Hw 8

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Problem 1
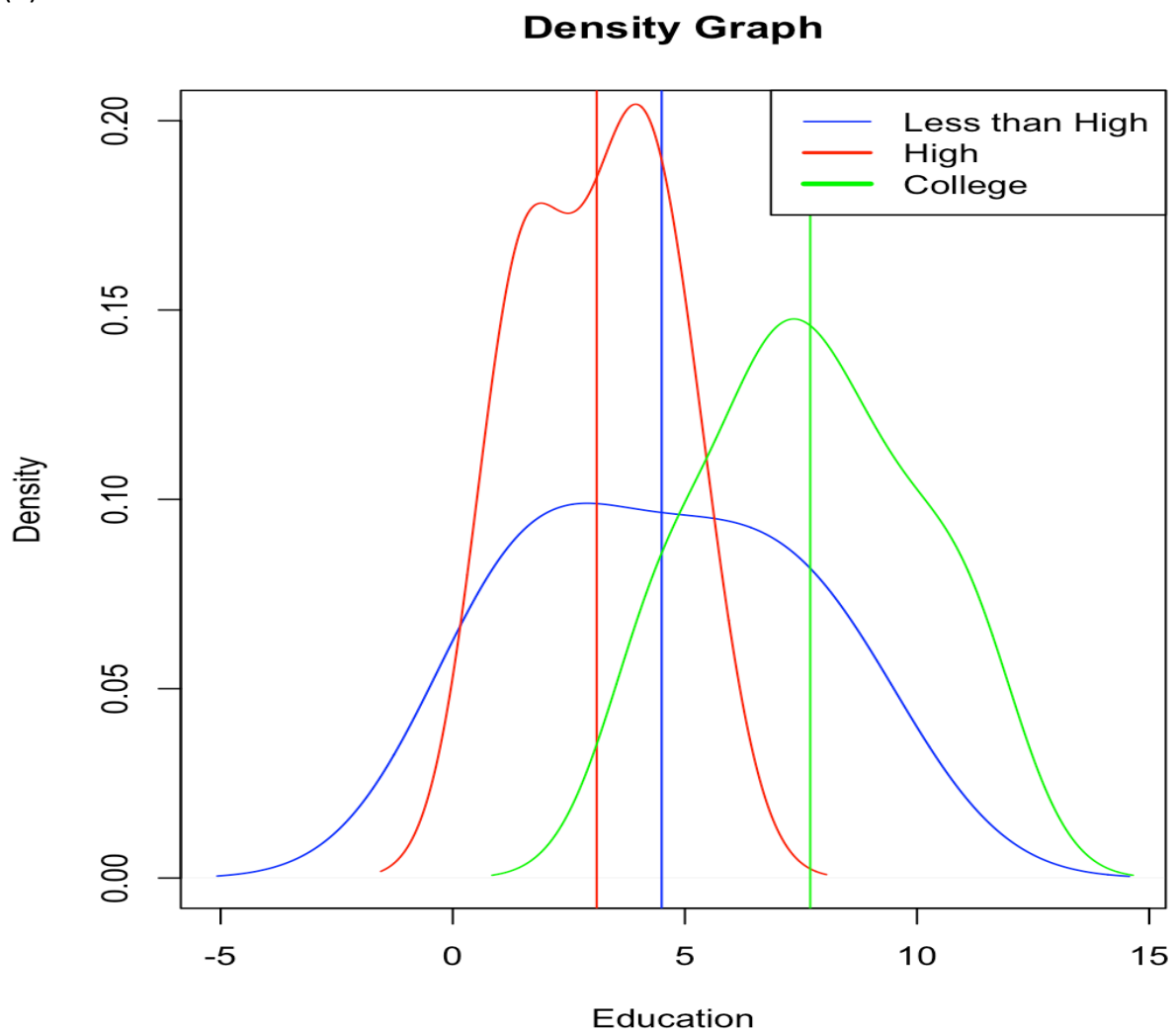
(a)

```
          Df Sum Sq Mean Sq F value Pr(>F)
education  2    55.6  27.800   4.601 0.0329 *
Residuals 12    72.5   6.042
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Since the p value is smaller than 0.05, we should reject the null hypothesis and adopt the alternative hypothesis that education has a significant effect on how long a mother breast-feeds her child.

(b)

Density Graph
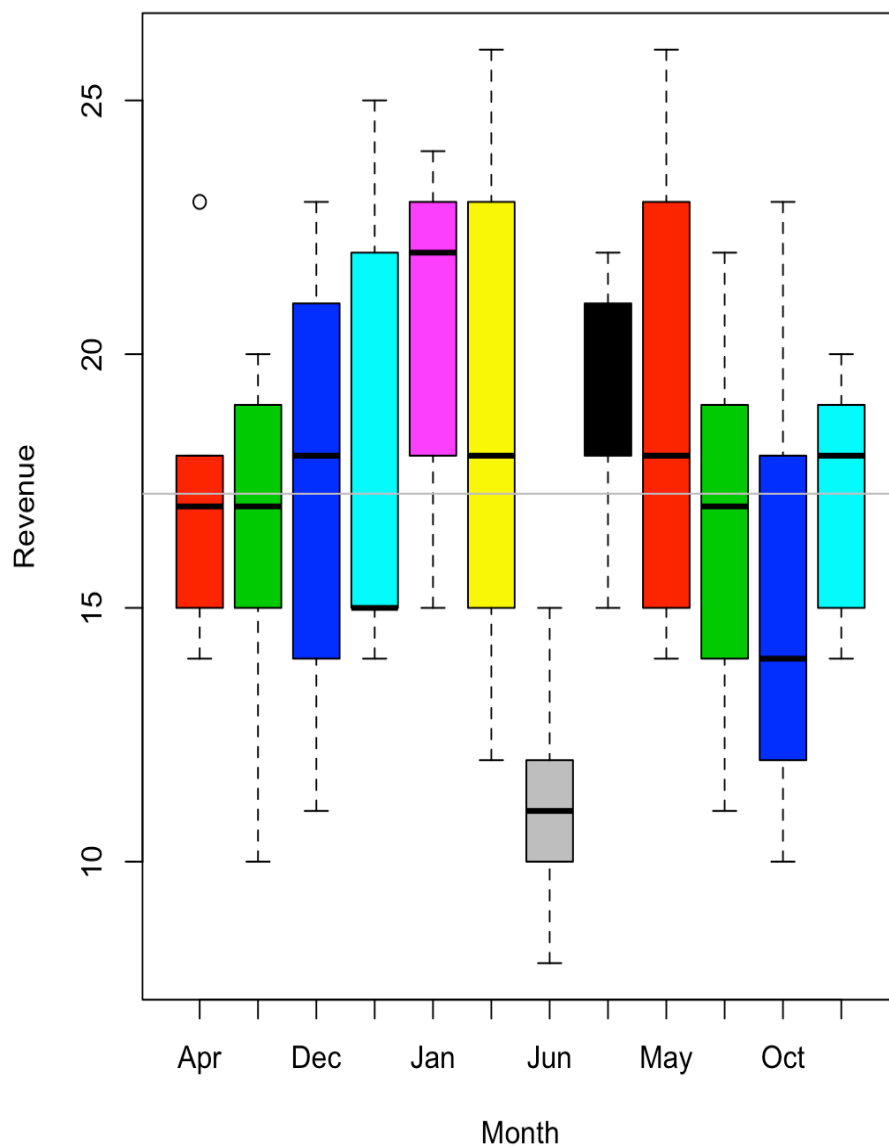
Problem 2

(a)
```
> summary(out2)
          Df Sum Sq Mean Sq F value Pr(>F)
month     11  308.4   28.04   1.500  0.166
year       4   44.2   11.04   0.591  0.671
Residuals 44  822.6   18.70
```
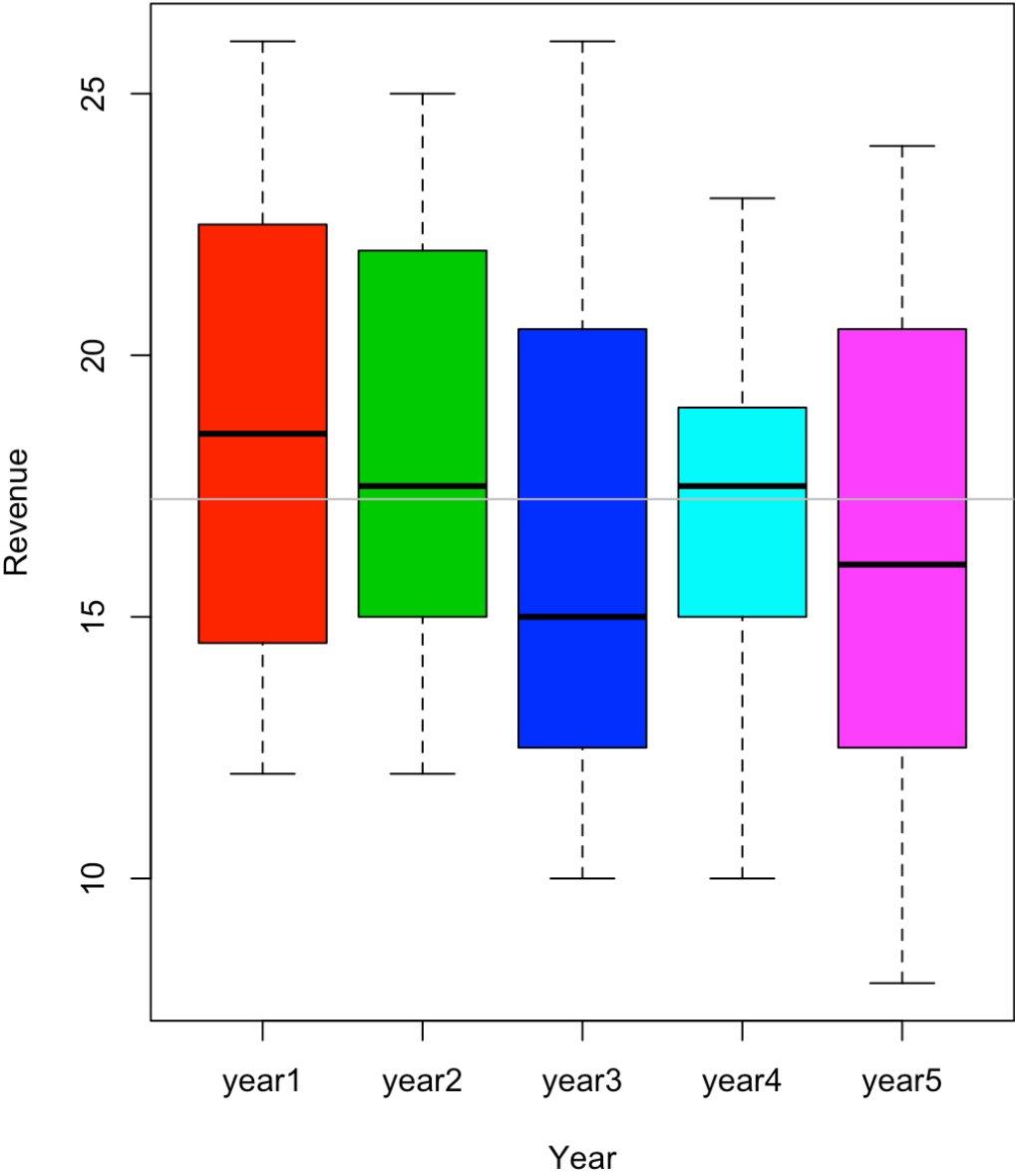
Checking the p value of month and year, we need to retain the null hypothesis, which is the means of revenue according to month and year are equal.

(b)

Revenue vs Month

Problem 3

(a)

```
> summary(out3)
            Df Sum Sq Mean Sq F value    Pr(>F)
Item         2  385.1   192.5   9.554  0.00149 **
Region       1  715.0   715.0  35.481 1.23e-05 ***
Item:Region  2  234.1   117.0   5.808  0.01132 *
Residuals   18  362.7    20.2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

From above, the p-value 0.0015 of item is smaller than 0.05, so the mean sales volume for the new menu items are not equal.

(b)

From above, since the p value of region is much smaller than 0.05, so the mean sales volume for the new menu items are not equal as well.

(c)

Since the p value 0.01 of interaction term is smaller than 0.05, we can say there is a interaction between item and region(coast location).

Problem 4

(a) Check the code.

```
> # Problem 4
> str(Baumann)
'data.frame':   66 obs. of  6 variables:
 $ group      : Factor w/ 3 levels "Basal","DRTA",..: 1 1 1 1 1 1 1 1 1 1 ...
 $ pretest.1  : int  4 6 9 12 16 15 14 12 12 8 ...
 $ pretest.2  : int  3 5 4 6 5 13 8 7 3 8 ...
 $ post.test.1: int  5 9 5 8 10 9 12 5 8 7 ...
 $ post.test.2: int  4 5 3 5 9 8 5 5 7 7 ...
 $ post.test.3: int  41 41 43 46 46 45 45 32 33 39 ...
```

(b)

```
> summary(fit)
            Df  Pillai approx F num Df den Df     Pr(>F)
group        2 0.40825   5.3005      6    124 6.765e-05 ***
Residuals   63
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(c) Since the p value of group is significantly smaller than 0.05, we reject the null hypothesis, and we can say post.test significantly differs by group. Hence, there is a significant difference among 3 groups ("Basal", "Strat", DRTA").