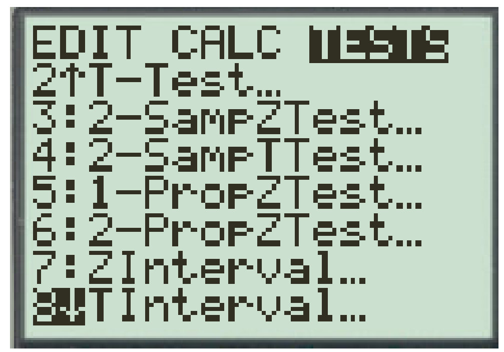
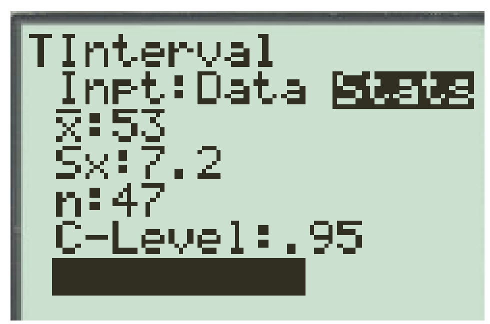
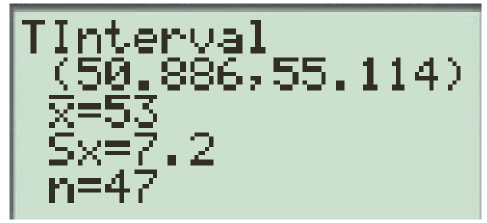
1. **To estimate the mean daily driving distance by the people in a region, a simple random sample of 47 people is taken and for these 47, the mean mileage is $\overline{x} = 53$ miles and the standard deviation $s = 7.2$ miles. Develop a 95% confidence interval for the mean daily driving distance of all the people in this region.**

When we are developping a confidence interval for the mean μ of the population,
we use the t-procedure (this procedure assumes that the population is a normal population)







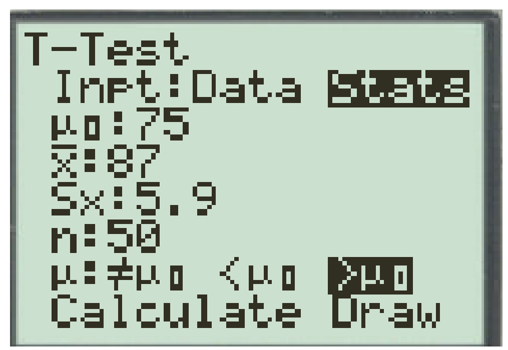
We are 95% confident that the mean daily mileage by all the people is in this interval.

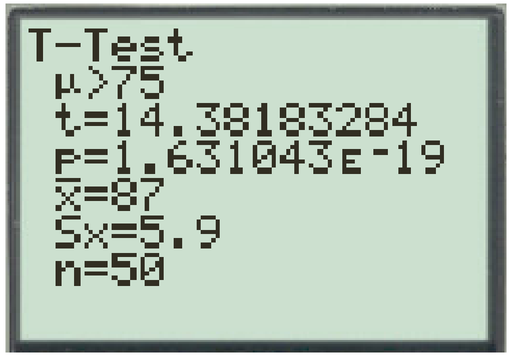
Example 2:

John (hypertensive) would like to have his mean diastolic boold pressure at 75 mmHg by deit, exercise, and medication.

$$\mathbf{H}_o:\ \boldsymbol{\mu} = \mathbf{75}$$
$$\mathbf{H}_A:\ \boldsymbol{\mu} > \mathbf{75}$$

In randomly taken 50 measurements, the diastolic blood pressure for John shows $\overline{X} = 87$ **mmHg and** $s = 5.9$ **mmHg.**





The P_value is 0.000000000000000000163
very small P_value, reject the null, there is a good evidence that
John's diastolic blood pressure is higher than 75 mmHg

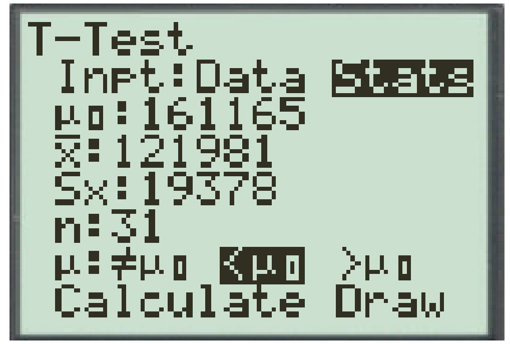
Example:

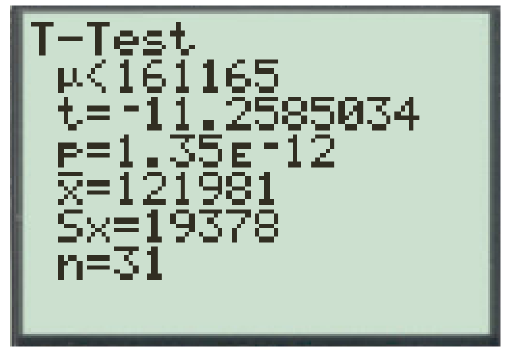
A business writes on a loan application that the mean monthly profit of this business has been $161,165.

$H_o : \mu = 161165$

$\mathbf{H}_A\mathbf{:}\ \boldsymbol{\mu} < \mathbf{161165}$

The bank takes a simple random sample of 31
months from past data and finds (inflation adjusted) that
$\overline{x} = \$121981$ **and** $s = \$19,378$
Test the above hypotheses at 1% level of significance.





P_value is smaller than 0.01 (1% level)
reject the null hypothesis.

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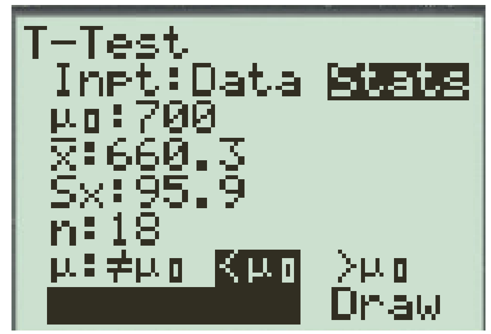
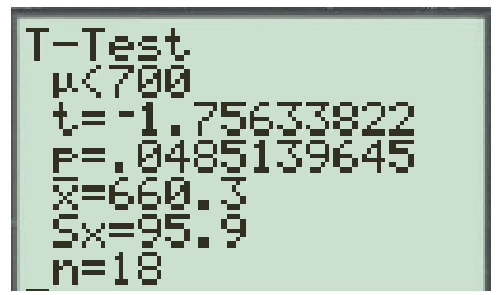
$\mathbf{H}_o$: $\mu = 700$
$\mathbf{H}_A$: $\mu < 700$





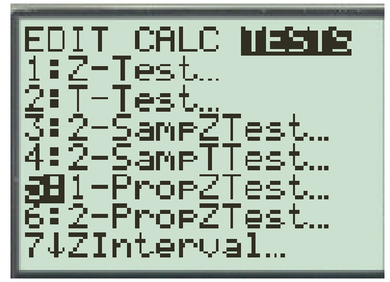
P_value 0.04851 $<$ 0.05

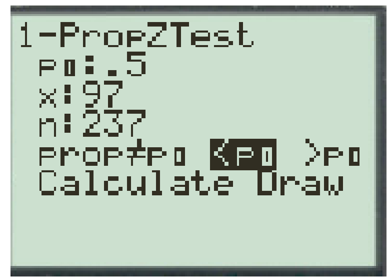
There is a good evidence at 5% level of significance that the mean credit rating in this population is less than 700.
Example 5 is talking about a region, in which, any medical tests to determine the gender of the fetus is illegal

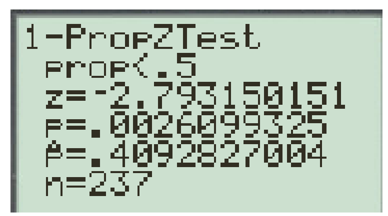
Example 5: A maternity clinic is charged with assisting in the abortion of female fetus.
In a randomly selected observations of 237 births at that clinic, 97 were females.
At 1% level of significance, is there a good evidence to conclude that the proportion of female births at this clinic is less than 0.50

$$\mathbf{H}_o\mathbf{:\ p = 0.50}$$

$\mathbf{H}_A\mathbf{: p < 0.50}$







The P_value is less than 0.01
Reject the null hypothesis

Example 6:

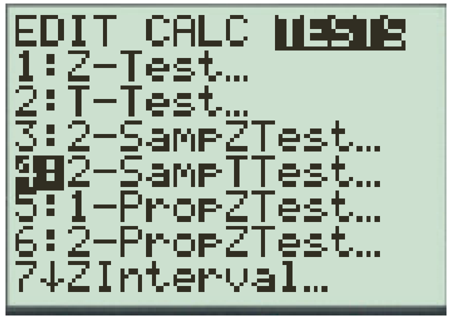
To determine if people stay longer in a mall with movie theaters as compared to a similar (area and options) mall without movie theatres, two independent samples have shown the following

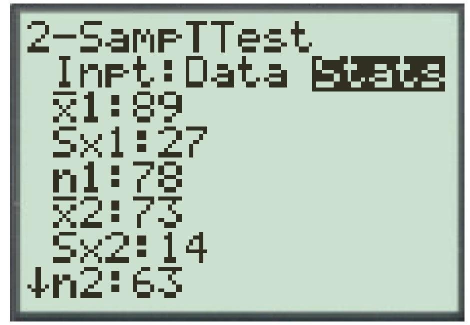
	mean	standard deviation	Number of people in the samples
With theatres	89 minutes	27 minutes	78
Without theatres	73	14 minutes	63

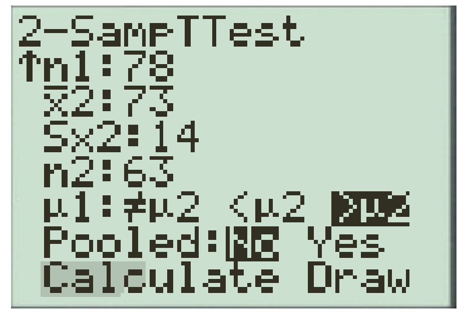
Do the above data show a good evidence at 1% level of significance that people stay longer in the malls with theatres.

$H_o : \mu_1 = \mu_2$

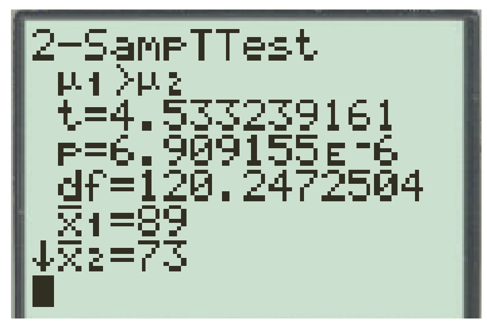
$\mathbf{H}_A: \boldsymbol{\mu}_1 > \boldsymbol{\mu}_2$







In this course, we are not using the pooled tests (that assumes equal population standard deviations for the two populations)



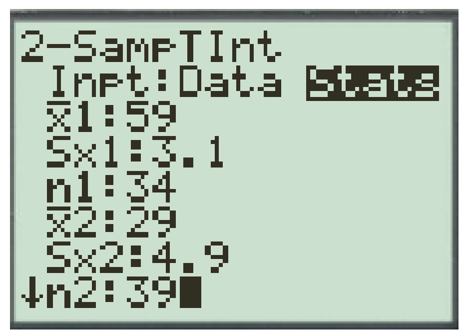
P_value is 6.9×10^{-6}**, which is very small**
Reject the null $\mu_1 = \mu_2$
have a good evidence for $\mu_1 > \mu_2$

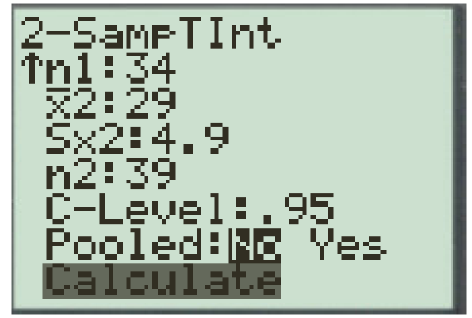
Example 7:

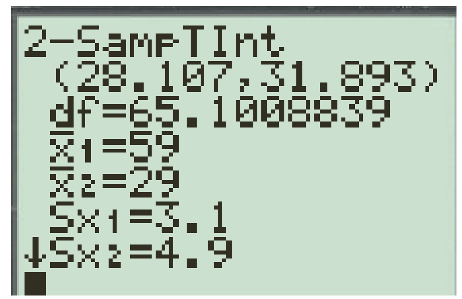
To estimate the difference in mileage between a hybrid car and a comparable traditional car, randomly sampled trips with full tanks showed the following results

	mileage	**standard deviation**	**sample size**
Hybrid	**59 mpg**	**3.1 mpg**	**34**
Traditional	**29 mpg**	**4.9 mpg**	**39**

Develop a 95% confidence interval for the difference between the mean of mileage for hybrid and a comparable traditional







A 95% confidence interval for $\mu_1 - \mu_2$ **is** $(28.107, 31.893)$

Example 8:

A treatment is developped to keep the flowers looking fresh for longer

The treatment solution will be mixed in the water in the vase the flower has to be kept

To estimate the difference between the mean number of days that the flowers receiving this treatment stay fresh as compared to the flowers not receiving this treatment, 63 flowers were divided randomly in two groups, one will be placed with treatment and the other without treatment under

similar environment

We placed 31 of them without treatment (control) and 32 with treatment

Had one person (P) look at these flowers each day, and determine whether the flower looks fresh or does not

Here are the data summary of the number of days such flowers looked fresh

	Mean $\overline{X}$	**Standard Deviation S**	**Sample Size**
Treatment Group (group1)	**7.9 days**	**1.5 days**	**32**
Control Group (group2)	**3.4 days**	**1.9 days**	**31**

The estimate for the difference in mean number of days that the flowers look fresh
in the observation of the person P is $7.9 - 3.4 = 4.5$ days

To estimate the margin of error of the difference between the "mean number of days of fresh looking" for the entire population of flowers

Remember that the margin of error depends on confidence level

when we are dealing with two independent samples, the margin of error
will be determined according to

$t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ **with** $n_1 + n_2 - 2$ **degrees of freedom**

For this case, if we are using a confidence level of 95% then

the degrees of freedom $32 + 31 - 2 = 61$

61 is not in the table but if we look at 60

$$\begin{array}{ccc} & & \mathbf{95\%} \\ & & \downarrow \\ \mathbf{60} & \rightarrow & \mathbf{2} \end{array}$$

$\mathbf{t^* = 2}$

The margin of error is

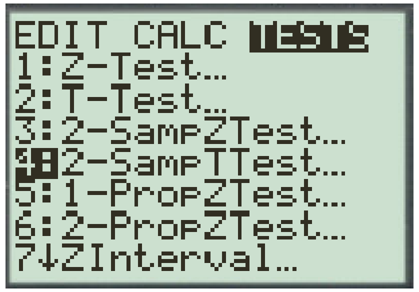
$$2\sqrt{\frac{1.5^2}{32}+\frac{1.9^2}{31}} = 0.86 \text{ days}$$

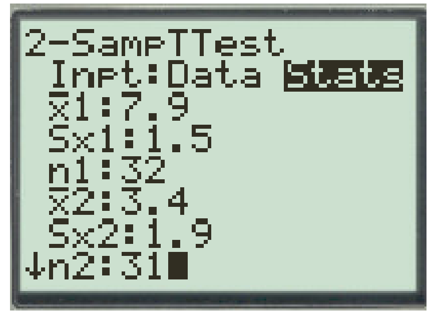
a 95% confidence interval is

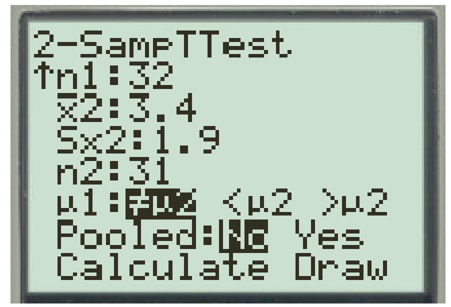
$$(4.5-.86, 4.5+.86)=(3.64, 5.36)$$

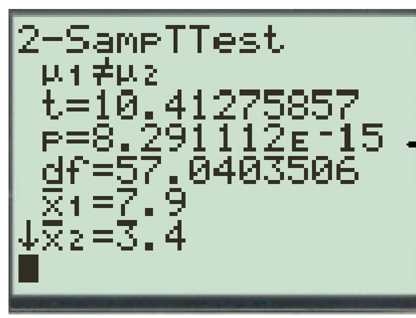
using a TI83 plus
Testing

$$\mathbf{H}_o\colon\ \boldsymbol{\mu}_1 = \boldsymbol{\mu}_2$$
$$\mathbf{H}_A\colon\ \boldsymbol{\mu}_1 \neq \boldsymbol{\mu}_2$$





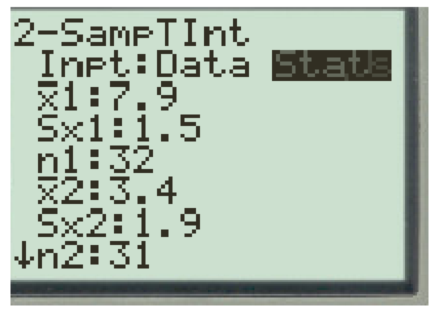


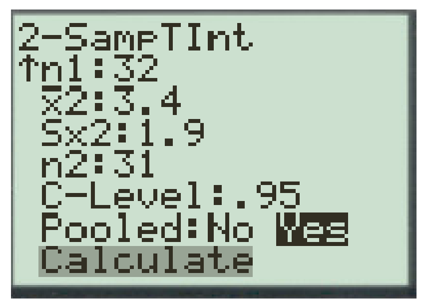


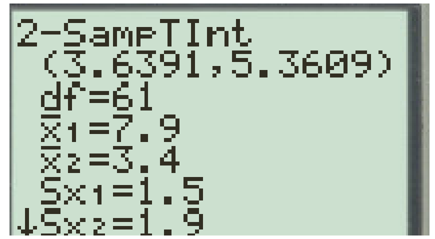
P_value
0.0000000000000083

P_value is extremely small
Favors the alternative

For a 95% confidence interval







Example 10:

32 out of 1677 patients in a treatment group suffered from congestive heart failure as compared to 7 out 1600 in a control group. At 1% level of significance, does this indicate that the proportion of patients with congestive heart failure is higher in the treatment group as compared to the proportion of such patients in the control group?

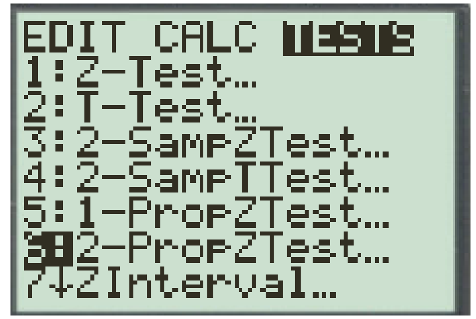
#**1**: **Treatment Group**

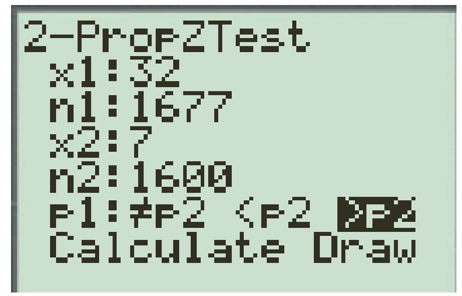
#**2**: **Control Group**

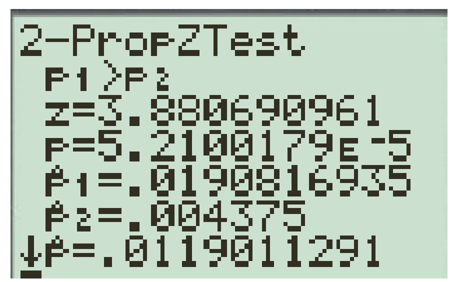
Comparing two population proportions

$\mathbf{H}_o\!: \mathbf{p}_1 = \mathbf{p}_2$

$\mathbf{H}_A\!: \mathbf{p}_1 > \mathbf{p}_2$







P_value is $5.21 \times 10^{-5} = 0.0000521 <.01$
much smaller than 0.01
do see a significant indication of higher "such" proportion

in the treatment as compared to the control group

Example11

A slacks manufacturer is deciding whether to purchase a new method for bonding seams together. Before purchasing a new method that bonds, or glues, the seams together, the manufacturer wishes to determine whether or not the "bonded" seams can withstand more pulling stress than standard seams sewn with thread. The creator of the new method provides a demonstration machine and supplies for the slacks maker to test. Two samples of the slacks produced are taken. Each pair of slacks has the seams tested in an application of force to determine the breaking point (in lbs.) for the seam. The sample results are:

Sample 1: Sewn	Sample 2: Glued
$n_1 = 50$ $\bar{x}_1 = 125$ lbs. $s_1 = 46$ lbs.	$n_2 = 50$ $\bar{x}_2 = 165$ lbs. $s_2 = 57$ lbs.

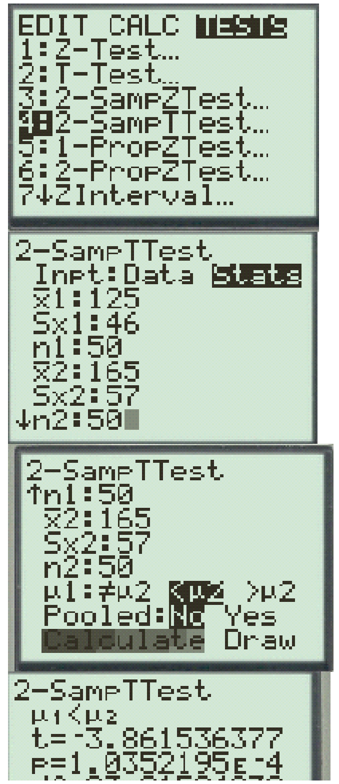
At the 0.05 level of significance, is the gluing of seams better than sewing? State the null and alternative hypothesis, the test statistic, and a reason for your conclusion?

Solution:

Solution:

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 < \mu_2$



We use the two sample z or t procedure for independent samples

Example 12:

Anorexia nervosa is a serious eating disorder, particularly among young women. The following data provides the weights, in pounds, of 17 anorexic young women before and after receiving a family therapy treatment for anorexia nervosa.

Before	After
83.3	94.3
86	91.5
82.5	91.9
86.7	100.3
79.6	76.7
87.3	98
76.9	76.8
94.2	101.6
73.4	94.9
80.5	75.2
81.6	77.8
83.8	95.2
82.1	95.5
77.6	90.7
83.5	92.5
89.9	93.8
86	91.7

Does the family therapy appear to be effective helping anorexic young women gain weight? Perform the appropriate hypothesis test at 5% significance level.

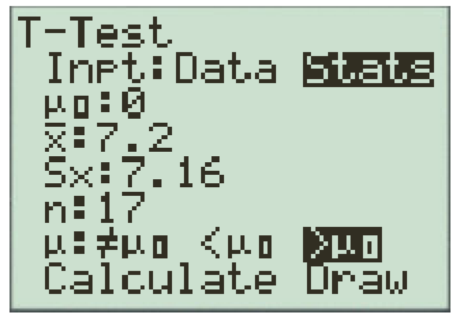
You may use the appropriate numbers from the following summary statistics.

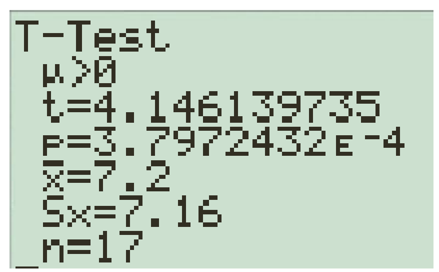
Variable	N	Mean	Median	TrMean	StDev	SE Mean
Before	17	83.23	83.30	83.15	5.02	1.22
After	17	90.49	92.50	90.77	8.48	2.06
After-Before	17	7.26	9.00	7.15	7.16	1.74

$$H_o : \mu_{after} - \mu_{before} = 0$$

$$H_A : \mu_{after} - \mu_{before} > 0$$

$$t = \frac{7.26 - 0}{\left(\frac{7.16}{\sqrt{17}}\right)} \rightarrow t \cong 4.18$$





Reject the null hypothesis.

The family therapy appears to be effective helping anorexic young women gain weight.