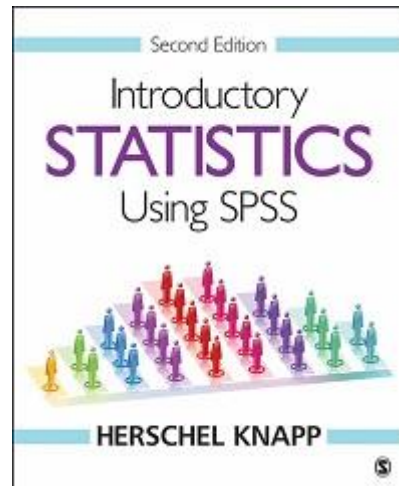


Chapter 5

t Test and Mann-Whitney *U* Test

Solutions to Odd Numbered Exercises



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Exercise 5.1, Data Set A

(a)

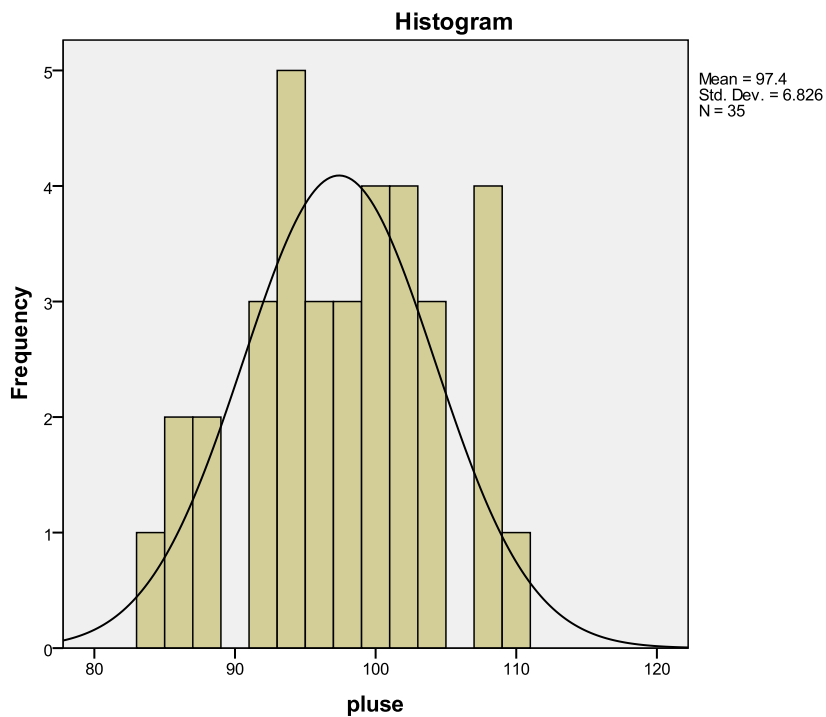
H_0 : Practicing meditation for 30 minutes a day, 3 days a week has no effect on resting pulse rate.

H_1 : Practicing meditation for 30 minutes a day, 3 days a week for 2 weeks affects resting pulse rate.

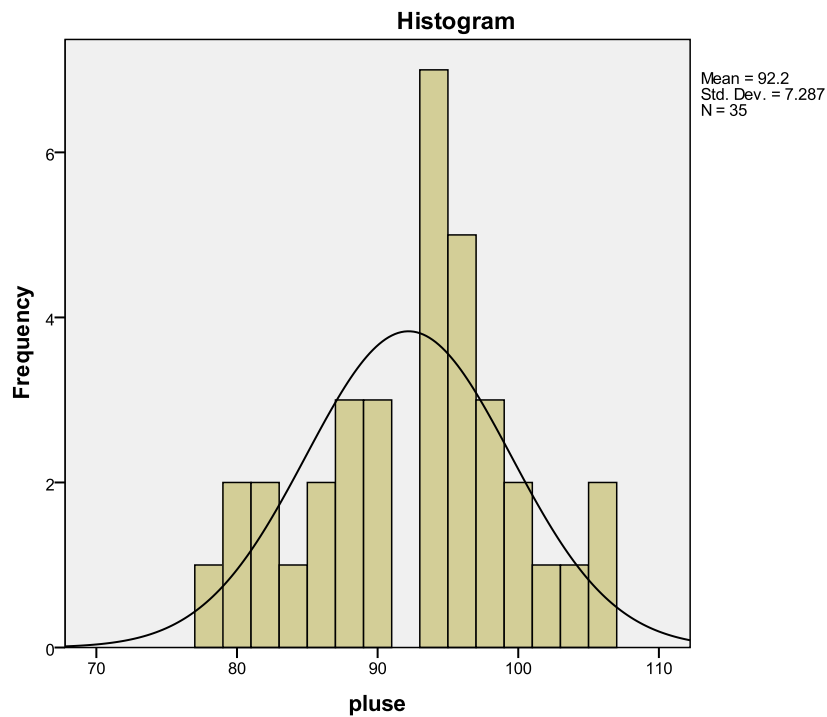
(b)

Histograms with normal curve plots show a normal distribution of *pulse* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *pulse* in Group 1 (No meditation)



Normal distribution for *pulse* in Group 2 (Meditated 30 minutes a day, 3 days per week)



Test of Homogeneity of Variances

pulse

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| .089 | 1 | 68 | .766 |

The homogeneity of variance score shows a significance (p) of .766; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group, as shown in the *Descriptives* table below is 35 for each group; since the n s are greater than 30, this criterion passes also.

(c)

The t test revealed the following:

Descriptives

pulse

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|----------------------|----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| No meditation | 35 | 97.40 | 6.826 | 1.154 | 95.06 | 99.74 | 84 | 109 |
| Meditates 30 minutes | 35 | 92.20 | 7.287 | 1.232 | 89.70 | 94.70 | 78 | 105 |
| Total | 70 | 94.80 | 7.483 | .894 | 93.02 | 96.58 | 78 | 109 |

ANOVA

pulse

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Between Groups | 473.200 | 1 | 473.200 | 9.492 | .003 |
| Within Groups | 3390.000 | 68 | 49.853 | | |
| Total | 3863.200 | 69 | | | |

The mean pulse rate for Group 1 (No meditation) is 97.40, whereas the mean pulse rate for Group 2 (Meditated 30 minutes, 3 days per week) is 92.20. This 5.2-point difference is statistically significant since the significance (p) is .003 (which is less than the .05 α level).

(d)

This study analyzed the effects that meditation had on resting pulse rates. The subjects were randomly assigned to one of two groups; the group that did not meditate, and the other group that meditated for 30 minute on Monday, Wednesday and Friday for 2 weeks. Results revealed a mean resting pulse rate of 97.40 for those who did not meditate, and 92.20 for those who did meditate. Using a .05 α level, the p value of .003 suggests that meditation does facilitate a significant reduction in resting pulse rate, hence, we reject H_0 . These findings suggest support for H_1 , specifically, that practicing meditation for 30 minutes a day, 3 days a week for 2 weeks affected the mean resting pulse rate among these participants.

Exercise 5.1, Data Set B

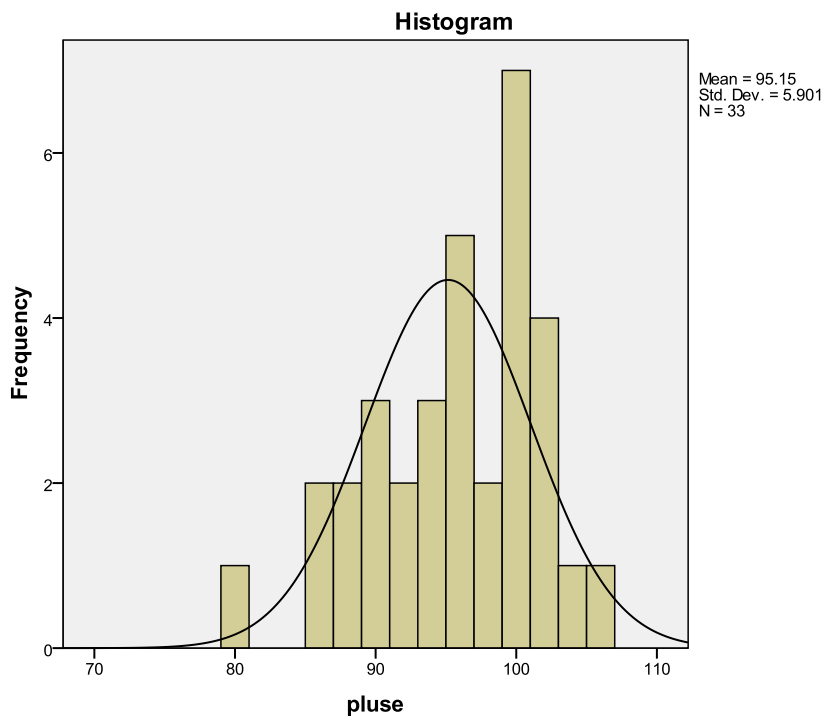
(a)

H_0 : Practicing meditation for 30 minutes a day, 3 days a week has no effect on resting pulse rate.

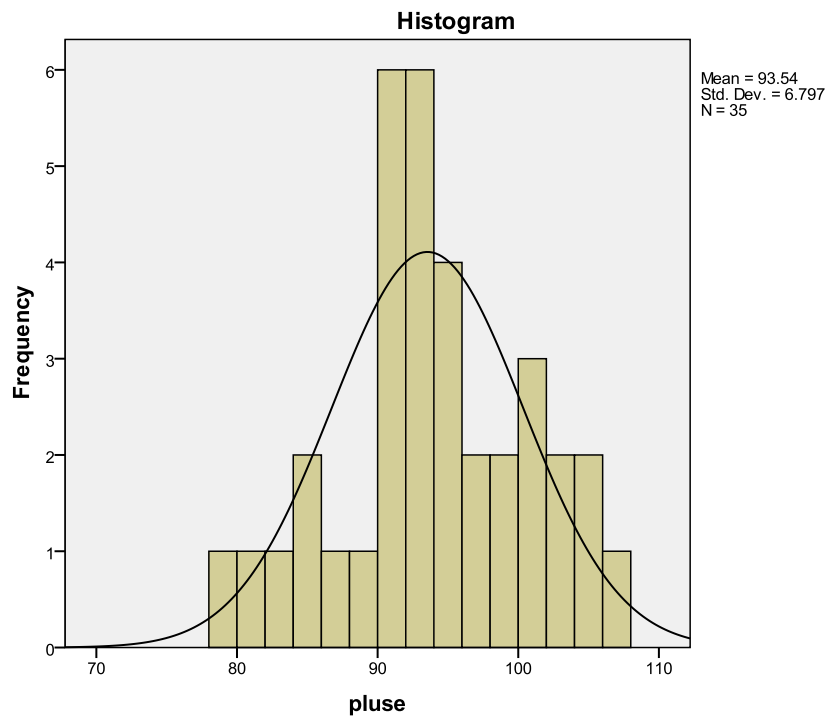
H_1 : Practicing meditation for 30 minutes a day, 3 days a week for 2 weeks affects resting pulse rate.

(b) Histograms with normal curve plots show a normal distribution of *pulse* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *pulse* in Group 1 (No meditation)



Normal distribution for *pulse* in Group 2 (Meditated 30 minutes a day, 3 days per week)



Test of Homogeneity of Variances

pulse

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| .317 | 1 | 66 | .576 |

The homogeneity of variance score for *pulse* shows a significance (p) of .576; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n criterion is satisfied as both groups have an n of more than 30 (see *Descriptives* table below).

(c)

The t test revealed the following:

Descriptives

pulse

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|----------------------|----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| No meditation | 33 | 95.15 | 5.901 | 1.027 | 93.06 | 97.24 | 80 | 105 |
| Meditates 30 minutes | 35 | 93.54 | 6.797 | 1.149 | 91.21 | 95.88 | 79 | 107 |
| Total | 68 | 94.32 | 6.382 | .774 | 92.78 | 95.87 | 79 | 107 |

ANOVA

pulse

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Between Groups | 43.954 | 1 | 43.954 | 1.080 | .302 |
| Within Groups | 2684.928 | 66 | 40.681 | | |
| Total | 2728.882 | 67 | | | |

The mean pulse rate for Group 1 (No meditation) is 95.15, whereas the mean pulse rate for Group 2 (Meditated 30 minutes, 3 days per week) is 93.54. Even though the mean pulse rate for the meditation group is 1.61 points lower than the control group, this difference is not considered to be statistically significant since the significance (p) is .302 (which is greater than the .05 α level).

(d)

This study analyzed the effects that meditation had on resting pulse rates. The subjects were randomly assigned to two groups; those that did not meditate, and those that meditated for 30 minutes on Monday, Wednesday and Friday for 2 weeks. Results revealed a mean resting pulse rate of 95.15 for those who did not meditate, and 93.54 for those who did meditate. This study showed a 1.61 reduction in the pulse rate of those who meditated; however, since the p value of .302 is greater than the .05 α level, we would conclude that this difference is not statistically significant, hence, we do not reject H_0 . For the subjects studied, meditation did not significantly affect resting pulse rate.

Exercise 5.3, Data Set A

(a)

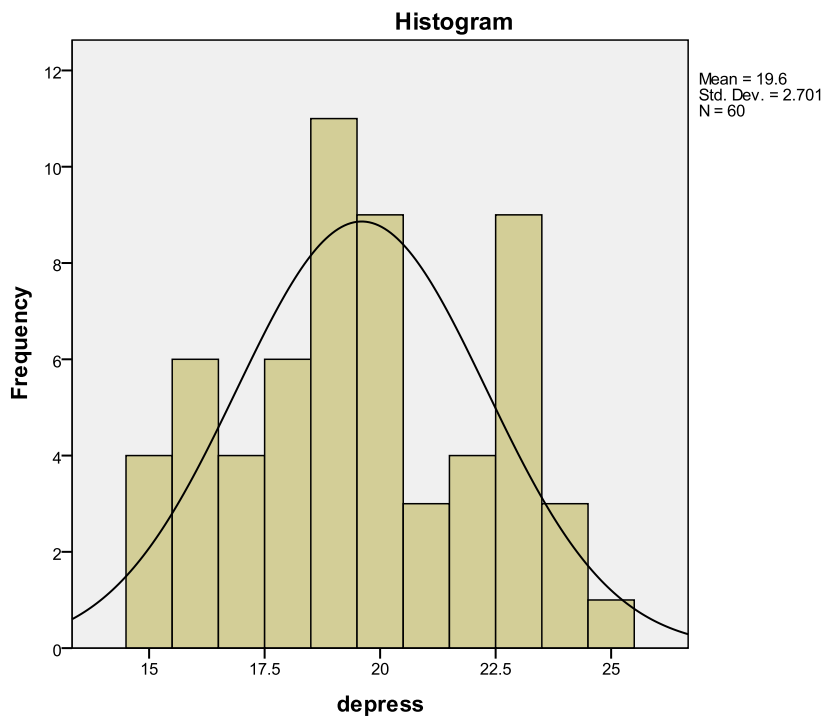
H_0 : Tending to a plant has no effect on depressive mood.

H_1 : Tending to a plant reduces depressive mood.

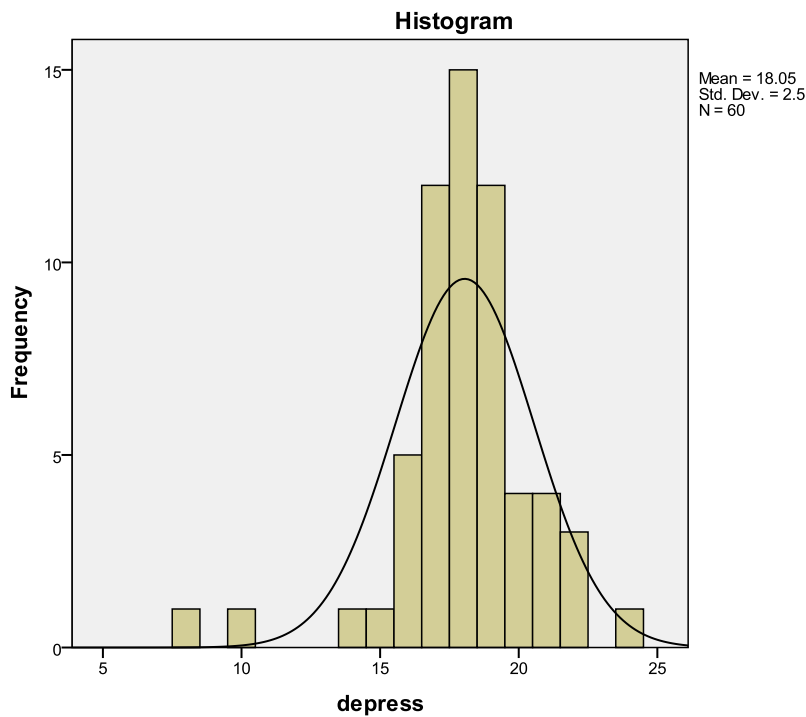
(b)

Despite the few low score outliers shown in the histogram for Group 2, the Histograms with normal curve plots show a normal distribution of the *depress* variable for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *depress* in Group 1 (No plant)



Normal distribution for *depress* in Group 2 (Bamboo)



Test of Homogeneity of Variances

depress

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 3.615 | 1 | 118 | .060 |

The homogeneity of variance score for *mood* shows a significance (p) of .060; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group is 60 (see *Descriptives* table below), which satisfies the 30 per group minimum criterion.

(c)

The t test revealed the following:

Descriptives

depress

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|----------|-----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| No plant | 60 | 19.60 | 2.701 | .349 | 18.90 | 20.30 | 15 | 25 |
| Bamboo | 60 | 18.05 | 2.500 | .323 | 17.40 | 18.70 | 8 | 24 |
| Total | 120 | 18.83 | 2.706 | .247 | 18.34 | 19.31 | 8 | 25 |

ANOVA

depress

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|--------|------|
| Between Groups | 72.075 | 1 | 72.075 | 10.641 | .001 |
| Within Groups | 799.250 | 118 | 6.773 | | |
| Total | 871.325 | 119 | | | |

The mean depression level for those in the control group (No plant) is 19.60, whereas those in the treatment group (Bamboo) had a mean depression level of 18.05. Since the significance (p) is .001 (which is less than the .05 α level), the 1.55-point improvement in those who were given plants is considered to be statistically significant. As such, we would reject H_0 in favor of H_1 .

(d)

We hypothesized that empowering nursing home residents with an opportunity to provide nurturance would help reduce depression. To test this hypothesis, 120 residents were randomly assigned to one of two groups: The 60 people in the treatment group were each given a small bamboo plant to tend to along with a card providing care instructions; the 60 members of the control group were given no plant. After 90 days, we administered the Acme Depression Scale (1 = Low depression, 100 = High depression) to members of both groups. We found that those who were given the bamboo plant scored an average of 18.05; their depression level was 1.55 points lower than those in the control group, who had an average depression score of 19.60. This improvement in depression, though small, produced a statistically significant p value of .001, using a .05 α level, hence, we rejected H_0 . For those involved in this study, it appears that having a plant reduced depression, thereby supporting H_1 .

Exercise 5.3, Data Set B

(a)

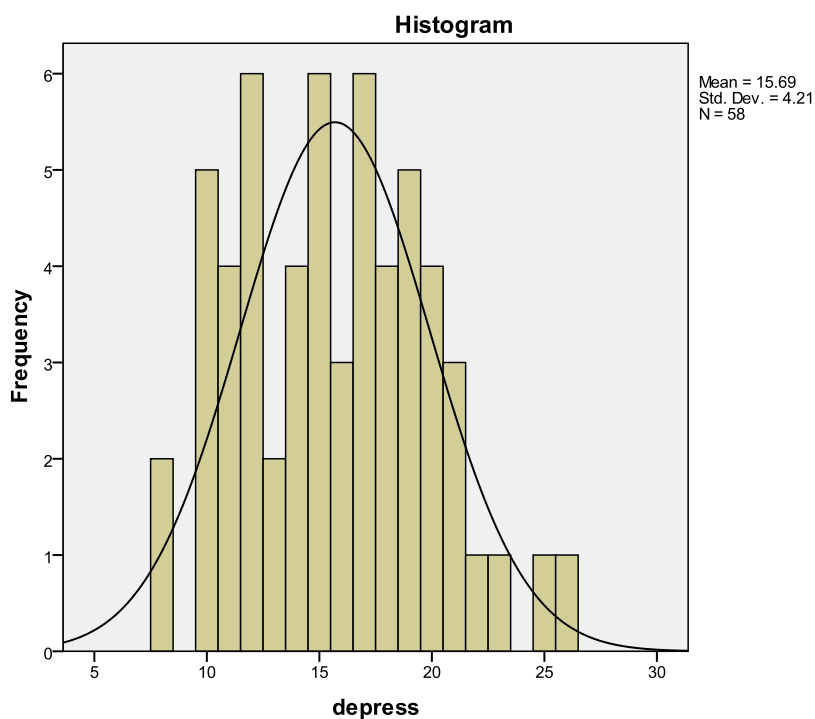
H_0 : Tending to a plant has no effect on depressive mood.

H_1 : Tending to a plant reduces depressive mood.

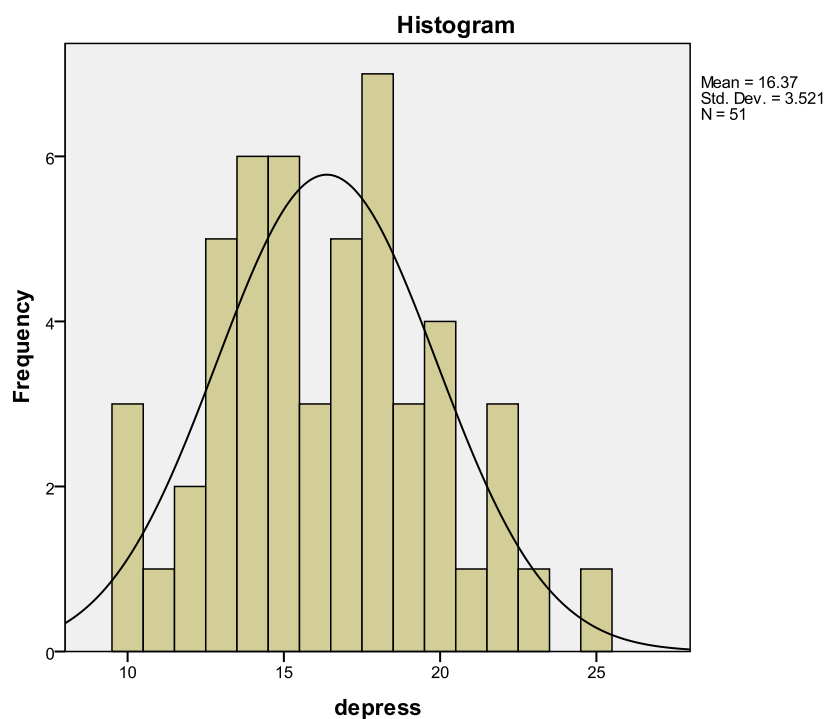
(b)

The Histograms with normal curve plots show a normal distribution of the *depress* variable for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *depress* in Group 1 (No plant)



Normal distribution for *depress* in Group 2 (Bamboo)



Test of Homogeneity of Variances

depress

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 2.039 | 1 | 107 | .156 |

The homogeneity of variance score for *mood* shows a significance (p) of .156; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for the No plant group is 58, and the n for the Bamboo group is 51 (see *Descriptives* table below). These n s exceed the 30 per group minimum criterion.

(c)

The t test revealed the following:

Descriptives

depress

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|----------|-----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| No plant | 58 | 15.69 | 4.210 | .553 | 14.58 | 16.80 | 8 | 26 |
| Bamboo | 51 | 16.37 | 3.521 | .493 | 15.38 | 17.36 | 10 | 25 |
| Total | 109 | 16.01 | 3.900 | .374 | 15.27 | 16.75 | 8 | 26 |

ANOVA

depress

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|------|------|
| Between Groups | 12.655 | 1 | 12.655 | .831 | .364 |
| Within Groups | 1630.335 | 107 | 15.237 | | |
| Total | 1642.991 | 108 | | | |

The mean depression level for those in the control group (No plant) is 15.69, whereas those in the treatment group (Bamboo) had a mean depression level of 16.37. Even though the mean depression score for those who received the bamboo plant was .68 points higher than those in the control group, ultimately, this difference is not statistically significant since the significance (p) is .364 (which is greater than the .05 α level). As such, we would not reject H_0 .

(d)

We hypothesized that empowering nursing home residents with an opportunity to provide nurturance would help reduce depression. To test this hypothesis, 109 residents were randomly assigned to one of two groups: 51 of the residents were given a small bamboo plant to tend to along with a card providing care instructions; the remaining 58 residents received no plant. After 90 days, we administered the Acme Depression Scale (1 = Low depression, 100 = High depression) to members of both groups. We found that on average, those who were given no plant were less depressed (15.69) than those who were given the bamboo plant (16.37), however, in light of the p value of .364, using a .05 α level, this .68-point difference in the average depression scores is not considered to be statistically significant. Accordingly, we did not reject H_0 .

Exercise 5.5, Data Set A

(a)

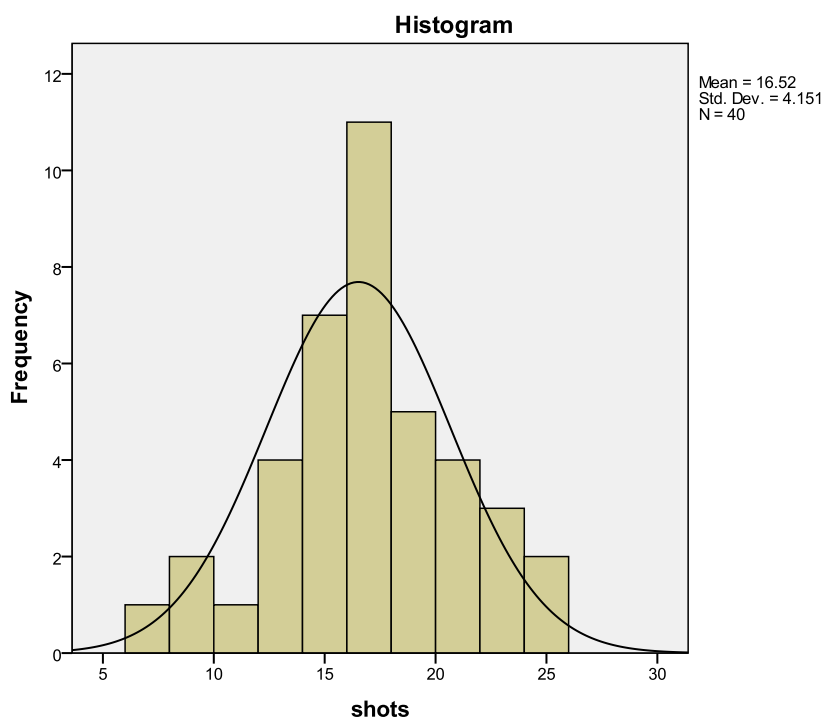
H_0 : Providing a flu shot information pamphlet has no impact on flu shot receptivity.

H_1 : Providing a flu shot information pamphlet has a positive impact on flu shot receptivity.

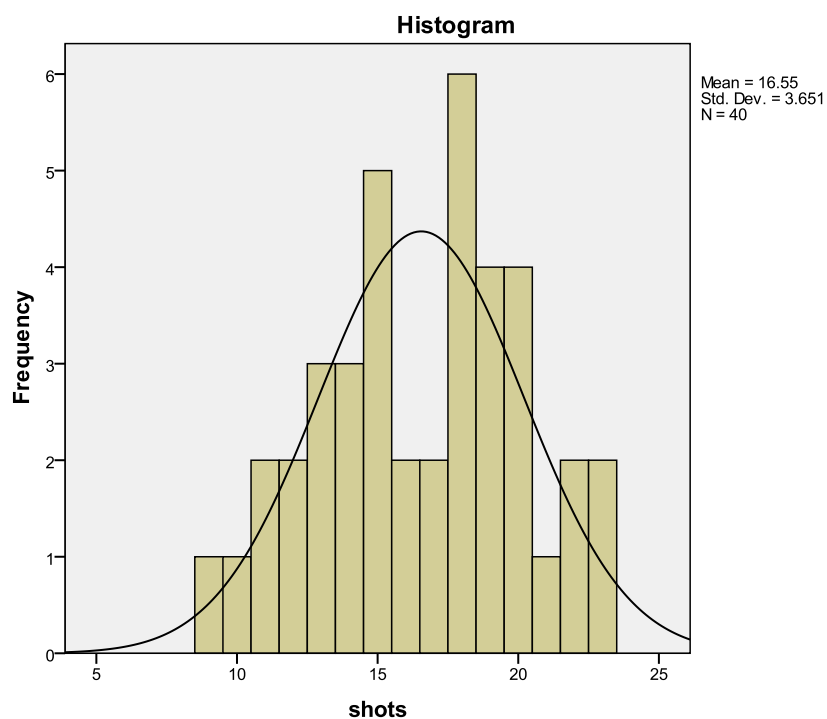
(b)

The histograms (below) for both groups show normal distributions of flu shots, hence the pretest criterion of normality is satisfied.

Group 1—No flu shot information pamphlet



Group 2—Flu shot information pamphlet

**Test of Homogeneity of Variances**

shots

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| .010 | 1 | 78 | .920 |

The homogeneity of variance score shows a significance (p) of .920; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the groups; hence, this pretest criterion passes. The n for each group, as shown in the *Descriptives* table below is greater than 30; the n quotas are satisfied.

(c)

The t test revealed the following:

Descriptives

shots

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------------------|----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| Nothing | 40 | 16.52 | 4.151 | .656 | 15.20 | 17.85 | 7 | 25 |
| Flu shot pamphlet | 40 | 16.55 | 3.651 | .577 | 15.38 | 17.72 | 9 | 23 |
| Total | 80 | 16.54 | 3.884 | .434 | 15.67 | 17.40 | 7 | 25 |

ANOVA

shots

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|------|------|
| Between Groups | .013 | 1 | .013 | .001 | .977 |
| Within Groups | 1191.875 | 78 | 15.280 | | |
| Total | 1191.887 | 79 | | | |

The mean daily flu shot count for Group 1 (No flu shot information pamphlet) is 16.52, whereas the mean flu shot count for Group 2 (Received a flu shot pamphlet) is 16.55. This .03-point difference is not statistically significant since the significance (p) is .977 (which is greater than the .05 α level).

(d)

This study analyzed the effects that providing a flu shot information pamphlet to patients in a walk-in clinic during flu season may have on patient receptivity to having a flu shot. The participants were randomly assigned to one of two groups: those who had drawn an odd-numbered service ticket were given a flu shot information pamphlet; those who drew an even-numbered ticket were not given any such literature. Results revealed that those who were given no pamphlet rendered a mean of 16.52 flu shots per day, compared to a mean of 16.55 among those who were issued a pamphlet. Using a .05 α level, the p value of .977 suggests that the flu shot pamphlet did not facilitate a significant increase in flu shot receptivity; hence, we do not reject H_0 . These findings do not suggest support for H_1 —specifically, that providing a flu shot pamphlet increases receptivity to having a flu shot during flu season among these participants.

Exercise 5.5, Data Set B

(a)

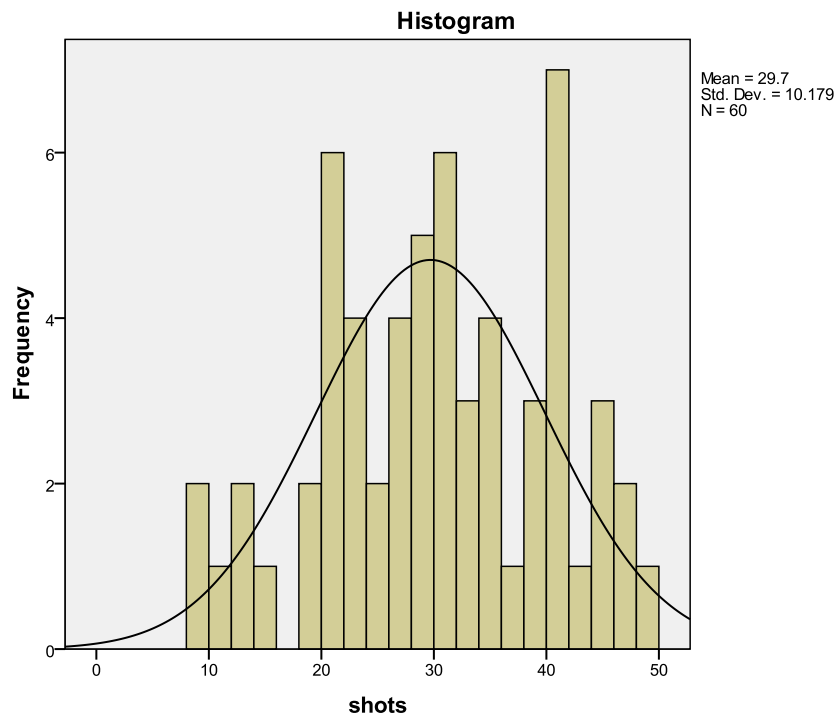
H_0 : Providing a flu shot information pamphlet has no impact on flu shot receptivity.

H_1 : Providing a flu shot information pamphlet has a positive impact on flu shot receptivity.

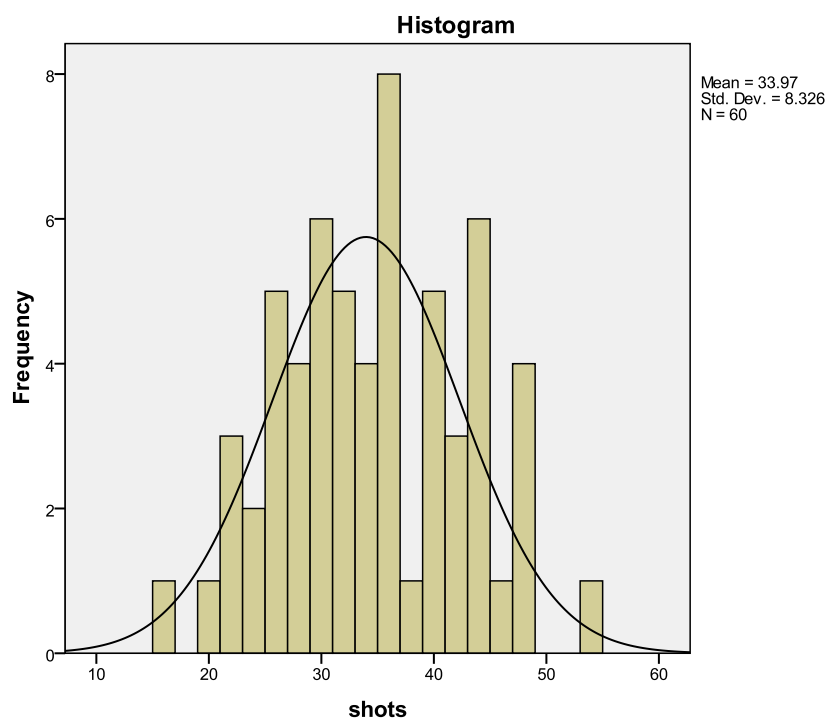
(b)

The histograms (below) for both groups show normal distributions of flu shots, hence the pretest criterion of normality is satisfied.

Group 1—No flu shot information pamphlet



Group 2—Flu shot information pamphlet

**Test of Homogeneity of Variances**

Shots

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 2.235 | 1 | 118 | .138 |

The homogeneity of variance score shows a significance (p) of .138; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the groups; hence, this pretest criterion passes. The n for each group, as shown in the *Descriptives* table below is greater than 30; the n quotas are satisfied.

(c)

The t test revealed the following:**Descriptives**

shots

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------------------|-----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| Nothing | 60 | 29.70 | 10.179 | 1.314 | 27.07 | 32.33 | 9 | 48 |
| Flu shot pamphlet | 60 | 33.97 | 8.326 | 1.075 | 31.82 | 36.12 | 16 | 53 |
| Total | 120 | 31.83 | 9.504 | .868 | 30.12 | 33.55 | 9 | 53 |

ANOVA

shots

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|-------|------|
| Between Groups | 546.133 | 1 | 546.133 | 6.316 | .013 |
| Within Groups | 10202.533 | 118 | 86.462 | | |
| Total | 10748.667 | 119 | | | |

The mean daily flu shot count for Group 1 (No flu shot information pamphlet) is 29.70, whereas the mean flu shot count for Group 2 (Received a flu shot pamphlet) is 33.97. This 4.27-point difference is statistically significant since the significance (p) is .013 (which is less than the .05 α level).

(d)

This study analyzed the effects that providing a flu shot information pamphlet to patients in a walk-in clinic during flu season may have on patient receptivity to having a flu shot. The participants were randomly assigned to one of two groups: those who had drawn an odd-numbered service ticket were given a flu shot information pamphlet; those who drew an even-numbered ticket were not given any such literature. Results revealed that those who were given no pamphlet rendered a mean of 29.70 flu shots per day, compared to a mean of 33.97 among those who were issued a pamphlet. Using a .05 α level, the p value of .013 suggests that the flu shot pamphlet facilitated a significant increase in flu shot receptivity; hence, we reject H_0 . These findings suggest support for H_1 —specifically, that providing a flu shot pamphlet increases receptivity to having a flu shot during flu season among these participants.

Exercise 5.7, Data Set A

(a)

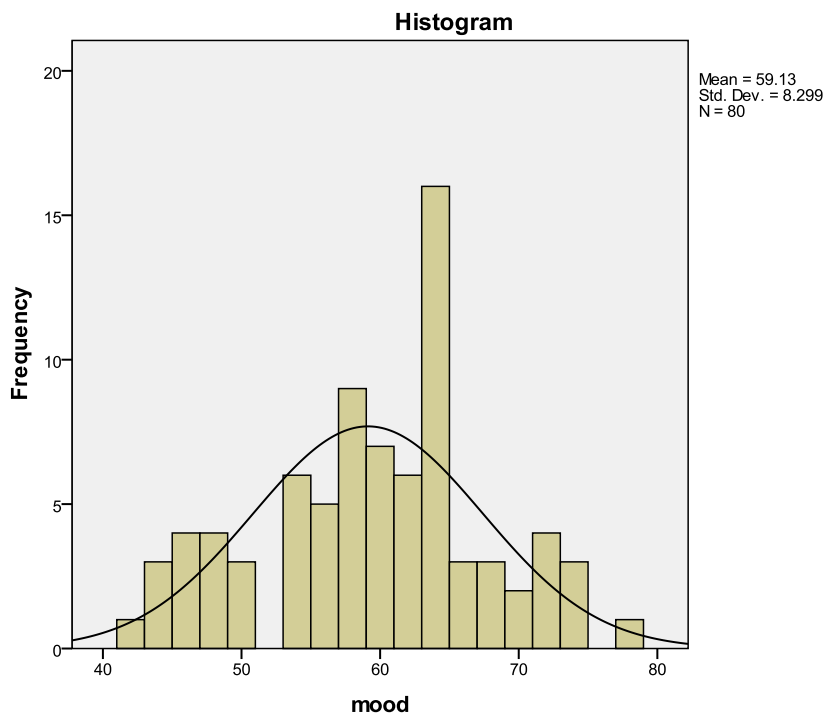
H_0 : Light therapy has no effect on depression.

H_1 : Light therapy is effective in reducing depression.

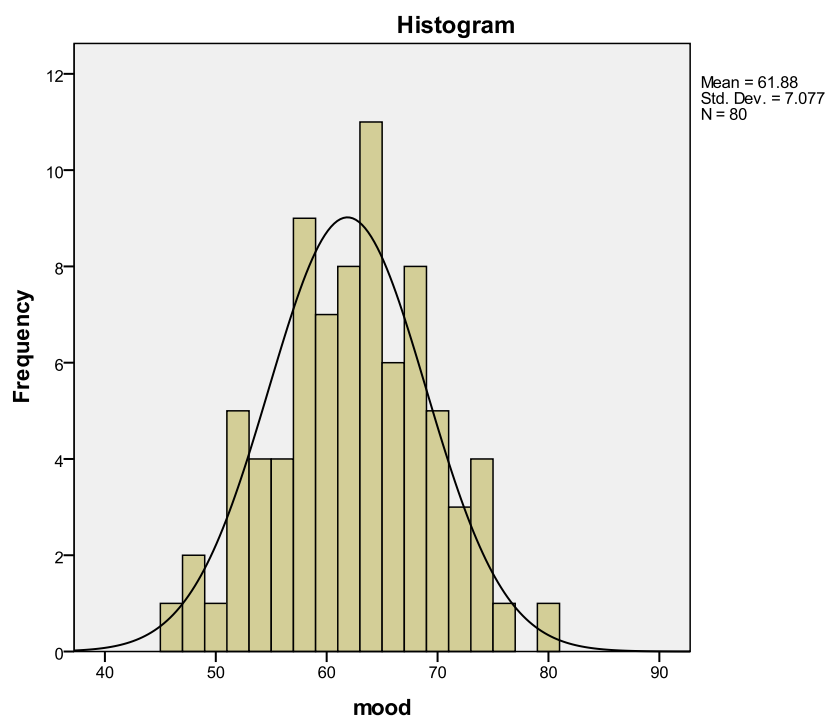
(b)

Histograms with normal curve plots show a normal distribution of *mood* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *mood* in Group 1 (No light therapy)



Normal distribution for *mood* in Group 2 (Light therapy: even days)



Test of Homogeneity of Variances

mood

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 1.700 | 1 | 158 | .194 |

The homogeneity of variance score for *mood* shows a significance (p) of .194; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group is 80 in each group, which satisfies the 30 per group minimum criterion (see *Descriptives* table below).

(c) The t test revealed the following:

Descriptives

mood

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|--------------------------|-----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| No light therapy | 80 | 59.13 | 8.299 | .928 | 57.28 | 60.97 | 42 | 77 |
| Light therapy: even days | 80 | 61.88 | 7.077 | .791 | 60.30 | 63.45 | 46 | 79 |
| Total | 160 | 60.50 | 7.811 | .617 | 59.28 | 61.72 | 42 | 79 |

ANOVA

mood

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|-------|------|
| Between Groups | 302.500 | 1 | 302.500 | 5.086 | .025 |
| Within Groups | 9397.500 | 158 | 59.478 | | |
| Total | 9700.000 | 159 | | | |

The mean mood level for those in the Light therapy group was 61.88, which is 2.75 points higher than the mean score of those in the control group (59.13). In light of the significance (p) score of .025 (which is less than the .05 α level) this difference is considered to be statistically significant.

(d)

In order to determine if light therapy is a viable supplement to treating depression, 160 subjects diagnosed with depression were randomly assigned to one of two groups: Half received 1 hour of light therapy every other day for a month; the other half received no light therapy. After 30 days, all participants completed the Acme Mood Scale, a 10 question survey that renders a score from 1 to 100 (1 = Extremely bad mood, 100 = Extremely good mood). Those who received light therapy showed a small but statistically significant improvement in mood; light therapy participants had an average mood score of 61.88; 2.75 points higher than those who did not have the light therapy who scored an average of 59.13 on the mood test. Using a .05 α level, the p value of .025 suggests that this difference is statistically significant, hence, we reject H_0 . For those tested, it appears that light therapy provided some relief from depressive symptoms, hence supporting H_1 .

Exercise 5.7, Data Set B

(a)

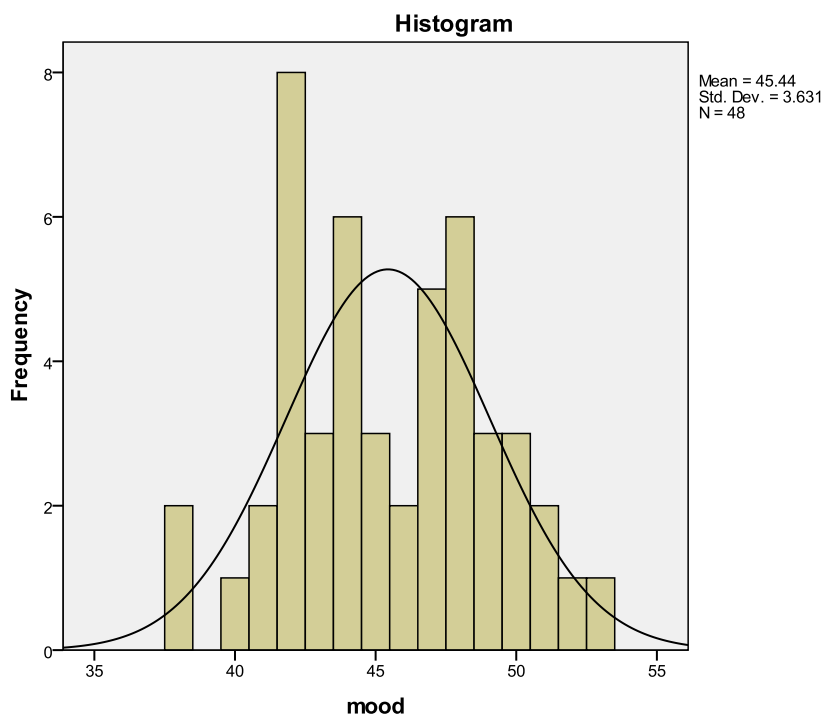
H_0 : Light therapy has no effect on depression.

H_1 : Light therapy is effective in reducing depression.

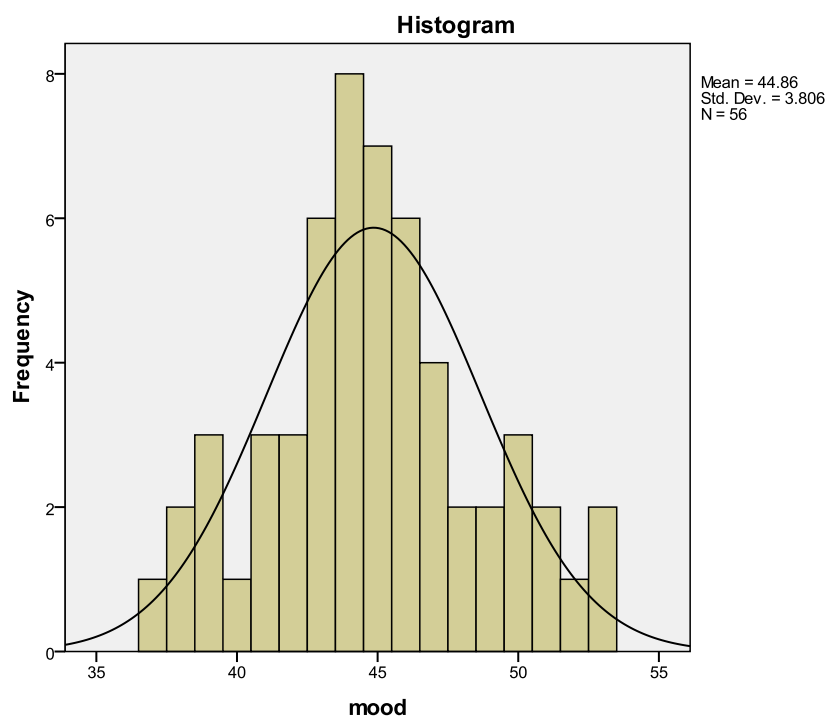
(b)

Despite the spike in the histogram for the No light therapy group (the tall bar at around 42), the histograms with normal curve plots show a normal distribution of *mood* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *mood* in Group 1 (No light therapy)



Normal distribution for *mood* in Group 2 (Light therapy: even days)



Test of Homogeneity of Variances

mood

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| .119 | 1 | 102 | .731 |

The homogeneity of variance score for *mood* shows a significance (p) of .731; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for the groups are 48 and 56 (see *Descriptives* table below); these figures exceed the 30 per group minimum criterion.

(c)

The t test revealed the following:

Descriptives

Mood

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|--------------------------|-----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| No light therapy | 48 | 45.44 | 3.631 | .524 | 44.38 | 46.49 | 38 | 53 |
| Light therapy: even days | 56 | 44.86 | 3.806 | .509 | 43.84 | 45.88 | 37 | 53 |
| Total | 104 | 45.13 | 3.720 | .365 | 44.40 | 45.85 | 37 | 53 |

ANOVA

Mood

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|------|------|
| Between Groups | 8.705 | 1 | 8.705 | .627 | .430 |
| Within Groups | 1416.670 | 102 | 13.889 | | |
| Total | 1425.375 | 103 | | | |

The mean mood level for those in the control group (No light therapy) is 45.44, whereas those in the treatment group (Light therapy: even days) had a mean mood level of 44.86. Unexpectedly, the mood for those who received no light therapy was .58 points higher than those who did, however, since the significance (p) is .430 (which is greater than the .05 α level), this difference is not considered to be statistically significant.

(d)

In order to determine if light therapy is a viable supplement to treating depressed individuals, 104 participants with a diagnosis of depression were randomly assigned to one of two groups: In addition to their regular care, 56 subjects received light therapy for 1 hour every other day; the other 48 participants received none. After 30 days, all participants completed the Acme Mood Scale, a 10 question survey that renders a score from 1 to 100 (1 = Extremely bad mood, 100 = Extremely good mood). Contrary to expectations, on the average, those in the Light therapy group scored 44.86; about a half point (.58) lower than those who had no light therapy, who had an average mood score of 45.44. Using a .05 α level, the p value of .430 suggests that this difference is not statistically significant, hence, we do not reject H_0 . For those tested, it appears that light therapy did not have a significant impact on their mood.

Exercise 5.9, Data Set A

(a)

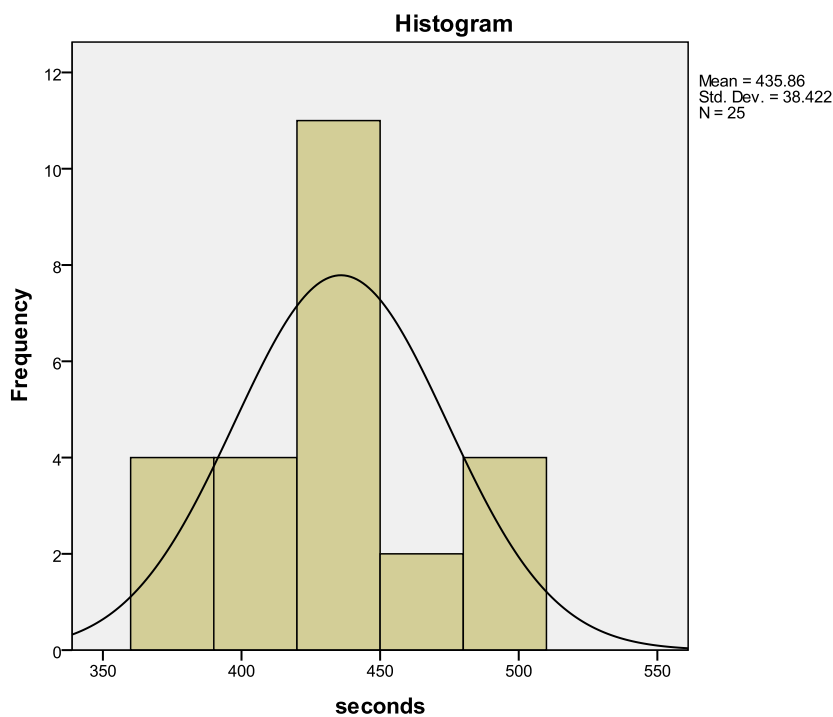
H_0 : The Acme reading lamp is no different from regular room lighting when it comes to reading speed.

H_1 : The Acme reading lamp facilitates faster reading speed than regular room lighting.

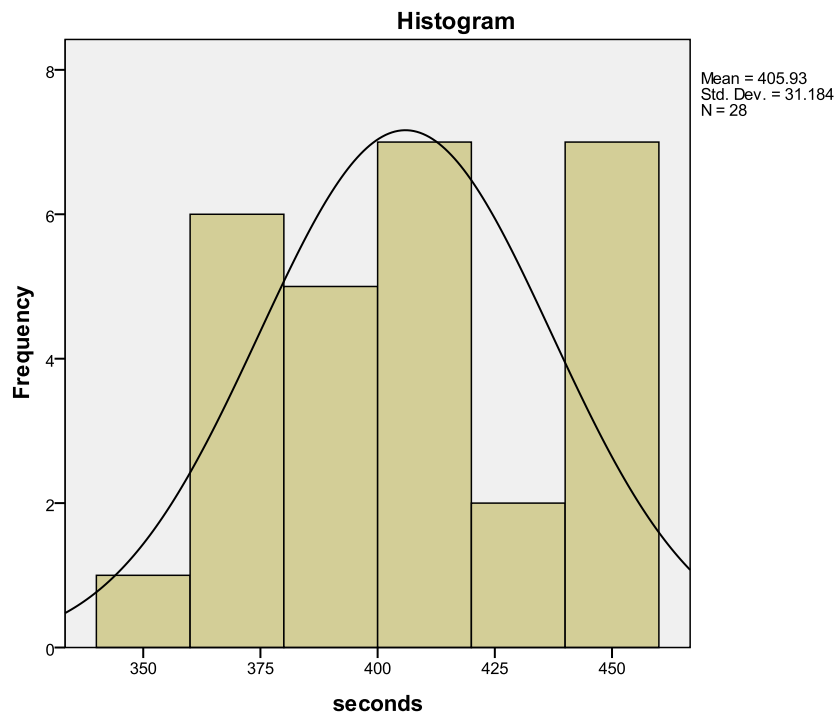
(b)

Histograms with normal curve plots show a normal distribution of *seconds* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *seconds* in Group 1 (Room lighting)



Normal distribution for *seconds* in Group 2 (Acme reading lamp)



Test of Homogeneity of Variances

| seconds | | | |
|------------------|-----|-----|------|
| Levene Statistic | df1 | df2 | Sig. |
| .217 | 1 | 51 | .643 |

The homogeneity of variance score for *seconds* shows a significance (p) of .643; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The Room lighting group had an n of 25, and the Acme lamp group had an n of 28 (see *Descriptives* table below); these figures are close to the minimal quota of 30 per group. The findings of the t test would be more robust if the n s were slightly higher for these groups.

(c)

The t test revealed the following:

Descriptives

seconds

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---------------|----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| Room lighting | 25 | 435.86 | 38.422 | 7.684 | 420.00 | 451.72 | 374 | 509 |
| Acme lamp | 28 | 405.93 | 31.184 | 5.893 | 393.84 | 418.02 | 357 | 455 |
| Total | 53 | 420.05 | 37.601 | 5.165 | 409.68 | 430.41 | 357 | 509 |

ANOVA

seconds

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Between Groups | 11835.678 | 1 | 11835.678 | 9.785 | .003 |
| Within Groups | 61685.335 | 51 | 1209.516 | | |
| Total | 73521.012 | 52 | | | |

The mean reading time for Group 1 (Room lighting) is 436 seconds (rounded), whereas the mean reading time for Group 2 (Acme reading lamp) is 406 seconds (rounded). This 30-second difference is statistically significant since the significance (p) is .003 (which is less than the .05 α level).

(d)

This study analyzed the effects that the Acme reading lamp had on reading speed. The 53 subjects were randomly assigned to one of two groups; one group read a 1,000 word essay using regular room lighting, and the other group read the same essay using the new Acme reading lamp. Results revealed that on the average, those who read using the Acme reading lamp completed the essay 30 seconds earlier than those who used regular room lighting to read the essay (406 seconds vs. 436 seconds, respectively). Using a .05 α level, the p value of .003 suggests that the Acme reading lamp facilitates prompter reading speeds; hence, we reject H_0 . These findings suggest support for H_1 ; specifically, that the Acme reading lamp enhances reading rates.

Exercise 5.9, Data Set B

(a)

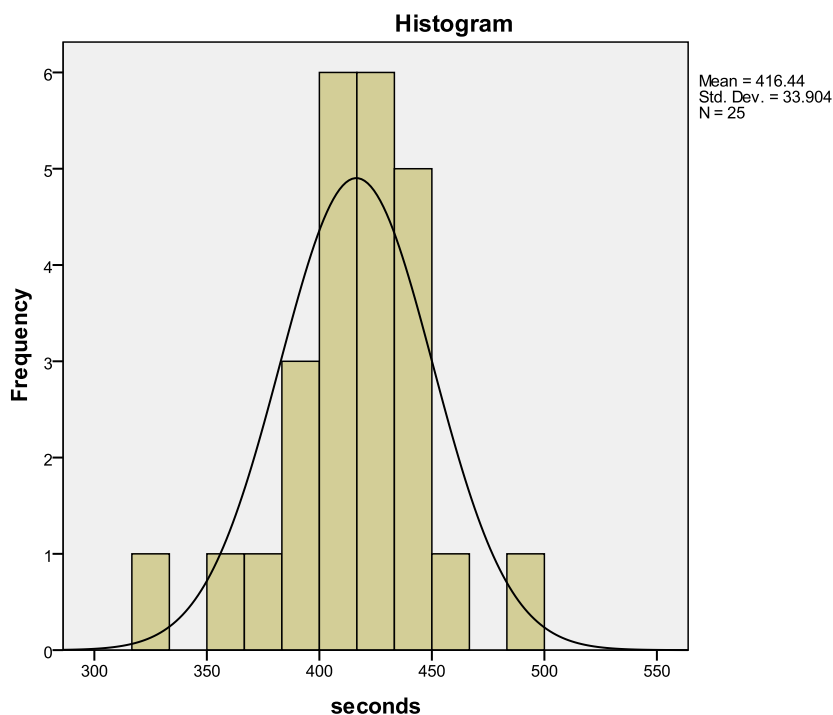
H_0 : The Acme reading lamp is no different from regular room lighting when it comes to reading speed.

H_1 : The Acme reading lamp facilitates faster reading speed than regular room lighting.

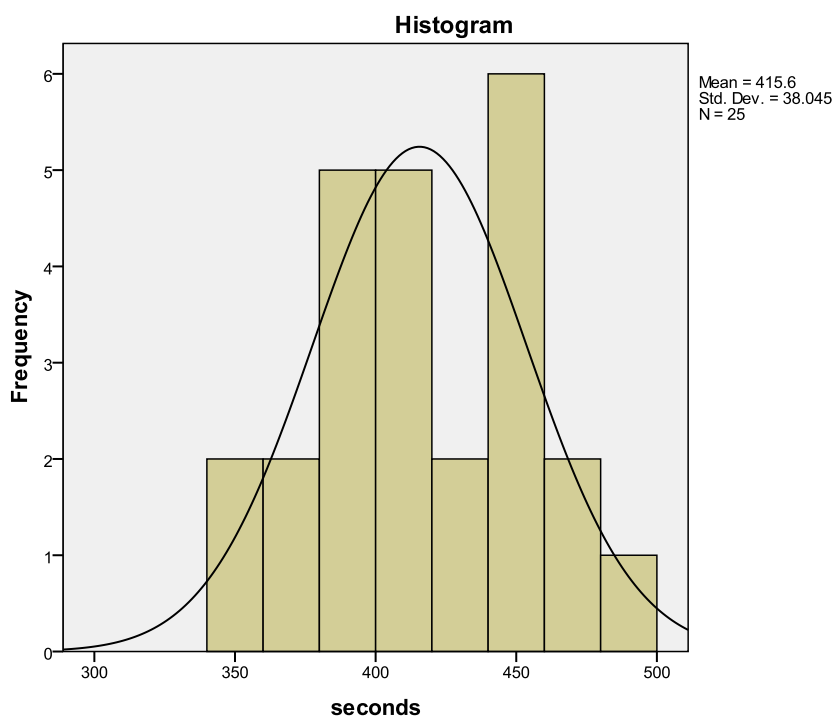
(b)

Histograms with normal curve plots show a normal distribution of *seconds* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *seconds* in Group 1 (Room lighting)



Normal distribution for *seconds* in Group 2 (Acme reading lamp)



Test of Homogeneity of Variances

| seconds | | | |
|------------------|-----|-----|------|
| Levene Statistic | df1 | df2 | Sig. |
| .785 | 1 | 48 | .380 |

The homogeneity of variance score for *seconds* shows a significance (p) of .380; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group is 25 (see *Descriptives* table below), which is close to the minimal quota of 30 per group. The findings of the t test would be more robust if the ns were slightly higher.

(c)

The t test revealed the following:

Descriptives

seconds

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---------------|----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| Room lighting | 25 | 416.44 | 33.904 | 6.781 | 402.44 | 430.44 | 331 | 489 |
| Acme lamp | 25 | 415.60 | 38.045 | 7.609 | 399.90 | 431.30 | 344 | 481 |
| Total | 50 | 416.02 | 35.667 | 5.044 | 405.88 | 426.16 | 331 | 489 |

ANOVA

seconds

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|------|------|
| Between Groups | 8.820 | 1 | 8.820 | .007 | .935 |
| Within Groups | 62326.160 | 48 | 1298.462 | | |
| Total | 62334.980 | 49 | | | |

The mean reading time for Group 1 (Room lighting) is 416.44 seconds, whereas the mean reading time for Group 2 (Acme reading lamp) is 415.60 seconds. This .84-second difference is statistically insignificant since the significance (p) is .935 (which is less than the .05 α level).

(d)

This study analyzed the effects that the Acme reading lamp had on reading speed. The 50 subjects were randomly assigned to one of two groups; half read a 1,000 word essay using regular room lighting, and the other half read the same essay using the new Acme reading lamp. Results revealed that, on average, those who read using the Acme reading lamp completed the essay about 1 second (.86 seconds) earlier than those who used regular room lighting read the essay (415.60 seconds vs. 416.44 seconds respectively). Using a .05 α level, the p value of .935 suggests that the Acme reading lamp does not facilitate significantly prompter reading speeds; hence, we do not reject H_0 . The claim that the Acme Company made, that this lamp increases reading speed, is not supported by these findings.