Statistics I, Fall 2012
Suggested Solution for Homework 14

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1. Let p be the proportion of consumers of this insurance company who reread their insurance policies, $\widehat{P}$ be the sample proportion, and $\alpha = 0.01$ be the significance level. The hypothesis is

$$H_0\colon p = 0.46$$
$$H_0\colon p \neq 0.46.$$

Because the sample size is large, we may use the z test. In this two-tailed test, because $\frac{147}{400} = 0.436 < 0.46$, the p-value is

$$\Pr(\widehat{P} < 0.436) = \Pr\left(Z < \frac{0.436 - 0.46}{\sqrt{(0.46)(0.54)/400}}\right) = \Pr(Z < -1.0032) = 0.1579.$$

As the p-value is larger than $\frac{\alpha}{2} = 0.005$, we do not reject H_0. With a 1% significance level, there is no strong evidence showing that the proportion of customers rereading their insurance policies has changed.

2. Let p be the proportion of accounting companies offering flexible scheduling to employees, $\widehat{P}$ be the sample proportion, and $\alpha = 0.01$ be the significance level. The hypothesis is

$$H_0\colon p = 0.76$$
$$H_0\colon p < 0.76.$$

Because the sample size is large, we may use the z test. In this left-tailed test, the p-value regarding the observed sample proportion $\frac{223}{315} = 0.7079$ is

$$\Pr(\widehat{P} < 0.7079) = \Pr\left(Z < \frac{0.7079 - 0.76}{\sqrt{(0.76)(0.24)/315}}\right) = \Pr(Z < -2.1636) = 0.0152.$$

As the p-value is larger than $\alpha = 0.01$, we do not reject H_0. With a 1% significance level, there is no strong evidence showing that the proportion of accounting companies offering flexible scheduling to employees is lower.

3. Let σ^2 be the the variance of the bearings and $\alpha = 0.01$ be the significance level. The hypothesis is

$$H_0\colon \sigma^2 = 0.001$$
$$H_0\colon \sigma^2 > 0.001.$$

Because the population is normal, we may use the chi-square test. In this right-tailed test, the p-value regarding the observed sample variance $s^2 = 0.00245$ is

$$\Pr(\chi^2_{19} > \frac{(20-1)(0.00245)}{0.001}) = \Pr(\chi^2_{19} > 46.495) = 0.0004$$

As the p-value is smaller than $\alpha = 0.01$, we reject H_0. With a 1% significance level, there is a strong evidence showing that the the variance of the bearings is larger than 0.001 cm^2.

4. Let σ^2 be the the variance of weekly deposits and $\alpha = 0.1$ be the significance level. The hypothesis is

$$H_0\colon \sigma^2 = 199996164$$
$$H_0\colon \sigma^2 \neq 199996164$$

Because the population is normal, we may use the chi-square test. In this two-tailed test, because the observed sample variance $s^2 = 832089743.6 > 199996164$, the p-value is

$$\Pr(\chi^2_{12} > \frac{(13-1)(832089743.6)}{199996164}) = \Pr(\chi^2_{12} > 49.9263) \approx 0$$

As the p-value is smaller than $\alpha = 0.1$, we reject H_0. With a 10% significance level, there is a strong evidence showing that the the variance of weekly deposits has changed.