

2018, Question 6abcd

Systolic blood pressure is the amount of pressure that blood exerts on blood vessels while the heart is beating. The mean systolic blood pressure for people in the United States is reported to be 122 millimeters of mercury (mmHg) with a standard deviation of 15 mmHg.

The wellness department of a large corporation is investigating whether the mean systolic blood pressure of its employees is greater than the reported national mean. A random sample of 100 employees will be selected, the systolic blood pressure of each employee in the sample will be measured, and the sample mean will be calculated.

Let μ represent the mean systolic blood pressure of all employees at the corporation.

Consider the following hypotheses:

$$H_o: \mu = 122$$

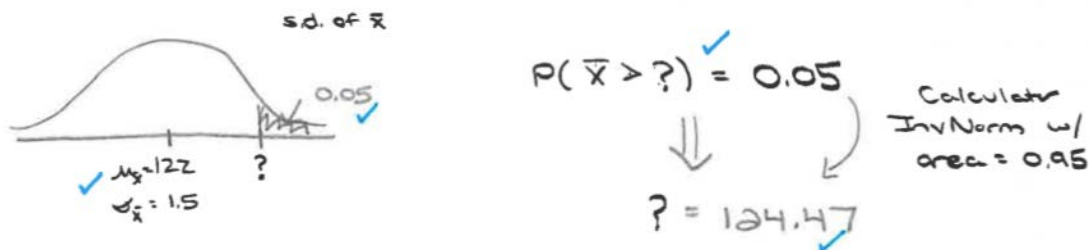
$$H_a: \mu > 122$$

- (a) Describe a Type II error in the context of the hypothesis test.
- (b) Assume that s , the standard deviation of the systolic blood pressure of all employees at the corporation, is 15 mmHg. If $m = 122$, the sampling distribution of \bar{x} for samples of size 100 is approximately normal with a mean of 122 mmHg and a standard deviation of 1.5 mmHg. What values of the sample mean \bar{x} would represent sufficient evidence to reject the null hypothesis at the significance level of $\alpha = 0.05$?

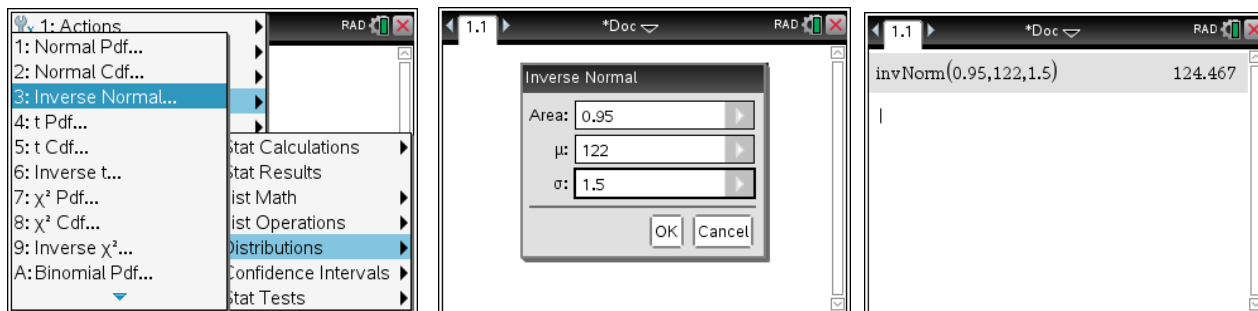
The actual mean systolic blood pressure of all employees at the corporation is 125 mmHg, not the hypothesized value of 122 mmHg, and the standard deviation is 15 mmHg.

- (c) Using the actual mean of 125 mmHg and the results from part (b), determine the probability that the null hypothesis will be rejected.
- (d) What statistical term is used for the probability found in part (c)?

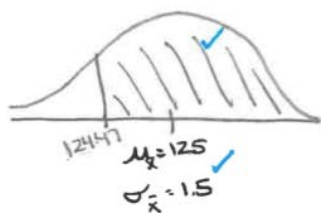
TI-Nspire Screenshots for (b):



Calculator Page > Menu > Statistics > Distributions > Inverse Normal

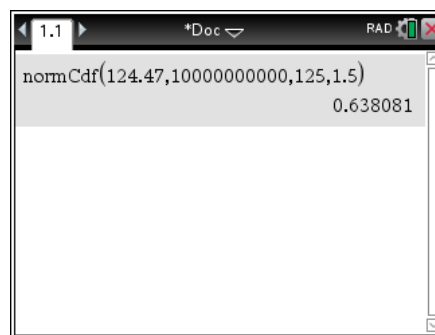
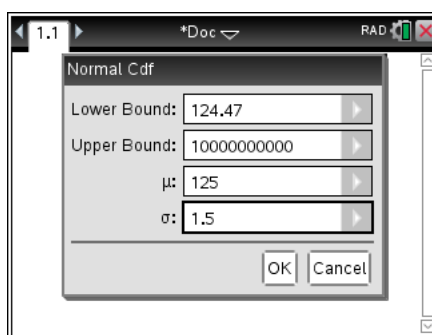
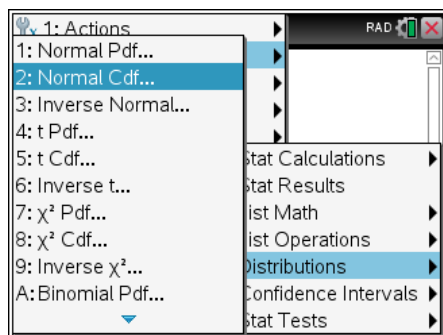


TI-Nspire Screenshots for (c):



$$P(\bar{x} > 124.47) \approx 0.638$$

Calculator Page > Menu > Statistics > Distributions > Normal Cdf



2018, Question 4b

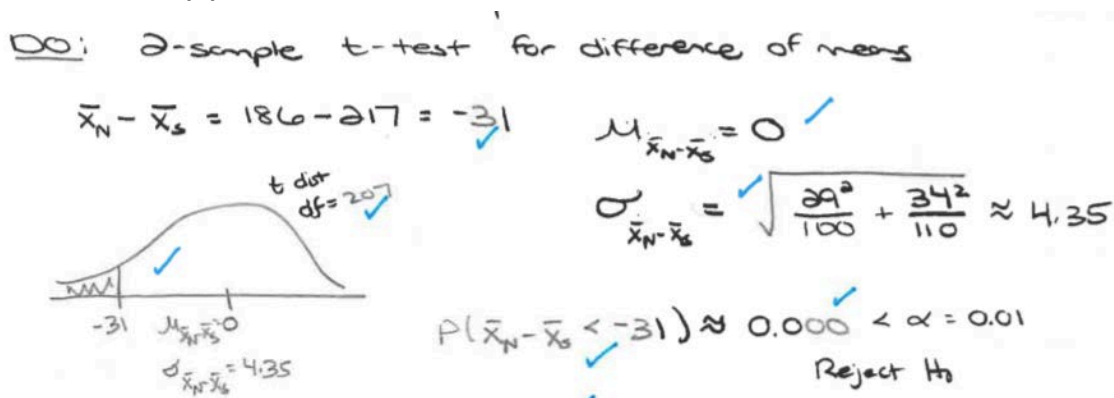
The anterior cruciate ligament (ACL) is one of the ligaments that help stabilize the knee. Surgery is often recommended if the ACL is completely torn, and recovery time from the surgery can be lengthy. A medical center developed a new surgical procedure designed to reduce the average recovery time from the surgery. To test the effectiveness of the new procedure, a study was conducted in which 210 patients needing surgery to repair a torn ACL were randomly assigned to receive either the standard procedure or the new procedure.

(b) Summary statistics on the recovery times from the surgery are shown in the table.

| Type of Procedure | Sample Size | Mean Recovery Time (days) | Standard Deviation Recovery Time (days) |
|-------------------|-------------|---------------------------|---|
| Standard | 110 | 217 | 34 |
| New | 100 | 186 | 29 |

Do the data provide convincing statistical evidence that those who receive the new procedure will have less recovery time from the surgery, on average, than those who receive the standard procedure, for patients similar to those in the study?

TI-Nspire Screenshots for (b):



Calculator Page > Menu > Statistics > Stat Tests > 2-Sample t Test

The screenshots show the following steps:

- Menu Navigation:** The 'Stat Tests' menu is open, and '2-Sample t Test...' is selected.
- 2-Sample t Test Dialog:** The 'Data Input Method' is set to 'Stats'.
- 2-Sample t Test Input Screen:** The following values are entered:
 - \bar{x}_1 : 217, Sx_1 : 34, n_1 : 110
 - \bar{x}_2 : 186, Sx_2 : 29, n_2 : 100
 - Alternate Hyp: $H_a: \mu_1 > \mu_2$
 - Pooled: No
- 2-Sample t Test Results Screen:** The results are displayed:
 - tTest_2Samp 217,34,110,186,29,100,1,0: sta
 - Title: "2-Sample t Test"
 - Alternate Hyp: " $\mu_1 > \mu_2$ "
 - t: 7.12708
 - PVal: 8.35799E-12
 - df: 207.179
 - \bar{x}_1 : 217.
 - \bar{x}_2 : 186.
 - sx_1 : 34.
 - sx_2 : 29.

2017, Question 2ab

The manager of a local fast-food restaurant is concerned about customers who ask for a water cup when placing an order but fill the cup with a soft drink from the beverage fountain instead of filling the cup with water. The manager selected a random sample of 80 customers who asked for a water cup when placing an order and found that 23 of those customers filled the cup with a soft drink from the beverage fountain.

- Construct and interpret a 95 percent confidence interval for the proportion of all customers who, having asked for a water cup when placing an order, will fill the cup with a soft drink from the beverage fountain.
- The manager estimates that each customer who asks for a water cup but fills it with a soft drink costs the restaurant \$0.25. Suppose that in the month of June 3,000 customers ask for a water cup when placing an order. Use the confidence interval constructed in part (a) to give an interval estimate for the cost to the restaurant for the month of June from the customers who ask for a water cup but fill the cup with a soft drink.

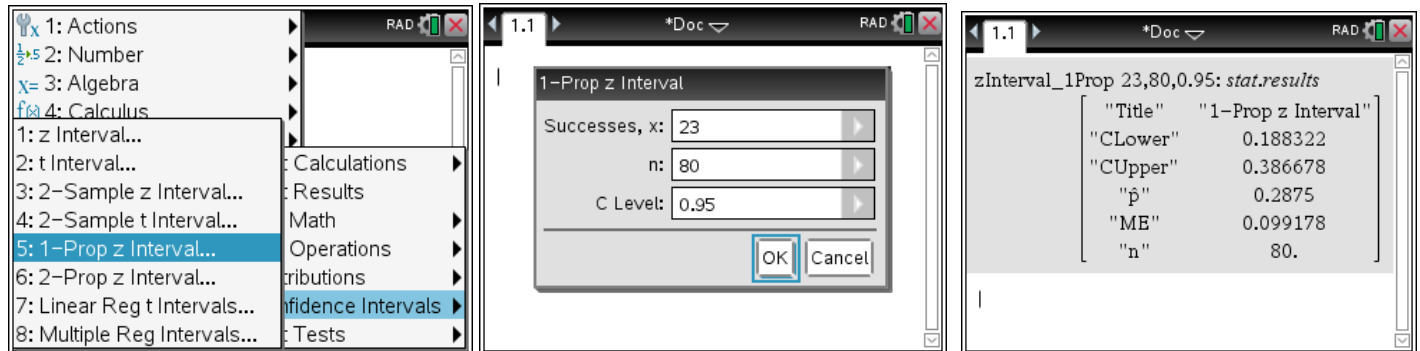
TI-Nspire Screenshots for (a):

$$\frac{23}{80} \pm 1.96 \sqrt{\frac{23/80(1-23/80)}{80}}$$

$$0.2875 \pm 0.099178$$

$$0.1883 \text{ to } 0.3867$$

Calculator Page > Menu > Statistics > Confidence Intervals > 1-Prop z Interval



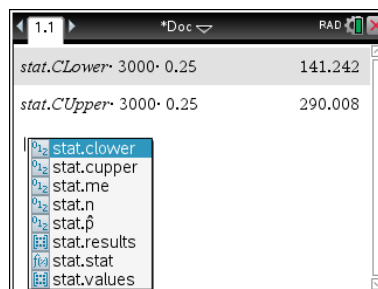
TI-Nspire Screenshots for (b):

$$0.1883 \times 3000 \times 0.25 = \$141.25$$

$$0.3867 \times 3000 \times 0.25 = \$290.01$$

$$\boxed{\$141.25 \text{ to } \$290.01}$$

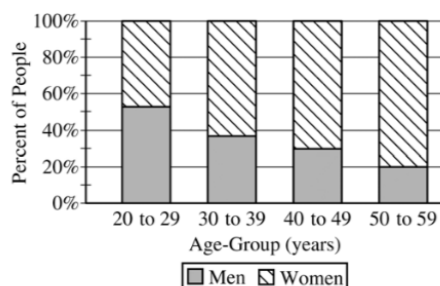
Use VAR to select stat.clower and stat.cupper



2017, Question 5

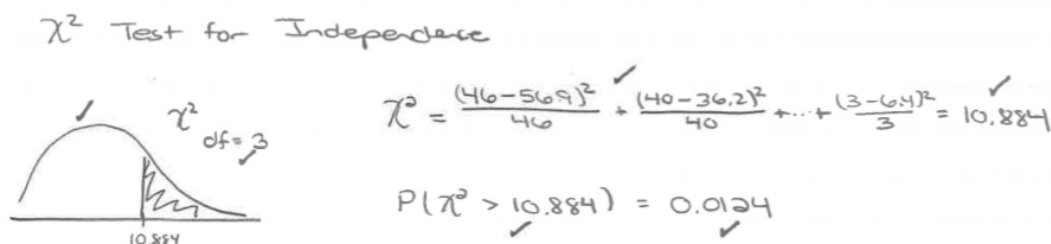
The table and the bar chart below summarize the age at diagnosis, in years, for a random sample of 207 men and women currently being treated for schizophrenia.

| | Age-Group (years) | | | | Total |
|-------|-------------------|----------|----------|----------|-------|
| | 20 to 29 | 30 to 39 | 40 to 49 | 50 to 59 | |
| Women | 46 | 40 | 21 | 12 | 119 |
| Men | 53 | 23 | 9 | 3 | 88 |
| Total | 99 | 63 | 30 | 15 | 207 |

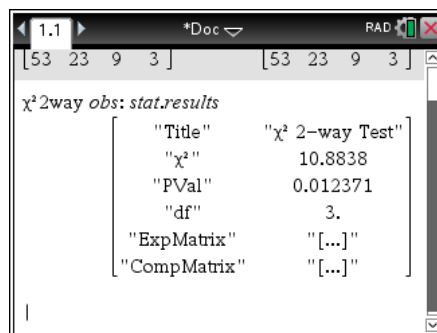
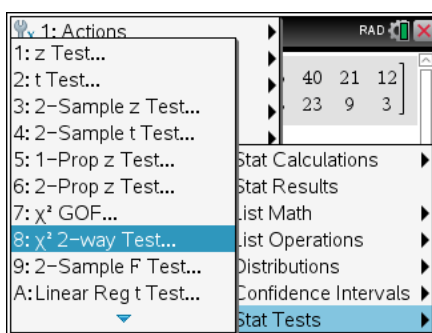
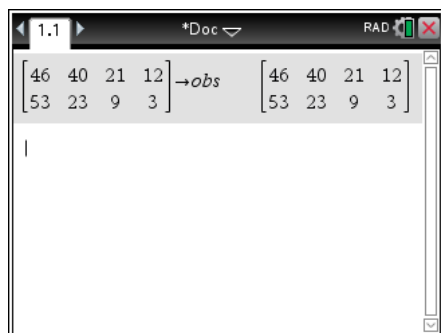


Do the data provide convincing statistical evidence of an association between age-group and gender in the diagnosis of schizophrenia?

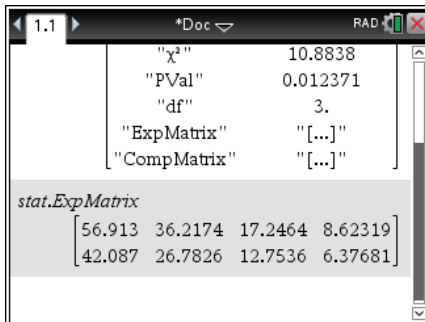
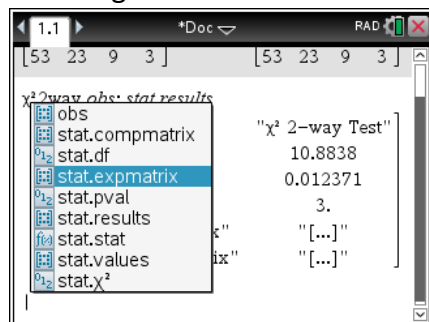
TI-Nspire Screenshots:



Calculator Page: Store Matrix, then Menu > Statistics > Stat Tests > 2-Way Test



Retrieve Expected Matrix using VAR button



2017, Question 3a

A grocery store purchases melons from two distributors, J and K. Distributor J provides melons from organic farms. The distribution of the diameters of the melons from Distributor J is approximately normal with mean 133 millimeters (mm) and standard deviation 5 mm.

- (a) For a melon selected at random from Distributor J, what is the probability that the melon will have a diameter greater than 137 mm?

TI-Nspire Screenshots for (a):



$$P(X > 137) = 0.212$$

Calculator Page > Menu > Statistics > Distributions > Normal Cdf

