F Distribution and One-Way ANOVA: Homework*

Susan Dean
Barbara Illowsky, Ph.D.

Abstract

This module provides a homework of F Distribution and One-Way ANOVA as a part of Collaborative Statistics collection (col10522) by Barbara Illowsky and Susan Dean.

Directions: Use a solution sheet to conduct the following hypothesis tests. The solution sheet can be found in the Table of Contents 14. Appendix.

Exercise 1 ***(Solution on p. 6.)***

Three students, Linda, Tuan, and Javier, are given 5 laboratory rats each for a nutritional experiment. Each rat's weight is recorded in grams. Linda feeds her rats Formula A, Tuan feeds his rats Formula B, and Javier feeds his rats Formula C. At the end of a specified time period, each rat is weighed again and the net gain in grams is recorded. Using a significance level of 10%, test the hypothesis that the three formulas produce the same mean weight gain.

Weights of Student Lab Rats

Linda's rats	Tuan's rats	Javier's rats
43.5	47.0	51.2
39.4	40.5	40.9
41.3	38.9	37.9
46.0	46.3	45.0
38.2	44.2	48.6

Table 1

Exercise 2

A grassroots group opposed to a proposed increase in the gas tax claimed that the increase would hurt working-class people the most, since they commute the farthest to work. Suppose that the

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group randomly surveyed 24 individuals and asked them their daily one-way commuting mileage. The results are below. Using a 5% significance level, test the hypothesis that the 3 mean commuting mileages are the same.

working-class	professional (middle incomes)	professional (wealthy)
17.8	16.5	8.5
26.7	17.4	6.3
49.4	22.0	4.6
9.4	7.4	12.6
65.4	9.4	11.0
47.1	2.1	28.6
19.5	6.4	15.4
51.2	13.9	9.3

Table 2

Exercise 3 ***(Solution on p. 6.)***

Refer to Exercise 13.8.1. Determine whether or not the variance in weight gain is statistically the same among Javier's and Linda's rats.

Exercise 4

Refer to Exercise 13.8.2 above (Exercise). Determine whether or not the variance in mileage driven is statistically the same among the working class and professional (middle income) groups.

For the next two problems, refer to the data from Terri Vogel's Log Book.
http://cnx.org/content/m17132/latest/?collection=col10522/latest/ [1]

Exercise 5 ***(Solution on p. 6.)***

Examine the 7 practice laps. Determine whether the mean lap time is statistically the same for the 7 practice laps, or if there is at least one lap that has a different mean time from the others.

Exercise 6

Examine practice laps 3 and 4. Determine whether or not the variance in lap time is statistically the same for those practice laps.

For the next four problems, refer to the following data.
The following table lists the number of pages in four different types of magazines.

home decorating	news	health	computer
172	87	82	104
286	94	153	136
163	123	87	98
205	106	103	207
197	101	96	146

Table 3

[1] http://cnx.org/content/m17132/latest/?collection=col10522/latest/

Exercise 7 *(Solution on p. 6.)*

Using a significance level of 5%, test the hypothesis that the four magazine types have the same mean length.

Exercise 8

Eliminate one magazine type that you now feel has a mean length different than the others. Redo the hypothesis test, testing that the remaining three means are statistically the same. Use a new solution sheet. Based on this test, are the mean lengths for the remaining three magazines statistically the same?

Exercise 9

Which two magazine types do you think have the same variance in length?

Exercise 10

Which two magazine types do you think have different variances in length?

Exercise 11 *(Solution on p. 6.)*

A researcher wants to know if the mean time (in minutes) that people watch their favorite news station are the same. Suppose that the table below shows the results of a study.

CNN	FOX	Local
45	15	72
12	43	37
18	68	56
38	50	60
23	31	51
35	22	

Table 4

Assume that all distributions are normal, the four population standard deviations are approximately the same, and the data were collected independently and randomly. Use a level of significance of 0.05.

Exercise 12

Are the means for the final exams the same for all statistics class delivery types? The table below shows the scores on final exams from several randomly selected classes that used the different delivery types.

Online	Hybrid	Face-to-Face
72	83	80
84	73	78
77	84	84
80	81	81
81		86
		79
		82

Table 5

Assume that all distributions are normal, the four population standard deviations are approximately the same, and the data were collected independently and randomly. Use a level of significance of 0.05.

Exercise 13 *(Solution on p. 6.)*

Are the mean number of times a month a person eats out same for whites, blacks, Hispanics and Asians? Suppose that the table below shows the results of a study.

White	Black	Hispanic	Asian
6	4	7	8
8	1	3	3
2	5	5	5
4	2	4	1
6		6	7

Table 6

Assume that all distributions are normal, the four population standard deviations are approximately the same, and the data were collected independently and randomly. Use a level of significance of 0.05.

Exercise 14

Are the mean number of daily visitors to a ski resort the same for the three types of snow conditions? Suppose that the table below shows the results of a study.

Powder	Machine Made	Hard Packed
1210	2107	2846
1080	1149	1638
1537	862	2019
941	1870	1178
	1528	2233
	1382	

Table 7

Assume that all distributions are normal, the four population standard deviations are approximately the same, and the data were collected independently and randomly. Use a level of significance of 0.05.

Exercise 15 *(Solution on p. 7.)*

Is the variance for the amount of money, in dollars, that shoppers spend on Saturdays at the mall the same as the variance for the amount of money that shoppers spend on Sundays at the mall? Suppose that the table below shows the results of a study.

Saturday	Sunday
75	44
62	137
18	58
0	82
150	61
124	39
94	19
50	127
62	99
31	141
73	60
118	73
	89

Table 8

Assume that both distributions are normal. Use a level of significance of 0.05.

Exercise 16

Are the variances for incomes on the East Coast and the West Coast the same? Suppose that the table below shows the results of a study. Income is shown in thousands of dollars.

East	West
38	71
47	126
30	42
82	51
75	44
52	90
115	88
67	

Table 9

Assume that both distributions are normal. Use a level of significance of 0.05.

**Exercises 11 - 16 were contributed by Dr. Larry Green

Solutions to Exercises in this Module

Solution to Exercise (p. 1)

a. H_o: $\mu_L = \mu_T = \mu_J$
c. $\text{df}(n) = 2$; $\text{df}(d) = 12$
e. 0.67
f. 0.5305
h. Decision: Do not reject null; Conclusion: There is insufficient evidence to conclude that the means are different.

Solution to Exercise (p. 2)

c. $\text{df}(n) = 4$; $\text{df}(d) = 4$
e. 3.00
f. $2(0.1563) = 0.3126$. Using the TI-83+/84+ function 2-SampFtest, you get the the test statistic as 2.9986 and p-value directly as 0.3127. If you input the lists in a different order, you get a test statistic of 0.3335 but the p-value is the same because this is a two-tailed test.
h. Decision: Do not reject null; Conclusion: There is insufficient evidence to conclude that the variances are different.

Solution to Exercise (p. 2)

c. $\text{df}(n) = 6$; $\text{df}(d) = 98$
e. 1.69
f. 0.1319
h. Decision: Do not reject null; Conclusion: There is insufficient evidence to conclude that the mean lap times are different.

Solution to Exercise (p. 3)

a. H_o: $\mu_d = \mu_n = \mu_h = \mu_c$
b. Alternate Hypothesis: At least one pair of means is different
c. $\text{df}(n) = 3$; $\text{df}(d) = 16$
e. 8.69
f. 0.0012
h. Decision: Reject null; Conclusion: There is sufficient evidence to conclude that the mean lengths are different.

Solution to Exercise (p. 3)

c: df(n) = 2; df(d) = 14
d: $F_{2,14}$
e: 4.08
f: 0.0401
h:
ii: Reject the null hypothesis
iv: There is sufficient evidence to conclude that the mean times are different.

Solution to Exercise (p. 4)

c: df(n) = 3; df(d) = 15
d: $F_{3,15}$
e: 0.8853
f: 0.4711

h:
ii: Do not reject the null hypothesis
iv: There is insufficient evidence to conclude that the mean number of times are different.

Solution to Exercise (p. 4)

c: df(n) = 11; df(d) = 12
d: $F_{11,12}$
e: 1.35
f: 0.6090
h:
ii: Do not reject the null hypothesis
iv: There is insufficient evidence to conclude that the variances are different.