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MA 331

Professor Li

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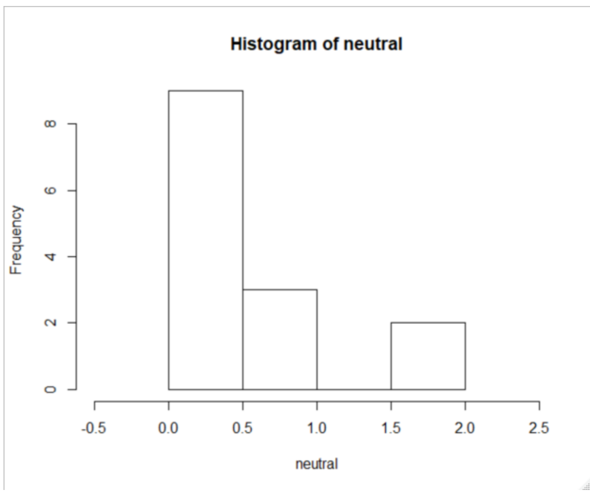
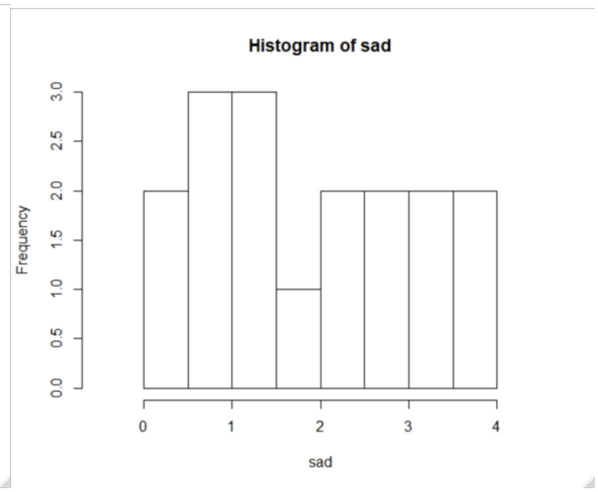
I pledge my honor that I have abided by the Stevens Honor System

Homework 4

7.71





While neither of these plots are particularly normal distributed, they have no outliers and seem random. Though the histogram of neutral seems to be skewed to the left, the use of t procedures still seems acceptable for this plot.

	Neutral	Sad
Sample Size	14	17
Mean	0.5714	2.1176
Standard Deviation	0.7300	1.2441

Let μ_N denote mean of neutral population and let μ_S denote mean of sad population

$H_0 : \mu_N = \mu_S$
$H_a : \mu_N < \mu_S$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{0.5714 - 2.1176}{\sqrt{\frac{0.73^2}{14} + \frac{1.24^2}{17}}}$$

$$t = -4.303$$

Degrees of freedom – min(14-1, 17-1) = 13.

$P(t_{13}<-4.303) = 4.29*10^{-4} = 0.000429$

CI = $(\bar{x}_1 - \bar{x}_2) \pm t_{95\%}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

$$(0.5714 - 2.1176) \pm 2.160\sqrt{\frac{0.73^2}{14} + \frac{1.24^2}{17}}$$

$$CI = (-2.32, -0.77)$$

7.89.

Let μ_B denote mean of breast-fed population and let μ_F denote mean of formula population

H_0: $\mu_B = \mu_F$
H_a: $\mu_B > \mu_F$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{13.3 - 12.4}{\sqrt{\frac{2.89}{23} + \frac{3.24}{19}}}$$

$$t = 1.654$$

Degrees of freedom = min(23-1, 19-1) = 18
$P(t_{18}>1.654) = 0.058$
My conclusion is that if the significance level is less than 0.058, we do not reject H_0, and if significance level is greater than 0.058, we reject H_0.

CI = $(\bar{x}_1 - \bar{x}_2) \pm t_{95\%}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

$$(13.3 - 12.4) \pm 2.101\sqrt{\frac{2.89}{23} + \frac{3.24}{19}}$$

$$(0.9 - 1.143, 0.9 + 1.143)$$

$$CI = (-0.243, 2.043)$$

The samples need to be two simple random samples from the two populations.

7.102.

$F \sim F((9.1/3.5) = 2.6)_{15,10}$

Critical value = 3.52

2.6<3.52, and therefore, do not reject the null hypothesis under 5% significance level that the standard deviations are equal.

7.122.

Two sample –

	Group 1	Group 2
Mean	49.692	50.545
Variance	5.372	3.703

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$
$$t = \frac{49.692 - 50.545}{\sqrt{\frac{5.372}{10} + \frac{3.703}{10}}}$$
$$t = -\frac{0.853}{.953}$$
$$t = -0.895$$

Degrees of freedom = min(10-1, 10-1) = 9

P(t_9<-0.895 or t_9>0.895) = 0.507

One sample –

Mean = -0.853
Variance = 1.61
t = $\frac{\bar{x}}{\sqrt{\frac{s^2}{n}}}$

t = -2.126

Degrees of freedom = n-1 = 9

P(t_9 < -2.126 or t_9 > 2.126) = 0.101

There is a large difference in the P-values, where the incorrectly done test calculates a 50% chance that the samples are different, while the correctly done test calculates a 10% chance that the samples are different. The incorrectly done test incorrectly suggests a much higher chance that the two samples are not consistent with each other.

8.71.

Females – 48/60, error = $\sqrt{\frac{\frac{48}{60}*\frac{12}{60}}{60}} = 0.0516$

Males – 52/132, error = $\sqrt{\frac{\frac{52}{132}*\frac{80}{132}}{132}} = 0.0425$

$$D = \frac{48}{60} - \frac{52}{132} = 0.406$$
$$SE_D = \sqrt{0.0516 + 0.0425} = 0.0669$$

$m = 1.645(0.0669) = 0.110$

$CI = (0.406 - 0.110, 0.406 + 0.110) = (0.296, 0.516)$

$$\hat{p} = \frac{X_1 + X_2}{n_1 + n_2}$$

$$\hat{p} = \frac{48 + 52}{60 + 132} = 0.573$$

$$SE_{DP} = \sqrt{\hat{p}(1 - \hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} = 0.0770$$

$$z = \frac{0.406}{0.0770} = 5.27$$

$$P(z > 5.27) \approx 0$$