Exercises

1. Is there any relationship between a mother's education level and how long she breast-feeds her child? A curious researcher selects samples of mothers from three different education levels and determines their length of breast-feeding (measured in months). (a) Test the null hypothesis that education level has no effect on how long a mother breast-feeds her child. (b) Draw density plots for the three groups with mean lines.

Less Than High School	High Graduate	College Graduate
1.00	1.50	11.00
6.50	4.00	6.50
4.50	3.50	4.50
2.00	1.50	7.50
8.50	5.00	9.00

2. The director of a company has collected revenue (thousand dollars) for 5 years and under per month. You want to see if the revenue depends on the year and/or month, or if they are independent of these two factors.

(a) Test the null hypothesis that the means of revenue evaluated according to the months and years are equal. (b) Draw boxplots for Revene~Months and Revene~Year.

Months	Year 1	Year 2	Year 3	Year 4	Year 5
January	15	18	22	23	24
February	22	25	15	15	14
March	18	22	15	19	21
April	23	15	14	17	18
May	23	15	26	18	14
June	12	15	11	10	8
July	26	12	23	15	18
August	19	17	15	20	10
September	15	14	18	19	20
October	14	18	10	12	23
November	14	22	19	17	11
December	21	23	11	18	14

Exercises

3. A fast food franchise is test marketing 3 new menu items in both East and West Coasts of continental United States. To find out if they the same popularity, 12 franchisee restaurants from each Coast are randomly chosen for participation in the study. In accordance with the factorial design, within the 12 restaurants from East Coast, 4 are randomly chosen to test market the first new menu item, another 4 for the second menu item, and the remaining 4 for the last menu item. The 12 restaurants from the West Coast are arranged likewise.

East Coast:

	Item1	Item2	Item3
E1	25	39	36
E2	36	42	24
E3	31	39	28
E4	26	35	29

West Coast:

	Item1	Item2	Item3
W1	51	43	42
W2	47	39	36
W3	47	53	32
W4	52	46	33

Suppose the above tables represent the sales figures of the 3 new menu items after a week of test marketing. Each row in the upper table represents the sales figures of 3 different East Coast restaurants and Coast restaurants.

(a) At 0.05 level of significance, test whether the mean sales volume for the new menu items are all equal.

(b) Decide also whether the mean sales volume of the two coastal regions differs.

(c) Is there a interaction between the menu item and coast location.

http://www.r-tutor.com/elementary-statistics/analysis-variance/factorial-design

4. The Baumann data from the car package are an experimental study conducted by Baumann and Jones, as reported by Moore and McCabe (1993). Students were randomly assigned to one of three experimental groups. Conduct a one-way multivariate analysis of variance.
Dependent variables: post.test.1, post.test.2, post.test.3
Independent variable: group

[Reference]
D. S. Moore and G. P. McCabe, Introduction to the Practice of Statistics, Second Edition (Freeman, 1993) p. 794–795.

(a) Input Baumann data from the car library

(b) Conduct a one-way multivariate analysis of variance.

(c) Explain the results