Question 1.2 (15 pts)

a. Results from the `t.test()` are shown in the Table 1.

Table 1. Results from two-sample t-test of diastolic blood pressure by diet type.

```
 Two Sample t-test with DBP by diet
t = 3.062, df = 12, p-value = 0.009861
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
  2.225 13.203
sample estimates:
    mean in group Fish mean in group Standard
                 6.571                 -1.143
```

b. Results from `anova()` and `summary()` are shown in Table 2 and Table 3 , respectively.

Table 2. Analysis of variance table for the diastolic blood pressure by diet type.

```
          Df Sum Sq Mean Sq F value Pr(>F)
diet       1    208   208.3    9.38 0.0099
Residuals 12    267    22.2
Total     13    475
```

Table 3. Coefficient results from the one-way ANOVA fit of diastolic blood pressure by diet type.

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept)      6.57       1.78    3.69   0.0031
dietStandard    -7.71       2.52   -3.06   0.0099
---
Residual standard error: 4.71 on 12 degrees of freedom
Multiple R-squared: 0.439,Adjusted R-squared: 0.392
F-statistic: 9.38 on 1 and 12 DF,  p-value: 0.00986
```

c. The overall p-value from the ANOVA table ($p = 0.0099$), for the slope coefficient ($p = 0.0099$), and for the two-sample t-test ($p = 0.0099$) are equal. With these p-values, very strong evidence to reject the null hypothesis exists. Thus, the group means appear to be different.

d. The intercept coefficient in the one-way ANOVA (6.57) is the same as the mean of the first (Fish) group in the two-sample t-test (6.57). This occurs because an intercept is defined as the "value of Y when X=0, on average" and the fish group is coded with a zero in `lm()`.

e. The difference in the means (i.e., -1.14-6.57 = -7.71) is the same as the slope coefficient in the one-way ANOVA model (i.e., -7.71). This is because the slope coefficient shows the change in Y (DBP) for a one "unit" change in X ("diet group"), which is a change from the "Fish" group (coded with a zero) to the "Standard" group (code with a one) because of the coding in `lm()`.

f. The df from the two-sample t-test (12) and the within df from the one-way ANOVA (12) are identical. The within df are equal to the total number of individuals ($n = n_1 + n_2$) minus the number of groups ($I = 2$), which is the same as for the two-sample t-test.

g. The F test statistic (9.38) is equal to the square of the t test statistic (3.06^2=9.38). This relationship occurs when the numerator df for the ANOVA is equal to one (i.e., there are only two groups).

h. The SE for the difference in means is equal to $\frac{\bar{x}_1 - \bar{x}_2}{t} = \frac{6.571429+1.142857}{3.0621} = 2.519280$. The pooled variance is then equal to this value divided by the sum of the reciprocals of the sample sizes – i.e., $\frac{SE^2_{\bar{x}_1-\bar{x}_2}}{\frac{1}{n_1}+\frac{1}{n_2}} = \frac{2.519280^2}{\frac{1}{7}+\frac{1}{7}} = 22.214$. This is the same as MS_{within} (Table 2).

R commands

```
> ## The three lines below are an alternative way to enter the data
> ##   using read.table() is likely easier
> DBP <- c(8,12,10,14,2,0,0,-6,0,1,2,-3,-4,2)
> diet <- factor(rep(c("Fish","Standard"),each=7))
> d <- data.frame(DBP,diet)
> t.test(DBP~diet,data=d,var.equal=TRUE)
> lm1 <- lm(DBP~diet,data=d)
> anova(lm1)
> summary(lm1)
> confint(lm1)
```