8.2.1(b)

```
> var1=c(32.1,30.6,33.7,29.7)
> var2=c(34.5,32.6,34.6,31.0)
> t.test(var1,var2,paired=TRUE)

        Paired t-test

data:  var1 and var2
t = -4.8833, df = 3, p-value = 0.01642
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -2.7253027 -0.5746973
```

Let muD be the population mean difference in the two varieties of wheat (lbs). Since p=0.016<0.05=alpha we reject H0: muD=0 at the 5% level. On average, variety 2 provides between 0.6 and 2.7 lbs more wheat per plot of land with 95% confidence.

8.2.4

```
> mcpp=    c( 1.1, 1.3, 1.0, 1.7, 1.4, 0.1, 0.5, 1.6,-0.5)
> placebo=c( 0.0,-0.3, 0.6, 0.3,-0.7,-0.2, 0.6, 0.9,-2.0)
> t.test(mcpp,placebo,paired=TRUE)

        Paired t-test

data:  mcpp and placebo
t = 4.1703, df = 8, p-value = 0.003121
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.4470396 1.5529604
```

Let muD be the population mean difference in weight loss (kgs) from MCPP vs. placebo. Since p=0.003<0.01=alpha, we reject H0: muD=0 at the 1% significance level. On average, C=MCPP provides between 0.4 and 1.6 kgs more weight loss than placebo with 95% confidence.

8.2.6

```
> treated=c(69.50,67.00,70.75,68.50,66.75,68.50,69.50,69.00,66.75,69.00,
+             69.50,69.00,70.50,68.00,69.00)
> control=c(70.00,69.00,69.50,69.25,67.75,66.50,68.75,70.00,66.75,68.50,
+             69.00,69.75,70.25,66.25,68.25)
> t.test(treated,control,paired=TRUE)

        Paired t-test

data:  treated and control
t = 0.4043, df = 14, p-value = 0.6921
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.5021850  0.7355184

> t.test(treated,control)

        Welch Two Sample t-test
```

```
data:   treated and control
t = 0.2535, df = 27.875, p-value = 0.8018
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.8262934   1.0596267
```

(a) The 95% confidence interval is (-0.50,0.74) degrees C.   This is done the correct way, pairing treated and untreated from the same carcass.
(b) The wrong 95% confidence interval is much (1.5 times) bigger, (-0.83,1.06).

8.4.5

Let etaD be the median difference in numbers of seizures from valproate vs. placebo within individuals. We want to test H0: etaD=0 versus HA: etaD<0, that valproate lowers the mean number of seizures.   We can use R's sum function to count the number of positive differences.

```
> placebo=   c(37,52,63, 2,25,29,15,52,19,12, 7, 9,65,52, 6,17,54,27,36, 5)
> valproate=c( 5,22,41, 4,32,20,10,25,17,14, 8, 8,30,22,11, 1,31,15,13, 5)
> sum(valproate-placebo>0)
[1] 5
> binom.test(5,20,alternative="less")

        Exact binomial test

data:   5 and 20
number of successes = 5, number of trials = 20, p-value = 0.02069
```

Since p=0.02<0.05=alpha, we reject H0: etaD=0 at the 5% level and conclude HA: etaD<0, that valproate significantly reduces the mean number of seizures within individuals.

8.4.6

Let etaD be the median difference in numbers of displays of dominance for Northern vs. Carolina.   We want to test H0: etaD=0 vs. HA: etaD not equal 0.

```
> northern=c( 0, 0, 0, 2, 0, 2, 1, 0)
> carolina=c( 9, 6,22,16,17,33,24,40)
> sum(northern-carolina>0)
[1] 0
> binom.test(0,8)

        Exact binomial test

data:   0 and 8
number of successes = 0, number of trials = 8, p-value = 0.007812
```

Since p=0.008<0.05=alpha, we reject H0: etaD=0 at the 5% level.   There is a signficant difference in dominance displays between pairs of birds.