Hypothesis Testing on Proportions

In this example, we will perform a left-tailed hypothesis test for a sample with one proportion. We will return to our example of quality control for space fasteners that could be supplied to organizations and companies like NASA, SpaceX and other companies that build satellites and other machines used in space.

Figure 58.4 Possible space fasteners

Figure 58.5 Satellite orbiting over Earth

Problem Setup: A company supplies Standard Hexagon Head Cap Screws. They have recently upgraded their machines and believe that they have decreased the percent of screws deemed as "defective." Historically, they would have 1 out of 125 screws deemed as 'defective.'

Figure 58.6 Military hexagon head cap screws

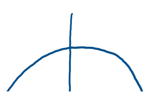
[994 not defective]
- defective

Question: Since replacing their machines, they sampled 1,000 screws and found that 6 were defective. At the 1% level of significance, is there sufficient evidence to that the percent of defective screws has decreased since replacing their machines?

1) Assumptions:

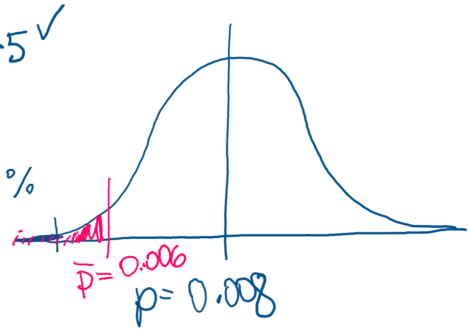
$n\bar{p} = 1000 \times \left(\frac{6}{1000}\right) = 6 > 5$ ✓

$n(1-\bar{p}) = 1000 \times (1-0.006) = 994 \geq 5$ ✓



$np =$

$n(1-\bar{p}) = 1000 \times (1-0.006) = 994 \geq 5$ ✓



2) $H_0 : p = \frac{1}{125} = 0.008$

$H_A : p < \frac{1}{5} = 0.008$

3) $$z_{test} = \frac{\bar{p}-p}{\sqrt{\frac{p(1-p)}{n}}} = \frac{\frac{6}{1000} - 0.008}{\sqrt{\frac{0.008(1-0.008)}{1000}}} = \frac{0.006-0.008}{\sqrt{\frac{0.008(0.992)}{1000}}} = \frac{-0.002}{0.002817}$$

$z_{test} = -0.71$

4) p-value = NORM.S.DIST(−0.71, TRUE)

= 0.2389 = 23.89%

5) Decision: Fail to reject H_0 since p-value > 1% (LOS)

6) Conclusion: There is NOT enough evidence to conclude that the defective rate has decreased.