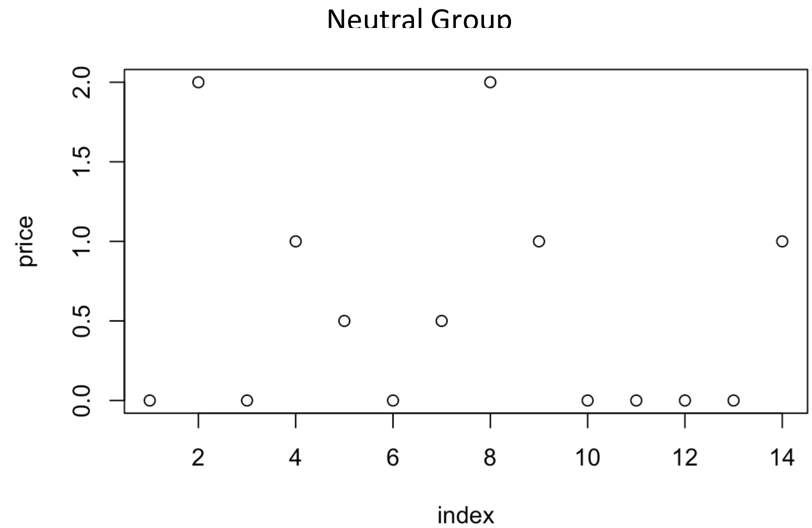
Christina Li
October 5, 2018
MA 331

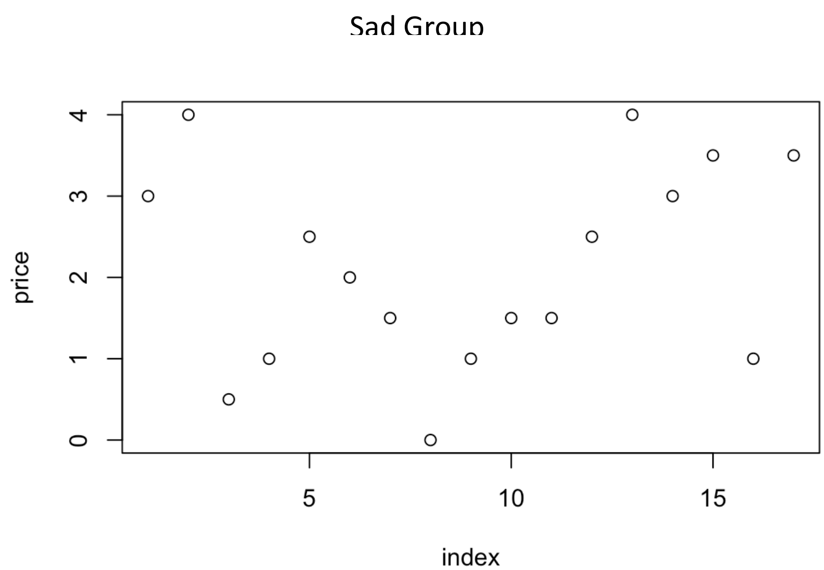
"I pledge my honor that I have abided by the Stevens Honor System." –cli50

Homework 4

7.71

a.





b.

	Neutral	Sad
Sample Size	14	17
Mean	0.571	2.118
Standard Deviations	0.730	1.244

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c.

H_0: $\mu_1 = \mu_2$

The null hypothesis states that there is no sufficient significant difference of the mean price of purchasing insulated water bottles from the neutral group and sad group.

H_1: $\mu_1 \neq \mu_2$

The alternative hypothesis states that there is sufficient difference of the mean price of purchasing insulated water bottles from the neutral group and sad group.

d.

$n_1 = 14$

$\bar{x}_1$=0.571

$s_1 = 0.730$

$n_2 = 17$

$\bar{x}_2$=2.118

$S_2 = 1.244$

Since the sample size is small (n < 30) and the population s.d. is unknown, the level of significance is $\alpha = 0.05$.

$$t= \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{0.571-2.118}{\sqrt{\frac{0.73^2}{14} - \frac{1.244^2}{17}}} = -4.3056$$

The test statistics is t = -4.3056

df = 13 because it's the minimum of (n_1-1,n_2-1) = (14-1,17-1) = (13,16)

P-value = 2P(T > t) = 2P(t > -4.3056)

= 1-2P(t≤4.3056) = 0.00

Since the P value is very small compared to the level of significance, we can conclude that there exists statistical significant evidence. Thus, we conclude there is a sufficient significant difference of the mean price of purchasing insulated water bottles for the Neutral group and sad group.

e.

$$(\bar{x}_1 - \bar{x}_2) \pm t\left(\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}\right) = (0.571-2.118) \pm 2.16\left(\sqrt{\frac{0.73^2}{14} - \frac{1.244^2}{17}}\right)$$

=-1.547 ± 0.77 = (-2.323,-0.771)

The 95% confidence interval for the mean difference between the two groups lies between -2.323 and -0.771. This shows that there is statistical significant evidence because the interval does not contain zero. Thus, there is sufficient significant difference of the mean price of the purchasing insulated water bottles between the two groups.

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7.89

a.

H_0 : the hemoglobin level among breast-fed babies are same as the hemoglobin level among formula babies

H_1 : the hemoglobin level among breast-fed babies are higher than the hemoglobin level among formula babies

$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{13.3 - 12.4}{\sqrt{\frac{1.7^2}{23} + \frac{1.8^2}{19}}} = 1.654$

P(value) = 0.053.

Because the P-value is greater than the significant level (0.05 we're assuming), then we fail to reject the null hypothesis. Therefore, we conclude there is no significant evidence to support the claim that hemoglobin level among breast-fed babies are higher than formula babies.

b.

$(\bar{x}_1 - \bar{x}_2) \pm t(\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}})$ = (13.3 – 12.4) $\pm$ 2.101$(\sqrt{\frac{1.7^2}{23} + \frac{1.8^2}{19}})$

= (-0.2434, 2.0434)

The 95% confidence interval is between -0.2434 and 2.0434

c.

a and b can only be valid when both samples are two independent samples from normal population.

7.102

H_0: $\sigma_1 = \sigma_2$

H1: : $\sigma_1 \neq \sigma_2$

a.

$F = \frac{s_2^2}{s_1^2} = \frac{9.1}{3.5} = 2.6$

The test statistics is 2.6.

b.

From R-Studio:

```
> qf(0.95,df1=15,df2=10)
[1] 2.845017
```

Therefore, the critical value is 2.845.

c.

Since 2.6 < 2.85, the test statistic value is less than the critical value. Therefore, we fail to reject the null hypothesis. We can conclude that the two population standard deviations are equal.

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7.122

a.

Mean:

$\bar{x}_1 = \frac{\sum x_1}{n_1} = \frac{496.92}{10} = 49.692$

$\bar{x}_2 = \frac{\sum x_2}{n_2} = \frac{505.45}{10} = 50.545$

Standard deviation:

$s_1 = \sqrt{\frac{\sum(x_1 - \bar{x}1)^2}{n_1 - 1}} = 2.3179$

$s_2 = \sqrt{\frac{\sum(x_2 - \overline{x2})^2}{n_2 - 1}} = 1.9244$

Degree of Freedom:

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}} = 17$$

test statics:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{49.692 - 50.545}{\sqrt{\frac{2.3179^2}{10} + \frac{1.9244^2}{10}}} = -0.9$$

The p-value is 0.3831.

b.

H_0: $\mu_d = 0$

H_1: $\mu_d \neq 0$

$\bar{d} = \frac{\Sigma d}{n} = -0.853$

$s_d = \sqrt{\frac{(d - \bar{d})^2}{n - 1}} = 1.2691$

df = n-1 = 10-1 = 9

$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}} = -2.13$

The p-value is 0.0625.

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c.

The test statistics for the paired t test is greater than the independent sample t test. Also, the p-value for the paired t test is less than the independent sample t test. Therefore, the tests show that there is no difference between the two population means.

8.71

a.

Female : $n_1 = 60$

$X_1 = 48$

$\hat{p}_1 = \frac{X1}{n1} = \frac{48}{60} = 0.8$

$SE(\hat{p}_1) = \sqrt{\frac{\hat{p}1(1-\hat{p}1)}{n1}} = \sqrt{\frac{0.8(0.2)}{60}} = 0.0516$

Male: $n_2 = 132$

$X_2 = 52$

$\hat{p}_2 = \frac{X2}{n2} = \frac{52}{132} = 0.394$

$SE(\hat{p}_2) = \sqrt{\frac{\hat{p}2(1-\hat{p}2)}{n2}} = \sqrt{\frac{0.394(0.606)}{132}} = 0.0425$

b.

$(\hat{p}_1\text{-}\hat{p}_2) \pm Z_{\alpha/2}\sqrt{\frac{\hat{p}1(1-\hat{p}1)}{n1} + \frac{\hat{p}2(1-\hat{p}2)}{n2}} = (0.8\text{-}0.394) \pm 1.645\sqrt{\frac{0.8(0.2)}{60} + \frac{0.394(0.606)}{132}}$

$= 0.406 \pm 0.11 = (0.296,0.516)$

The difference between the two proportion is somewhere between 0.296 and 0.516.

c.

H_0: $p_1 = p_2$

H_1: $p_1 \neq p_2$

p_1 represents the population proportion of females, p_2 represents the population proportion of males

$\hat{p} = \frac{X_1+X_2}{n_1+n_2} = \frac{48+52}{60+132} = 0.5208$

$z = \frac{(\hat{p}1-\hat{p}2)-(p1-p2)}{\sqrt{\hat{p}(1-\hat{p})(\frac{1}{n1}+\frac{1}{n2})}} = \frac{(0.8-0.394)-0}{\sqrt{0.5208(0.4792)(\frac{1}{60}+\frac{1}{132})}} = 5.22$

Reject H_0 if $z < -1.645$ or $z > 1.645$

Otherwise do not reject H_0

Since the test statistic value (5.22) falls in the rejection region, we can reject the null hypothesis. Therefore, we can conclude that there is a difference in the proportion of female references that are girls to the male references that are boys.