Mathematics 363 - Exam II

April 27, 2009

1. (a) \( \frac{7}{2} \) and \( \frac{35}{1200} \)
(b) \[ z = \frac{3.75 - 3.5}{\sqrt{ \frac{35}{1200} }} = 1.46385, P\{Z > 1.4635\} = 0.0716 \]
(c) Decrease. The distribution of \( \bar{X} \) will be more concentrated about the mean and so deviations from the mean of 0.25 or more is less likely.

2. (a) \( X_2 \) It is the more reliable measurement.
(b) \[ L(\mu|x_1, x_2) = \frac{1}{\sqrt{\pi}} \exp -\left( x_1 - \mu \right)^2 \cdot \frac{\sqrt{10}}{\sqrt{\pi}} \exp -10(x_2 - \mu)^2 = \frac{\sqrt{10}}{\pi} \exp -((x_1 - \mu)^2 + 10(x_2 - \mu)^2) \]
(c) \( \ln L(\mu|x_1, x_2) = \ln \frac{\sqrt{10}}{\pi} - ((x_1 - \mu)^2 + 10(x_2 - \mu)^2) \)
\[ \hat{\mu} = \frac{x_1 + 10x_2}{11} \]
(d) 3.21
(e) Yes

3. (a) \( \frac{111}{278} = 0.3992806 \)
(b) \[ \hat{p} \pm z_{0.01} \sqrt{ \frac{\hat{p}(1 - \hat{p})}{n} } = 0.3993 \pm 0.0683 \]
with \( \hat{p} = 0.4007092 \) and \( z_{0.01} = 2.326 \)
(c) Larger - we have fewer observations.

4. (a) \( H_0 : \mu \geq 18 \) versus \( H_1 : \mu < 18 \) where \( \mu \) is the mean iron intake for adult females under the age of 51.
(b) \[ t = \frac{16.8 - 18}{3.08/\sqrt{41}} = -2.4947 \]
(c) Make a drawing of the \(t\) density curve and shade in the area corresponding to the \(p\)-value.
(d) Yes and yes. The \(p\)-value is about 0.8%.

5. (a) \(H_0 : \mu_h \leq \mu_w\) versus \(H_1 : \mu_h > \mu_w\) where \(\mu_w\) is the mean age of a women on the date of marriage and \(\mu_h\) is the mean age of a men on the date of marriage.
(b) We look to a match pair procedure. The mean age difference \(\bar{x} = 2\) and the standard deviation \(s = 3.406\).
(c) \(t = 2/(3.406/\sqrt{5}) = 1.4383\). Using the \(t\) distribution with 5 degrees of freedom, we find that the \(p\)-value is between 0.10 and 0.15.
(d) It would double.