**Problem 1.**

(a). 

(b). 

Assumptions:

This is a comparing between several population means that based on independent SRS from each population. We assume all the populations are normal and they have the same StDev.

The study used three groups of rat to compare a control group that the rats were fed either a low dose or a high dose of isoflavones from kudzu.

Null hypothesis:

H0: µ1 = µ2 = µ3

Ha: At least one of them is different.

The significant level is at 5%.

(c). **One-way ANOVA: BMD versus Treatment**

Source DF SS MS F P

Treatment 2 0.003186 0.001593 7.72 0.001

Error 42 0.008668 0.000206

Total 44 0.011853

S = 0.01437 R-Sq = 26.88% R-Sq(adj) = 23.39%

Individual 95% CIs For Mean Based on

Pooled StDev

Level N Mean StDev --+---------+---------+---------+-------

Control 15 0.21887 0.01159 (-------\*------)

HighDose 15 0.23507 0.01877 (------\*-------)

LowDose 15 0.21593 0.01151 (-------\*------)

--+---------+---------+---------+-------

0.210 0.220 0.230 0.240

Pooled StDev = 0.01437

Grouping Information Using Tukey Method

Treatment N Mean Grouping

HighDose 15 0.23507 A

Control 15 0.21887 B

LowDose 15 0.21593 B

Means that do not share a letter are significantly different.

Tukey 95% Simultaneous Confidence Intervals

All Pairwise Comparisons among Levels of Treatment

Individual confidence level = 98.07%

Treatment = Control subtracted from:

Treatment Lower Center Upper

HighDose 0.00344 0.01620 0.02896

LowDose -0.01569 -0.00293 0.00983

Treatment +---------+---------+---------+---------

HighDose (-------\*-------)

LowDose (-------\*-------)

+---------+---------+---------+---------

-0.032 -0.016 0.000 0.016

Treatment = HighDose subtracted from:

Treatment Lower Center Upper

LowDose -0.03189 -0.01913 -0.00637

Treatment +---------+---------+---------+---------

LowDose (-------\*-------)

+---------+---------+---------+---------

-0.032 -0.016 0.000 0.016

(d). **Grouping Information Using Tukey Method**

Treatment N Mean Grouping

HighDose 15 0.23507 A

Control 15 0.21887 B

LowDose 15 0.21593 B

Means that do not share a letter are significantly different.

Tukey 95% Simultaneous Confidence Intervals

All Pairwise Comparisons among Levels of Treatment

Individual confidence level = 98.07%

Treatment = Control subtracted from:

Treatment Lower Center Upper

HighDose 0.00344 0.01620 0.02896

LowDose -0.01569 -0.00293 0.00983

Treatment +---------+---------+---------+---------

HighDose (-------\*-------)

LowDose (-------\*-------)

+---------+---------+---------+---------

-0.032 -0.016 0.000 0.016

Treatment = HighDose subtracted from:

Treatment Lower Center Upper

LowDose -0.03189 -0.01913 -0.00637

Treatment +---------+---------+---------+---------

LowDose (-------\*-------)

+---------+---------+---------+---------

-0.032 -0.016 0.000 0.016

**Grouping Information Using Fisher Method**

Treatment N Mean Grouping

HighDose 15 0.23507 A

Control 15 0.21887 B

LowDose 15 0.21593 B

Means that do not share a letter are significantly different.

Fisher 95% Individual Confidence Intervals

All Pairwise Comparisons among Levels of Treatment

Simultaneous confidence level = 87.97%

Treatment = Control subtracted from:

Treatment Lower Center Upper

HighDose 0.00561 0.01620 0.02679

LowDose -0.01352 -0.00293 0.00765

Treatment +---------+---------+---------+---------

HighDose (------\*------)

LowDose (------\*------)

+---------+---------+---------+---------

-0.030 -0.015 0.000 0.015

Treatment = HighDose subtracted from:

Treatment Lower Center Upper

LowDose -0.02972 -0.01913 -0.00855

Treatment +---------+---------+---------+---------

LowDose (------\*------)

+---------+---------+---------+---------

-0.030 -0.015 0.000 0.015

We can conclude that the means of control is significantly different to the other treatment mean levels of high dose, because the confidence interval for their differences does not contain 0. But the treatment control is not significant to the treatment low dose.

We can also see that the difference of means related to high dose is significantly different to the low dose, because the confidence interval for their differences does not contain 0.

(e). According to the output we have the value of the test statistic is F = 7.72. P-value is 0.001. Since the P-value is smaller than the significant level 5%, we reject the null hypothesis. We can conclude that there is no effect of kudzu isoflavones on the femur of the rat.

**Problem 2.**

(a). ****

(b). ****

**Descriptive Statistics: Insects**

Total

Variable Color Count Mean StDev

Insects Blue 6 14.83 5.34

Green 6 31.50 9.91

Lemon 6 47.17 6.79

White 6 15.67 3.33

(c)(d). Assumption is not satisfied for these data, because the largest StDev is 9.91, which is twice larger than the smallest one 3.33.

We still going to do that though.

Null hypothesis:

H0: µ1 = µ2 = µ3  = µ4 = µ5 = µ6

Ha: Not all µi are equal.

**One-way ANOVA: Insects versus Color**

Source DF SS MS F P

Color 3 4218.5 1406.2 30.55 0.000

Error 20 920.5 46.0

Total 23 5139.0

S = 6.784 R-Sq = 82.09% R-Sq(adj) = 79.40%

Individual 95% CIs For Mean Based on

Pooled StDev

Level N Mean StDev --+---------+---------+---------+-------

Blue 6 14.833 5.345 (---\*----)

Green 6 31.500 9.915 (----\*----)

Lemon 6 47.167 6.795 (----\*----)

White 6 15.667 3.327 (----\*----)

--+---------+---------+---------+-------

12 24 36 48

Pooled StDev = 6.784

(e). Grouping Information Using Tukey Method

Color N Mean Grouping

Lemon 6 47.167 A

Green 6 31.500 B

White 6 15.667 C

Blue 6 14.833 C

Means that do not share a letter are significantly different.

Tukey 95% Simultaneous Confidence Intervals

All Pairwise Comparisons among Levels of Color

Individual confidence level = 98.89%

Color = Blue subtracted from:

Color Lower Center Upper -------+---------+---------+---------+--

Green 5.699 16.667 27.634 (----\*---)

Lemon 21.366 32.333 43.301 (---\*---)

White -10.134 0.833 11.801 (---\*----)

-------+---------+---------+---------+--

-25 0 25 50

Color = Green subtracted from:

Color Lower Center Upper -------+---------+---------+---------+--

Lemon 4.699 15.667 26.634 (---\*----)

White -26.801 -15.833 -4.866 (----\*---)

-------+---------+---------+---------+--

-25 0 25 50

Color = Lemon subtracted from:

Color Lower Center Upper -------+---------+---------+---------+--

White -42.468 -31.500 -20.532 (---\*----)

-------+---------+---------+---------+--

-25 0 25 50

Grouping Information Using Fisher Method

Color N Mean Grouping

Lemon 6 47.167 A

Green 6 31.500 B

White 6 15.667 C

Blue 6 14.833 C

Means that do not share a letter are significantly different.

Fisher 95% Individual Confidence Intervals

All Pairwise Comparisons among Levels of Color

Simultaneous confidence level = 80.83%

Color = Blue subtracted from:

Color Lower Center Upper ------+---------+---------+---------+---

Green 8.496 16.667 24.837 (---\*--)

Lemon 24.163 32.333 40.504 (--\*--)

White -7.337 0.833 9.004 (--\*---)

------+---------+---------+---------+---

-25 0 25 50

Color = Green subtracted from:

Color Lower Center Upper ------+---------+---------+---------+---

Lemon 7.496 15.667 23.837 (--\*---)

White -24.004 -15.833 -7.663 (---\*--)

------+---------+---------+---------+---

-25 0 25 50

Color = Lemon subtracted from:

Color Lower Center Upper ------+---------+---------+---------+---

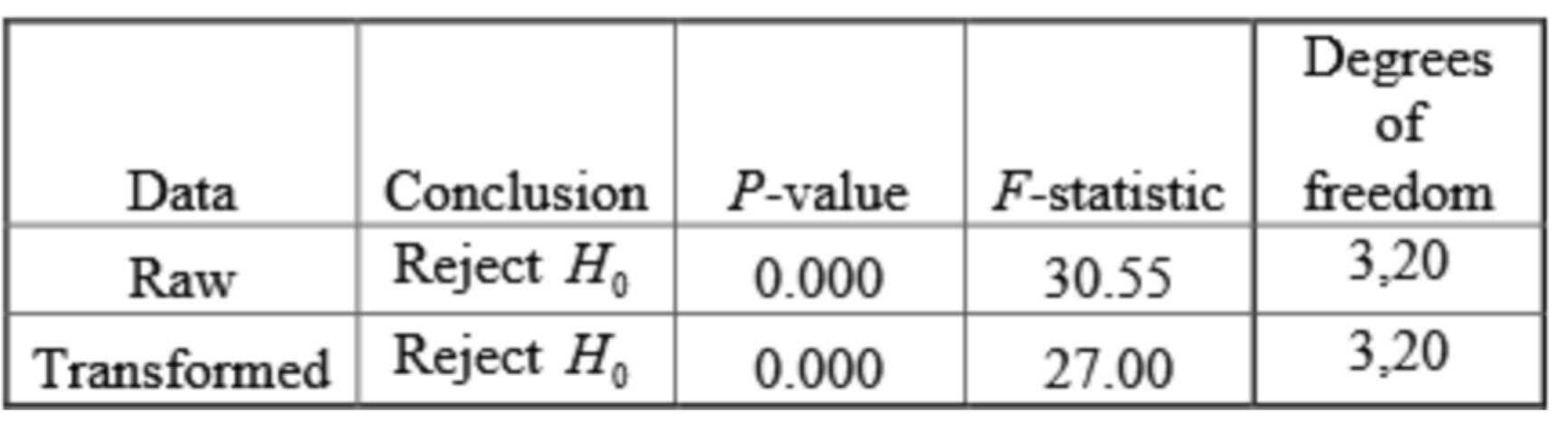
White -39.670 -31.500 -23.330 (--\*---)

------+---------+---------+---------+---

-25 0 25 50

(f). From the output we have F = 27, degrees of freedom = 3, 20. P-value is 0.000.

Since the P-value is smaller than the level of significance 0.05, we reject null hypothesis. Therefore, we can conclude that there is difference in the means of four color groups.



In Tukey Method, 99% confidence interval is needed to make sure the error is 5%.

In Fisher Method, 80.83% confidence interval is needed to make sure the error is 5%.

Lemon is the best, green is ok, blue and white are not statistically significantly different.