AP Statistics

Example: Confidence Intervals for One Proportion

In January 2007, Consumer Reports conducted a study of bacteria in frozen chicken sold in the US. They purchased a random selection of 525 packages of frozen chicken of various brands from different food stores in 23 different states. They tested them for various types of bacteria that cause food-borne illnesses. They found that 83% were infected with Campylobacter and 15% were infected with Salmonella.

Construct a 95% Confidence Interval for the proportion of chickens infected with Campylobacter.

Given:

« $= \hat{p} = 0.83, \quad n = 525$

BY HAND, USING THE FORMULA

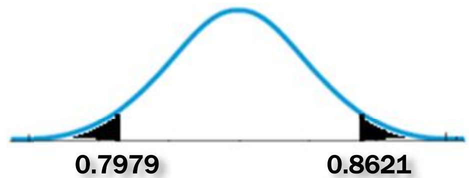
$$\hat{p} \pm z^*\left(\sqrt{\frac{\hat{p}\hat{q}}{n}}\right)$$

$$= 0.83 \pm (1.96)\left(\sqrt{\frac{(.83)(.17)}{525}}\right)$$

$$= (0.7979,\ 0.8621)$$

$$z^* = invNorm(0.975, 0, 1)$$

$$= 1.96$$



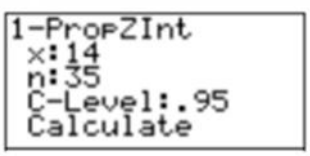
Based on our sample, We are 95% confident that all frozen chicken sold in the US infected with Campylobacter lies between 79.79% and 86.21% .

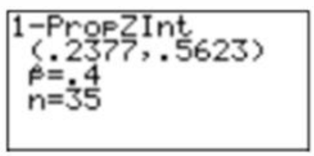
Example: Confidence Intervals for One Proportion

For $x = 14$, $n = 35$ construct a 95% confidence interval for p, the true population proportion.

USING THE TI-CALCULATOR

Solution:
Select [**A:1–PropZInt…**] and enter the information above, highlight [**Calculate**] press **ENTER** to get the results shown in the screen.



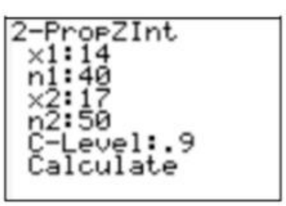


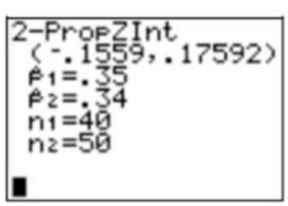
Example: Confidence Intervals for Difference in Two Proportions

Find a 90% confidence interval for the difference in population proportions where $x_1 = 14$, $n_1 = 40$, $x_2 = 17$, and $n_2 = 50$.

USING THE TI-CALCULATOR

Solution:
Select [**B:2–PropZInt…**] and enter the information above, highlight [**Calculate**] press **ENTER** to get the results shown below.



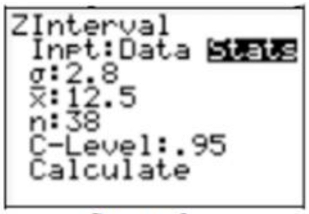


Example: Confidence Intervals for One Population Mean (Given Summary Stats)

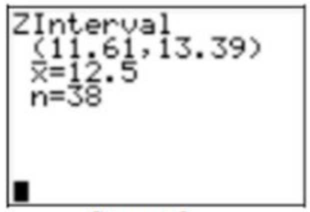
A sample of 38 items is chosen from a normally distributed population with a sample mean of 12.5 and a population standard deviation of 2.8. Construct a 95% confidence interval for the true population mean.

USING THE TI-CALCULATOR

Solution:
Choose [**7:Z-interval**] since we are using a z-distribution. Enter the information as shown in screen 1 below, highlight [**Calculate**] and press **ENTER** to get screen 2.



Screen 1



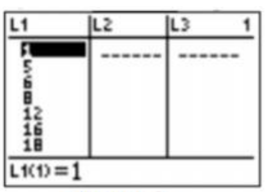
Screen 2

Example: Confidence Intervals for One Population Mean (Given the Data)

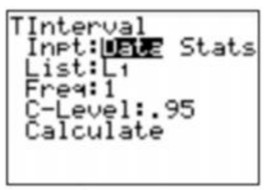
A sample of 7 items is chosen from a normal distribution with the following results: {1, 5, 6, 8, 12, 16, 18}. Construct a 95% confidence interval for the true population mean.

USING THE TI-CALCULATOR

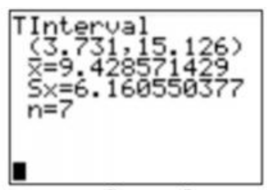
Solution:
Here we are given the actual data from the sample. We can have the calculator do all of the work on the sample by entering the data into a list, say **L1** as shown in screen 3. Choose [**8:TInterval…**] and enter the information as shown in screen 4, highlight [**Calculate**] press **ENTER** to get the results shown in screen 5.



Screen 3



Screen 4



Screen 5

Example: Confidence Intervals for the Difference in Two Population Means

Find a 95% confidence interval for the difference in means for two normally distributed populations from the sample information given.

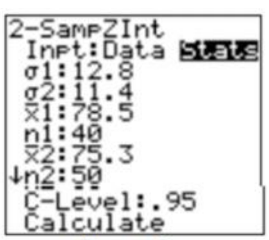
$\bar{x}_1 = 78.5$ $\quad$ $\bar{x}_2 = 75.3$

$\sigma_1 = 12.8$ $\quad$ $\sigma_2 = 11.4$

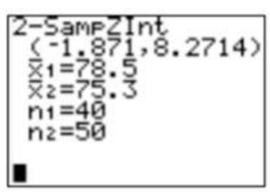
$n_1 = 40$ $\quad$ $n_2 = 50$

USING THE TI-CALCULATOR

Solution:
Select [**9:2–SampZInt…**] and enter the information shown in screen 8, highlight [**Calculate**] press **ENTER** to get the results shown in screen 9.



Screen 8



Screen 9

HYPOTHESIS TEST OF MEAN FOR NORMAL DISTRIBUTION (SIGMA, σ IS KNOWN) - ONE SAMPLE

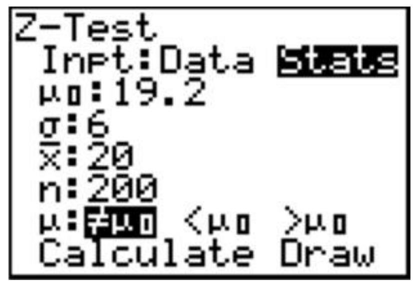
Example: A sample of size 200 has a mean of 20. Assume the population standard deviation is 6. Use the TI-83/84 calculator to test the hypothesis that the population mean is not different from 19.2 with a level of significance of $\alpha = 5\%$.

Solution:

"The population mean is not different from 19.2" means the same as "the population mean is equal to 19.2." Therefore, the null and alternate hypotheses are H_0: $\mu = 19.2$ and H_a: $\mu \neq 19.2$, respectively. Follow the steps below to solve the problem using the TI-83/84.
[**NOTE:** If the p-value < α, reject the null hypothesis; otherwise, do not reject the null hypothesis.]

Press **STAT** and the right arrow twice to select **TESTS**.

To select the highlighted **1:Z-Test…,** Press **ENTER**.

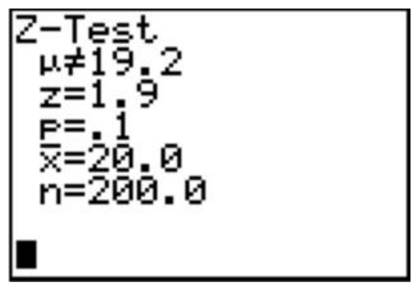


Use right arrow to select **Stats** (summary values rather than raw data) and Press **ENTER**.

Use the down arrow to enter the hypothesized mean, population standard deviation, sample mean, and sample size.

Select alternate hypothesis.

Press down arrow to select **Calculate** and press **ENTER**.



Results:

Since the p-value is 0.1, do not reject the null hypothesis with an α(alpha) value of 0.10 or smaller (10% level of significance or smaller).
[In this example, $\alpha = 0.05$.]

HYPOTHESIS TEST OF MEAN FOR NORMAL DISTRIBUTION (SIGMA, σ IS KNOWN) - TWO SAMPLES

Example: Two samples were taken, one from each of two populations. Use the TI-83/84 calculator to test the hypothesis that the two population means are not different with a level of significance of $\alpha = 5\%$.

Solution:

For the two samples, we have the following summary data:

$n_1 = 38$, $\bar{x}_1 = 19.5$, $\sigma_1 = 5$

$n_2 = 35$, $\bar{x}_2 = 22.875$, $\sigma_2 = 7$

H_0: $\mu_1 = \mu_2$
H_a: $\mu_1 \neq \mu_2$
Use $\alpha = 5\%$

"The two population means are not different" means the same as "the two population means are equal." Therefore, the null and alternate hypotheses are H_0: $\mu_1 = \mu_2$ and H_a: $\mu_1 \neq \mu_2$, respectively. Follow the steps below to solve the problem using the TI-83/84.

Press **STAT** and the right arrow twice to select **TESTS**.

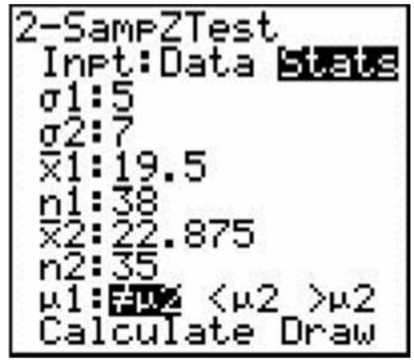
Use the down arrow to select **3:2-SampZTest**…, then press **ENTER**.

Use right arrow to select **Stats** (summary values rather than raw data).

Enter standard deviations, mean and sample size for samples 1 and 2.

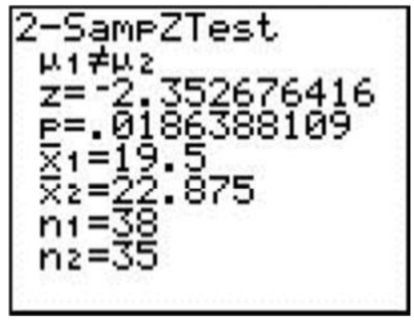
Select alternate hypothesis.

Press down arrow to select **Calculate** and press **ENTER**.



Results:
Since the p-value is 0.0186, reject the null hypothesis with an alpha value of 0.05 or larger (5% level of significance or larger).

Conclude that the two population means are not different.



HYPOTHESIS TEST OF PROPORTION FOR NORMAL DISTRIBUTION - ONE SAMPLE

Example: In sampling 200 people, we found that 30% of them favored a certain candy. Use α = 10% to test the hypothesis that the proportion of people who favored that candy is less than 35%.

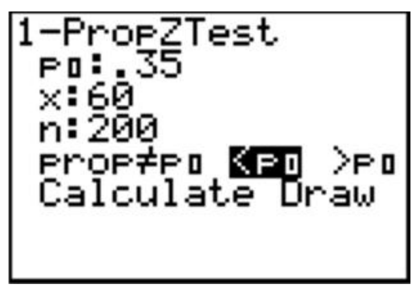
Solution:
This represents a one-sample test of proportion. So we use the **"1-PropZTest"** function. The sample proportion is 30% or p = 0.30, and the hypotheses are H_0: $p \geq 0.35$ and H_a: $p < 0.35$ (claim). Hypothesized value is 0.35.

Press **STAT** and the right arrow twice to select **TESTS**.

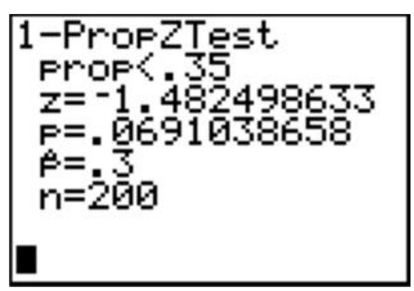
Use the down arrow to select **5:1-PropZTest…,** then press **ENTER**.

Enter hypothesized proportion, number of favorable outcomes, x, sample size, n, and select the alternate hypothesis.

Use down arrow to select **Calculate** and press **ENTER**.



Results:
Since the p = 0.069 is less than α = 0.10, reject the null hypothesis. Conclude that the sample proportion of 0.30 is significantly less than the hypothesized proportion of 0.35.



HYPOTHESIS TEST OF PROPORTION FOR NORMAL DISTRIBUTION - TWO SAMPLES

Example: In sampling 200 freshman college students (Sample 1), we found that 61 of them earned an A in statistics. A sample of 250 sophomore college students (Sample 2) had 60 people who earned an A in statistics. Test the hypothesis that the proportion of freshmen that earned an A in statistics is greater than the proportion of sophomores that earned an A in statistics.

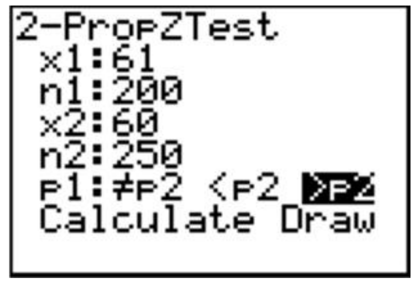
Solution:
This represents a two-sample test of proportion. We use the **"2-PropZTest"** function. The hypotheses are H_0: $p_1 \leq p_2$ and H_a: $p_1 > p_2$ (claim)

Press **STAT** and the right arrow twice to select **TESTS**.

Use the down arrow to select **6:2-PropZTest…,** then press **ENTER.**

Enter number of favorable outcomes and sample size of samples 1 and 2. Select the alternate hypothesis.

Use down arrow to select Calculate and press **ENTER.**



Results:
Since the p = 0.061, reject the null hypothesis for values of ~=> 0.061. Conclude that the sample 1 proportion of 0.305 is significantly greater than sample 2 proportion of 0.24 when ~ > 0.061.