V. Hypothesis Testing on Probability

eg Now we consider the claim that the gender selection increases the likelihood of having a baby girl. Preliminary results from a test of gender selection involved 100 couples who gave birth to 58 girls and 42 boys. Use the given claim and the preliminary results to calculate the test statistic.

tricky

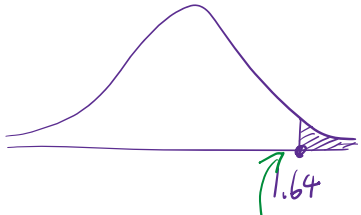
50/50 for gender

S:

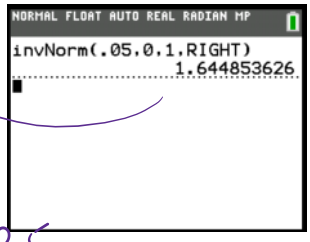
$H_0 : p = 0.5$

$H_1 : p > 0.5$

α = not given = 0.05, with >



p' for our text



$\hat{p} = \frac{58}{58+42} = 0.58$, $p = 0.5$, $q = 1 - p = 1 - 0.5 = 0.5$

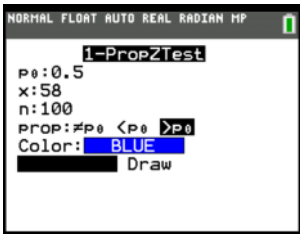
$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} = \frac{0.58 - 0.5}{\sqrt{\frac{0.5 \cdot 0.5}{100}}} = 1.60$$

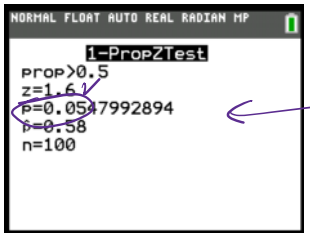
since $z = 1.6 < C.V. = 1.64$,

H_1 fails to reject H_0.

Thus, there is not enough evidence to support the claim that for the gender solution increases the likehood of having a baby girl than a baby boy.

TI-84: stat → TESTS → 5 : 1-PropZ Test ...





(p-value ≈ 0.0548 > α = 0.05)

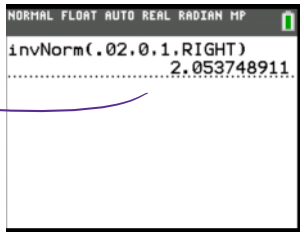
eg In recent years, there has been increasing concern about the health effects of computer terminals. It is known that the miscarriage rate under general conditions is about 20%. A random sample of 650 pregnant women working with a computer 1 to 20 hours per week was taken. For this sample, there were 155 miscarriages. Test the claim that computer terminals detrimentally affect pregnant women with a 0.02 significance level.

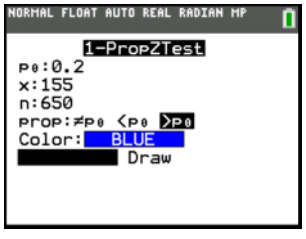
S:

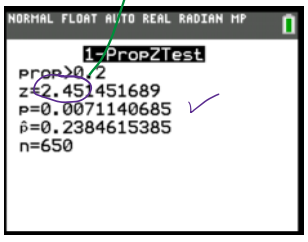
$H_0 : p = 0.2$

$H_1 : p > 0.2$

$x = 155, \quad n = 650, \quad \alpha = 0.02$ with $>$:







Since $Z = 2.45 > C.V. = 2.05$ $(p = 0.007 < \alpha = 0.02)$

H_1 rejects H_0.

Thus, there is enough evidence to support the claim that working at a computer for a long time increases the chance of a miscarriage.

eg Based on information from the National Cyber Security Alliance, 93% of computer owners believe they have antivirus programs installed on their computers. In a random sample of 400 scanned computers, it is found that 380 of them actually have antivirus software programs. Use the sample data from the scanned computers to test the claim that 93% of computers have antivirus software.

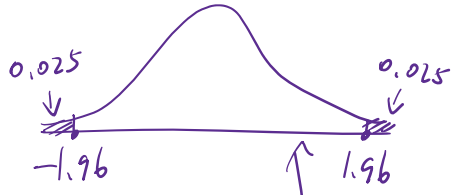
S:

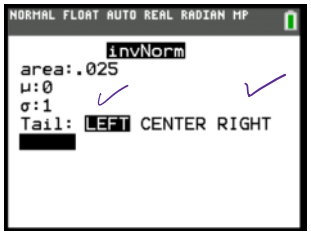
$H_0 : p = 0.93$

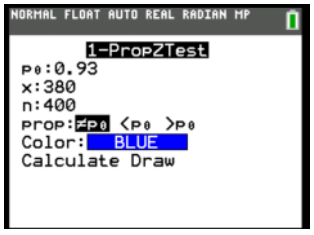
$H_1 : p \neq 0.93$

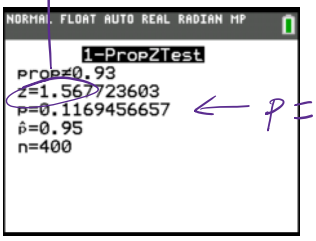
$x = 380, \quad n = 400, \quad \alpha = \text{not given} = 0.05$

with $\neq$, $\frac{\alpha}{2} = \frac{0.05}{2} = 0.025$









$p = 0.12 > \alpha = 0.05$

Since $z \approx 1.57 < C.V. = 1.96$,

H_1 fails to reject H_0.

Therefore, this is not enough evidence to support the claim that this sample ensure 93% of the computer have antivirus software.

Exercise

According to the Mothers Against Drunk Driving (MADD) website, one in three people will be involved in an alcohol related crash. To investigate this issue statistically, a Sociologist randomly sampled 2856 people and discovered that 941 of them had been involved in an alcohol related crash.

$\frac{1}{3}$

or not, so it is $\neq$

Based on the results obtained by the Sociologist, is the proportion mentioned on the MADD website valid at the 5% level of significance?

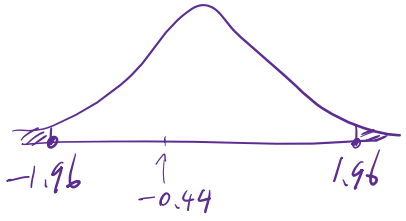
Based on the results obtained by the Sociologist, is the proportion mentioned on the MADD website valid at the 5% level of significance?

S: α

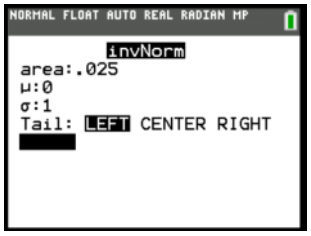
$H_0: p = \frac{1}{3}$

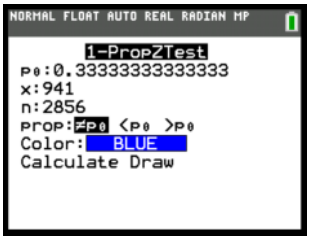
$H_1: p \neq \frac{1}{3}$

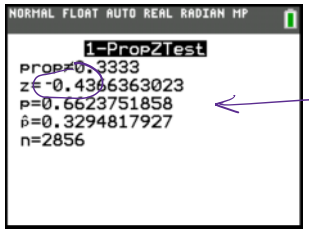
$\alpha = 5\%$ with $\neq$: $\frac{\alpha}{2} = \frac{0.05}{2} = 0.025$



$X = 941, \quad n = 2856$







$P \approx 0.66 > 0.05$

Since $Z \approx -0.44 > C.V. = -1.96$,

H_1 fails to reject H_0.

Thus, it does not have evidence to support the claim that the alcohol related crash stated on the website is valid.

Exercise 2

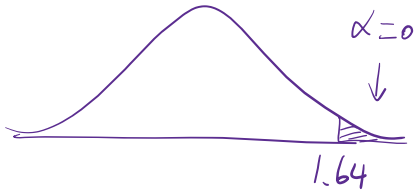
Do the majority of Sierra College Elementary Statistics students rate their ability as a mathematics student as just average? Address this question statistically using the results obtained in the Sierra College Elementary Statistics Student Survey and a 0.05 level of significance.

70% of 45 students. ← 'missing info'

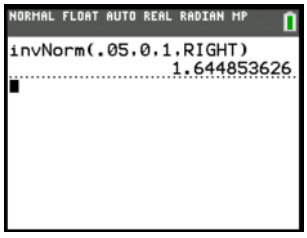
S:

$H_0: p = 0.5$

$H_1: p > 0.5$



$\alpha = 0.05$, with $>$:



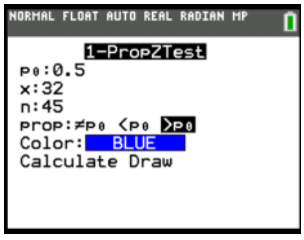
p'

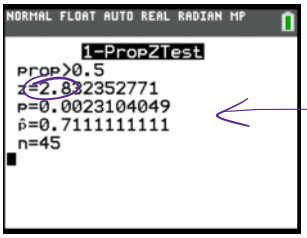
$\hat{p} = 70\%, \quad n = 45$

$\hat{p} = \frac{x}{n} \Rightarrow x = \hat{p} \cdot n$

TI-84 needs whole number

$x = 70\% \cdot 45 = 31.5 \approx 32$





$p \approx 0.00 < \alpha = 0.05$

Since $z \approx 2.83 > C.V. = 1.64$

H_1 rejects H_0.

Therefore, it has enough evidence to support the claim that the majority of students rate their ability as a math student as just average.