StatCrunch Lab 10 for Statistics 301

Topics: test of p (p-value and classical approaches), μ and σ

Test For Proportion p.
Of $n = 600$ batteries chosen at random, $\frac{54}{600}$ths $\left(\frac{54}{600} = 0.09\right)$ of them are found to be defective. Does data support hypotheses of an *increase* in defective batteries (from 0.08) at $\alpha = 0.05$ in this case? Solve using both p-value and classical approaches to hypothesis testing.

1. *P-value approach.*

   (a) *Statement.* $H_0 : p = 0.08$ versus $H_1 : p > 0.08$

   (b) *Test.*

   $$\text{p–value} = P(\hat{p} \geq 0.09) = P\left(\frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} \geq \frac{0.09 - 0.08}{\sqrt{\frac{0.08(1-0.08)}{600}}}\right) \approx P\left(Z \geq 0.903\right) \approx 0.18$$

   Stat, Proportions, One sample, with summary, Number of successes: 54, Number of observations: 600, Next, Null: prop. = 0.08 Alternative: > Calculate.
   Level of significance $\alpha = 0.05$

   (c) *Conclusion.*
   Since p–value $= 0.18 > \alpha = 0.05$, do not reject null guess: $H_0 : p = 0.08$.

2. *Classical approach.*

   (a) *Statement.* $H_0 : p = 0.08$ versus $H_1 : p > 0.08$

   (b) *Test.*

   $$z_0 = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} \approx \frac{0.09 - 0.08}{\sqrt{\frac{0.08(1-0.08)}{600}}} \approx 0.903$$

   $$z_\alpha = z_{0.05} \approx 1.645$$

   Stat, Calculators, Normal, Mean: 0, Std. Dev.: 1, Prob(X <= $\boxed{?}$) = 0.95 Calculate.

   (c) *Conclusion.*
   Since $z_0 = 0.903 < z_{0.05} = 1.645$, do not reject null guess: $H_0 : p = 0.08$.

Test For Mean μ

Average hourly wage in US is assumed to be \$10.05 in 1985. Midwest big business, however, claims average hourly wage to be larger than this. A random sample of size $n = 15$ of midwest workers determines average hourly wage $\bar{x} = \$10.83$ and standard deviation in wages $s = 3.25$. Does data support big business's claim at $\alpha = 0.05$? Assume normality.

1. *Statement.* $H_0 : \mu = \$10.05$ versus $H_1 : \mu > \$10.05$

2. *Test.*

   $$\text{p–value} = P(\bar{X} \geq 10.83) = P\left(\frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}} \geq \frac{10.83 - 10.05}{\frac{3.25}{\sqrt{15}}}\right) \approx P\left(t \geq 0.93\right) \approx 0.18$$

   Stat, T Statistics, with summary, Sample mean: 10.83, Sample std. dev.: 3.25, Sample size: 15, Next, Null: mean = 10.05, Alternative: > Calculate.
   Level of significance $\alpha = 0.05$

3. *Conclusion.*
   Since p–value = 0.18 > $\alpha = 0.05$, do not reject null guess: $H_0 : \mu = 10.05$.

Test For Variance σ^2.

In a simple random sample of 28 cars, SD in gap between door and jamb is $s = 0.7$ mm. Test if SD is *greater* than 0.6 mm at $\alpha = 0.05$. Assume normality with no outliers.

1. *Statement.* $H_0 : \sigma = 0.6$ versus $H_1 : \sigma > 0.6$

2. *Test.*

   $$\text{p–value} = P(s \geq 0.7) = P\left(\frac{(n-1)s^2}{\sigma^2} \geq \frac{(28-1)(0.7^2)}{0.6^2}\right) \approx P\left(\chi^2 \geq 36.75\right) \approx 0.10$$

   Stat, Variance, with summary, Sample variance: 0.49, Sample size: 28, Next, Null: mean = 0.36, Alternative: > Calculate. Notice, SDs must be squared to variances to use StatCrunch.
   Level of significance $\alpha = 0.05$

3. *Conclusion.*
   Since p–value = 0.10 > $\alpha = 0.05$, do not reject null guess: $H_0 : \sigma = 0.6$.