Harris Spahic
"I pledge my honor I have abided by the Steven's Honor System."

Problem 12.31:

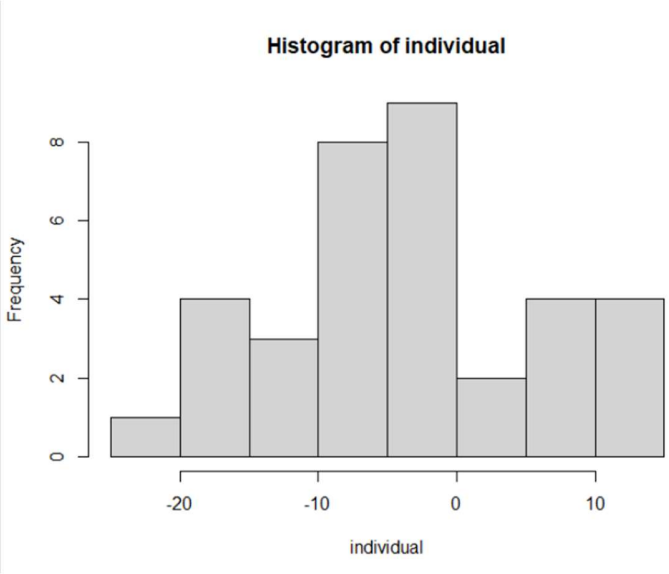
Part A:

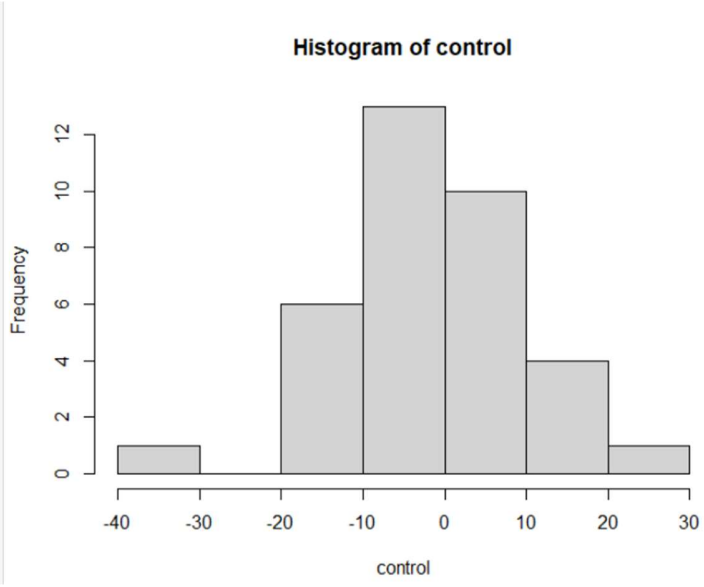
```
> data
  sample_sizes      means       sds
1           35  -1.008571 11.500726
2           35  -3.708571  9.078364
3           34 -10.785294 11.139151
```

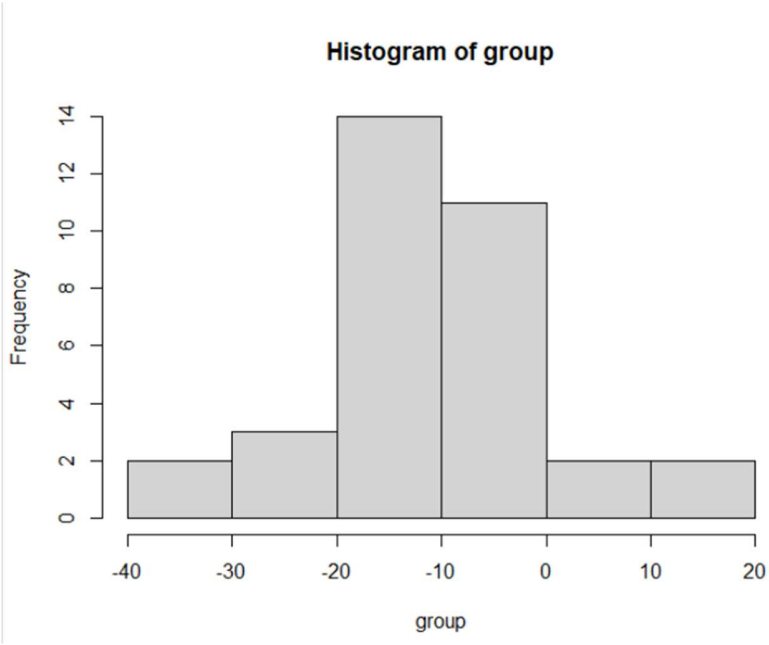
Part B:

```
Check for how similar greatest difference in SD's are
 2 * sd of minimum:  18.15673  >  11.50073 : greatest sd
 Since this implies ratio of largest dif in standard deviations, belongs to (0.5, 3) we can combine variances.
```

Part C:


Histogram of individual
Frequency
0
2
4
6
8
-20
-10
0
10
individual


Histogram of control
Frequency
0
2
4
6
8
10
12
-40
-30
-20
-10
0
10
20
30
control



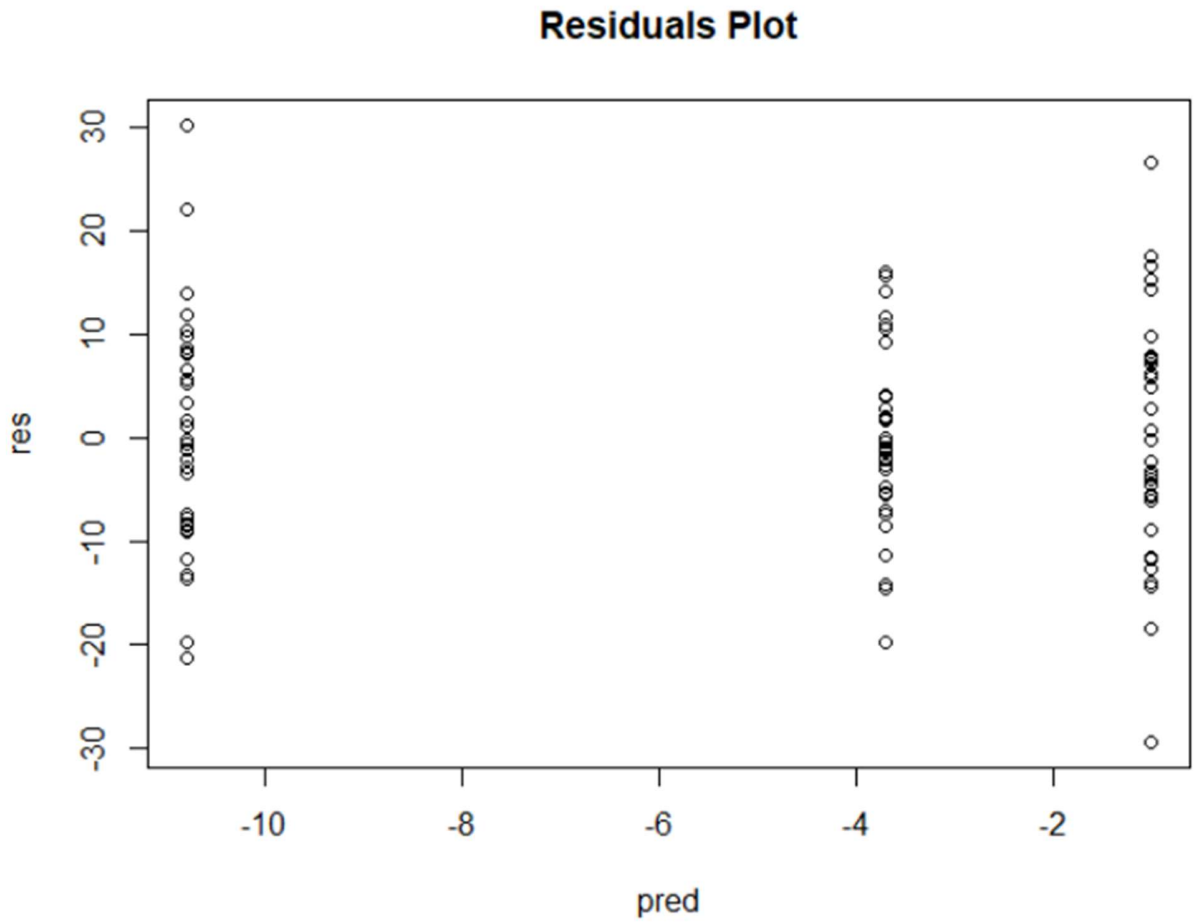
Control seems left skewed but other than that all graphs seem symmetric
Regardless, each sample is larger than 30 so we can assume normality.

Problem 12.32:

Part A:

```
            Df Sum Sq Mean Sq F value   Pr(>F)
ind          2   1753   876.3   7.768 0.000728 ***
Residuals  101  11394   112.8
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
1 observation deleted due to missingness
> # There is significant evidence to reject H0 since p-value = 0.001 << 0.05, meaning the means of at least 1 weight group is not
 the same.
> # F-value = 7.768,  df = 101
```

Part B:




```
# Data appears to be centered around 0 & normally distributed.
```

Part C:

```
# C

# We will do LSD tests on each pair of groups

# H0: mean1 = mean2
# Ha: mean1 != mean2

# Control & Individual: T_stat = 1.0886, p = 0.273 --> p > a & we dont have significant evidence to reject the null
# Control & Group: T_stat = 3.3097, p = 0.0013 --> p < a & we have significant evidence to say groups dont have same mean
# Individual & Group: T_stat = 2.7523, p = 0.007 --> p < a & we  have significant evidence to to say groups dont have same mean
```

Part D:

```
> # From both methods, we see the group-incentive program is significantly better than the control and individual groups. The group-incentive program has a lower mean than either of the two groups and our least-
significant differences test tells us that its mean is different.
```

Problem 12.41:

Part A:

```
> control
 [1]   2.3873874   1.7567568   7.4324324  -6.7117117  -0.1351351  -1.9369369 -13.6936937  -5.6306306  -6.9369369  -8.7837838  -2.9279279   6.0360360  -1.8918919   3.1081081  11.4864865  -0.1351351
[17]  -1.4414414   0.8558559  -2.9729730  -5.7207207  -0.5405405  -6.1711712   6.4414414   3.9639640   3.0630631  -3.1981982  -4.4594595  -2.5225225   6.9819820   2.1621622   2.7477477  -2.2072072
[33]   2.7477477   2.9729730  -2.0270270
> individual
 [1]  -3.06306306  -2.16216216   2.47747748   5.36036036  -4.05405405  -2.11711712  -4.09909910  -6.80180180  -0.72072072  -1.71171171   3.28828829  -2.83783784   5.58558559  -0.40540541  -0.85585586
[16]  -8.24324324   3.10810811  -8.01801802   4.68468468 -10.58558559   3.60360360  -2.56756757   0.22522523  -0.94594595  -2.25225225  -3.78378378   0.09009009   5.40540541  -2.52252252  -0.72072072
[31]  -4.81981982  -1.80180180  -4.95495495  -5.45045045  -6.80180180
> group
 [1]  -5.1351351  -3.2882883  -8.9189189  -6.1711712  -4.0540541 -10.0900901  -4.3243243   0.4954955  -1.1711712  -0.1801802  -1.1261261  -0.4504505  -0.9909910 -14.4594595 -13.7387387  -1.8468468
[17]  -8.1531532  -2.4774775  -6.3513514  -8.1981982  -4.9549550  -8.5585586   1.3963964  -5.4054054 -10.9909910  -5.0900901   5.0900901  -2.3423423  -5.8108108  -8.3783784   8.7387387  -8.6486486
[33] -10.7657658  -8.8288288          NA
```

Part B:

```
             Df Sum Sq Mean Sq F value   Pr(>F)
ind           2   1753   876.3   7.768 0.000728 ***
Residuals   101  11394   112.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
1 observation deleted due to missingness
>
> # Because we are multiplying by constant the normal distribution doesn't change
> # which means the anova test will give us the same P & F_value
```

Problem 12.41:

```
#A
#c1=μ2−(μ1+μ4)/2

#B
#c2=(μ1+μ2+μ4)/3−μ3
```

Problem 12.42:

Part A:

```
# H0: c1 = 0
# Ha: C1 != 0

# H0: c2 = 0
# Ha: c2 != 0
```

Part B:

```
> SC_c1 <- mean[2] - (mean[1] + mean[4]) / 2
> SC_c2 <- (mean[1] + mean[2] + mean[4]) / 3 - mean[3]
> SC_c1
[1] 0.195
> SC_c2
[1] 0.48
```

Part C:

```
> # C
>
> SE_c1 <- 0.3093
> SE_c2 <- 0.2929
>
> SE_c1
[1] 0.3093
> SE_c2
[1] 0.2929
```

Part D:

```
#t1 = 0.630, df = 218, P = 0.529.
#t2 = 1.639, df = 218, P = 0.1026.
#In both cases, P > $\alpha = 0.05$ and we fail to reject the null hypothesis on both contrasts.
```

Part E:

```
# E

# C1 confidence interval: (-0.41, -0.80)
# C2 confidence interval: (-.10, -1.06)
```