Assignment 6 407

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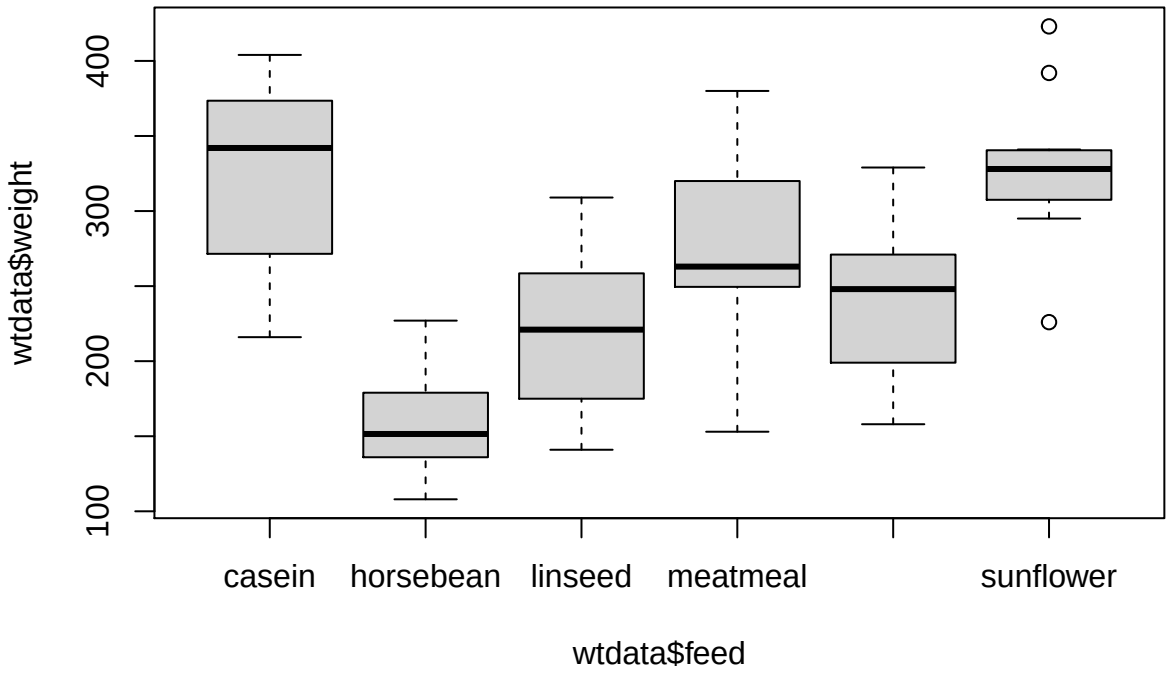
```
boxplot(wtdata$weight~wtdata$feed)
```




```
means = tapply(wtdata$weight, wtdata$feed, mean)
sds = tapply(wtdata$weight,wtdata$feed,sd)
```

Feed Type	Mean	Standard Deviation
casein	323.583	64.434
horsebean	160.2	38.626
linseed	218.75	52.236
meatmeal	276.909	64.901
soybean	246.429	54.129
sunflower	328.917	48.836

b)

From the box plots we can see that the means vary quite a lot between the groups, with the biggest difference

being from sunflower and horse bean where mean horse bean weight gain is less than half the mean of sunflower weight gain. There are also similar means between the groups, such as sunflower and casein. The soy bean diet is also similar in means to linseed and meatmeal. We can also see there are a couple outliers on the high end and one outlier on the low end of the sunflower diet group.

```
mi=min(sds)*2
ma = max(sds)
```

c)

Since the largest standard deviation is less than double the smallest standard deviation, the assumption of equal variance is valid for this problem. Max = 64.901 < 2 x Min = 2 x 38.626=77.252

Question 2

a)

The null hypothesis suggests that the mean weight gain is the same throughout all six populations of chicks being fed different diets. Whereas the alternative hypothesis suggests that at least two of the six population mean weight gains will differ between the six populations.

$H_0 : \mu_1 = \mu_2 = ... = \mu_6$
$H_A : \mu_i \neq \mu_j$ for at least one pair (i,j) where $i, j \in 1, 2, 3, 4, 5, 6$ $i \neq j$
μ_1 is the mean weight gain of the population of chicks fed casein
μ_2 is the mean weight gain of the population of chicks fed horse bean
μ_3 is the mean weight gain of the population of chicks fed linseed
μ_4 is the mean weight gain of the population of chicks fed meatmeal
μ_5 is the mean weight gain of the population of chicks fed soybean
μ_6 is the mean weight gain of the population of chicks fed sunflower

b)

```
results <- aov(weight ~ feed,data=wtdata)
anova(results)
```

```
## Analysis of Variance Table
##
## Response: weight
##           Df Sum Sq Mean Sq F value  Pr(>F)
## feed       5 231129   46226    15.4 5.9e-10 ***
## Residuals 65 195556    3009
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The estimate of σ is s = $\sqrt{MS_E} = \sqrt{3009} = 54.854$

c)

Since the p-value is $5.9 * 10^{-10} < \alpha$=0.05 we have strong evidence to reject the null hypothesis.

d)

After performing tests we have found strong evidence to suggest that the mean weight gain will differ between the populations of chicks being fed different diets.

Question 3

a)

```r
TukeyHSD(results, conf.level = 0.95)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = weight ~ feed, data = wtdata)
##
## $feed
##                         diff     lwr   upr p adj
## horsebean-casein    -163.38 -232.35 -94.4 0.000
## linseed-casein      -104.83 -170.59 -39.1 0.000
## meatmeal-casein      -46.67 -113.91  20.6 0.332
## soybean-casein       -77.15 -140.52 -13.8 0.008
## sunflower-casein       5.33  -60.42  71.1 1.000
## linseed-horsebean     58.55  -10.41 127.5 0.141
## meatmeal-horsebean   116.71   46.34 187.1 0.000
## soybean-horsebean     86.23   19.54 152.9 0.004
## sunflower-horsebean  168.72   99.75 237.7 0.000
## meatmeal-linseed      58.16   -9.07 125.4 0.128
## soybean-linseed       27.68  -35.68  91.0 0.793
## sunflower-linseed    110.17   44.41 175.9 0.000
## soybean-meatmeal     -30.48  -95.38  34.4 0.739
## sunflower-meatmeal    52.01  -15.22 119.2 0.221
## sunflower-soybean     82.49   19.13 145.9 0.004
```

```r
feeds = levels(as.factor(wtdata$feed))
```

160.2	218.75	246.429	276.909	323.583	328.917
horsebean	linseed	soybean	meatmeal	casein	sunflower

b)

From the pairwise experiments we can see that the mean weight gain for populations chicks fed casein, meatmeal, and sunflower are not significantly different. The mean weight gain for populations of chicks fed horsebean, and linseed are not significantly different. The mean weight gain for the populations of chicks fed linseed, meatmeal, and soybeans are not significantly different.

c)

The feed supplements that are most effictive in producing the heaviest chicks are casein, and sunflower