters were polled, the incumbent representative would receive between 32% and 60% of the vote. It is not possible at this time to claim that the incumbent would lose. Note that this is a very large range. To narrow the confidence interval, more voters should be sampled.

Example 4:   A sample of 500 voters was taken and they were asked if they supported the incumbent representative. The percentage indicating support was 47%, which was 235 voters of the original sample. What is the 98% confidence interval for the population percentage supporting the incumbent? At this time, does it appear the incumbent would lose the election?

Solution: The third confidence interval is used for means from proportions.

[→] _STAT_ (6) (ENTER) (3) (ENTER) (2)(3)(5) (ENTER) (5)(0)(0) (ENTER) (0)(·)(9)(8) (ENTER)

```
▓▓▓▓▓▓▓ CONF. INT.: 1 P ▓▓▓▓▓▓
x:▓235.00▓▓▓▓▓▓▓▓▓▓▓▓
n:500.00
c:0.98

Sample success count
 EDIT |   | HELP |   |CANCL| OK
```
Figure 15

▓▓OK▓▓

```
▓▓▓98.00% Confidence interval▓▓▓
Critical Z=±2.33
      π Min =0.42
      π Max =0.52


           |HELP|GRAPH|CANCL| OK |
```

Figure 16

GRAPH

```


           |HELP|TEXT|CANCL| OK |
     -2.33 ← Crit. Z → 2.33
     0.42 ← 98.00% CI → 0.52
              0.47
```
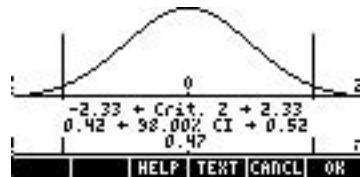
Figure 17

OK

```
RAD XYZ HEX R= 'X'
{HOME}
5:
4:
3:
2: Critical Z:{-2.33 2.▶
1:  Interval:{0.42 0.52}
EDIT|VIEW| RCL |STO▶|PURGE|CLEAR
```

Figure 18

Answer: The 98% confidence interval is the range of 0.42 to 0.52. This means there is a 98% confidence that the population
mean percentage falls within this range. If all of the voters were polled, the incumbent representative would receive
between 42% and 52% of the vote. It is not possible at this time to claim that the incumbent would lose. With the
larger sample in this problem, the range is much narrower. An even larger sample would allow for a better estimation
of the population mean.