Hypothesis Testing
Two Proportions
Two Means

Math 122

In any hypothesis test:

- We define two hypotheses H_0 and H_1 .
- We collect data relevant to the claim.
- We assume H_0 and use this assumption to calculate the probability of seeing data as extreme as our data. This probability is P.
- If P is small, the observations are inconsistent with H_0. We reject H_0 and support H_1.
- If P is large, the observations are consistent with H_0. We do not reject H_0 and do not support H_1.

P-value and formal conclusion

- If **P** $\leq$ **α** then H_0 is not consistent with the observations.
  - Reject H_0 and support H_1.

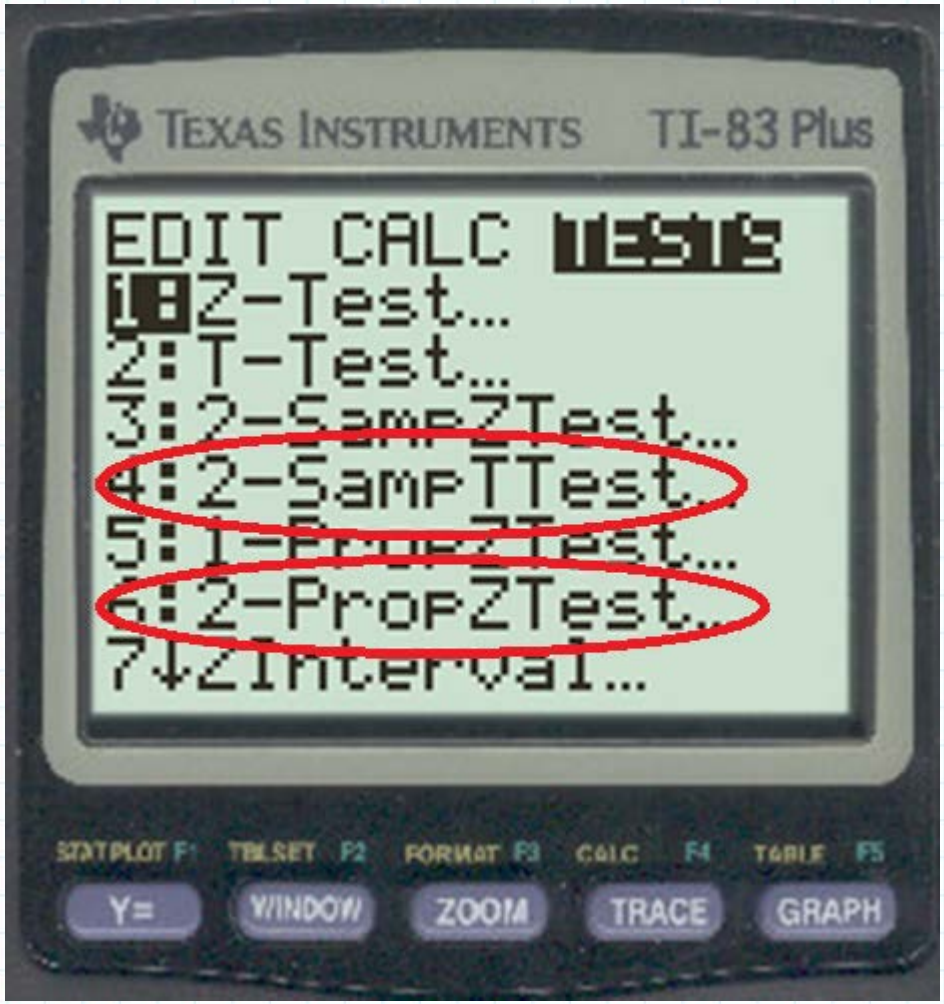
- If **P > α** then H_0 is consistent with the observations.
  - Do not reject H_0 and do not support H_1.

We consider claims about two means or two proportions such as

H_0	H_1
$\mu_1 \leq \mu_2$	$\mu_1 > \mu_2$
$\mu_1 = \mu_2$	$\mu_1 \neq \mu_2$
$\mu_1 \geq \mu_2$	$\mu_1 < \mu_2$

(Mechanically, we actually consider the difference $\mu_1 - \mu_2$ and compare that difference to 0.)

Two Samples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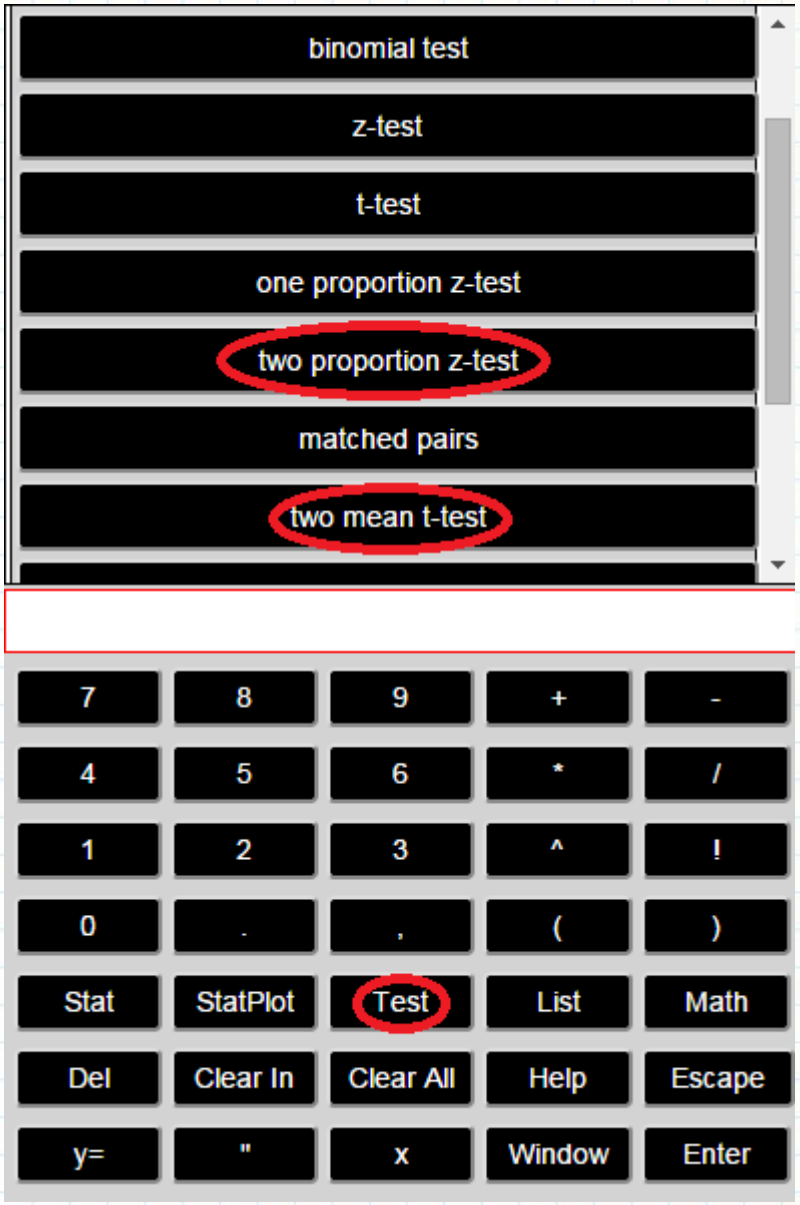
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Two Proportions

Polio Vaccine

- In a famous 1954 experiment to test the effectiveness of the Salk Polio vaccine, 200,000 children were given the vaccine and 200,000 were given a placebo. 33 vaccinated children contracted Polio. 115 non-vaccinated children contracted Polio.

- Test the claim: **The rate of Polio among the vaccinated children is lower than the rate among the non-vaccinated children. Use a significance level of $\alpha = 0.5\%$**

- $p_1 =$
- $p_2 =$
- $n_1 =$
- $n_2 =$
- $x_1 =$
- $x_2 =$
- Claim:
- Opposite:
- H_0:
- H_1:
- P-value=
- Formal Conclusion:
- Conclusion:

H1N1 and Obesity

- In a sample of 268 adult H1N1 patients, 47% were found to be obese.
- In a sample of 700 adults, 34% were found to be obese.

- Test the claim: **The rate of obesity among H1N1 patients is greater than the rate of obesity in the general population.**

- $p_1 =$
- $p_2 =$
- $n_1 =$
- $n_2 =$
- $x_1 =$
- $x_2 =$
- Claim:
- Opposite:
- H_0:
- H_1:
- P-value=
- Formal Conclusion:
- Conclusion:

Two Independent Means

Age and Promotion

- A large company conducted a competition for promotions in which employees were asked to apply for promotion and the “most qualified” applicants received promotions or raises.
- Many of the applicants complained of age discrimination in granting the promotions.
- There were 23 unsuccessful applicants whose average age was 47 with a standard deviation of 7.2.
- There were 30 successful applications whose average age was 43.9 with a standard deviation of 5.9.

Age and Promotion

- Test the claim: **The successful applicants come from a population whose average age is less than the average age of the population from which the unsuccessful applicants come.**

	Number	Mean Age	St. Dev
Unsuccessful	23	47	7.2
Successful	30	43.9	5.9

- $\mu_1 =$
- $\bar{x}_1 =$
- $s_1 =$
- $n_1 =$
- Claim:
- Opposite:
- H_0:
- H_1:
- P-value=
- Formal Conclusion:
- Conclusion:

- $\mu_1 =$
- $\bar{x}_1 =$
- $s_1 =$
- $n_1 =$

Hours of Sleep

On average, male and female students get the same amount of sleep.

- $\mu_1 =$
- $\bar{x}_1 =$
- $s_1 =$
- $n_1 =$
- Claim:
- Opposite:
- H_0:
- H_1:
- P-value=
- Formal Conclusion:
- Conclusion:

- $\mu_1 =$
- $\bar{x}_1 =$
- $s_1 =$
- $n_1 =$