

MATH 204: PRINCIPLES OF STATISTICS 2
WINTER 2026

EXERCISES ON HYPOTHESIS TESTING FOR EQUAL VARIANCES

In the following two-sample problems, with samples of size n_A and n_B , we wish to test the null hypothesis

$$H_0 : \sigma_A = \sigma_B$$

or equivalently

$$H_0 : \sigma_A^2 = \sigma_B^2$$

or

$$H_0 : \frac{\sigma_A^2}{\sigma_B^2} = 1$$

against the alternative, using the significance level α , as given in the question. The summary statistics needed are the sample mean and sample variance for the two samples, s_A^2 and s_B^2 .

We will test under the assumptions of

- Normality for both samples
- Independence of the samples

We will use the test statistic, F , where the observed value of the test statistic is computed as

$$F_{obs} = \frac{s_A^2}{s_B^2}.$$

If the null hypothesis is true, we have that the distribution of F is

$$F \sim F_{n_A-1, n_B-1}$$

that is the F-distribution with $n_A - 1$ and $n_B - 1$ degrees of freedom. If

- $H_a : \sigma_A \neq \sigma_B$, we use a two-tailed test, and reject H_0 if F_{obs} is too **large** or too **small**
- $H_a : \sigma_A > \sigma_B$, we use a right-tailed test, and reject H_0 if F_{obs} is too **large**
- $H_a : \sigma_A < \sigma_B$, we use a left-tailed test, and reject H_0 if F_{obs} is too **small**

Suitable tables of the F-distribution can be found here:

Math204-Winter2026-FTable.pdf

Carry out the tests at the $\alpha = 0.05$ level.

Problem	n_A	s_A^2	n_B	s_B^2	H_a
1	6	4.07	10	1.16	$\sigma_A \neq \sigma_B$
2	16	7.91	121	2.61	$\sigma_A > \sigma_B$
3	8	5.94	16	0.70	$\sigma_A < \sigma_B$
4	6	1.14	13	5.42	$\sigma_A < \sigma_B$
5	13	0.69	31	2.18	$\sigma_A > \sigma_B$
6	7	7.54	10	3.07	$\sigma_A \neq \sigma_B$
7	11	3.86	6	3.67	$\sigma_A < \sigma_B$
8	31	0.54	6	0.26	$\sigma_A \neq \sigma_B$
9	41	2.28	41	5.07	$\sigma_A < \sigma_B$
10	11	9.15	9	3.43	$\sigma_A \neq \sigma_B$
11	13	1.36	7	0.10	$\sigma_A < \sigma_B$
12	7	4.26	31	1.66	$\sigma_A < \sigma_B$
13	25	1.93	121	3.18	$\sigma_A \neq \sigma_B$
14	6	1.24	31	3.93	$\sigma_A < \sigma_B$
15	121	11.40	16	1.00	$\sigma_A \neq \sigma_B$
16	6	6.29	5	1.50	$\sigma_A > \sigma_B$
17	9	4.79	21	7.26	$\sigma_A \neq \sigma_B$
18	10	5.22	6	8.84	$\sigma_A \neq \sigma_B$
19	61	7.01	61	4.56	$\sigma_A < \sigma_B$
20	9	0.07	31	8.52	$\sigma_A > \sigma_B$
21	25	3.13	16	2.83	$\sigma_A > \sigma_B$
22	21	6.81	8	0.89	$\sigma_A < \sigma_B$
23	5	1.55	41	1.88	$\sigma_A < \sigma_B$
24	5	2.64	16	3.37	$\sigma_A \neq \sigma_B$
25	9	4.53	5	3.14	$\sigma_A < \sigma_B$

Problem	n_A	s_A^2	n_B	s_B^2	H_a
26	9	1.67	25	5.56	$\sigma_A > \sigma_B$
27	31	3.24	9	1.63	$\sigma_A < \sigma_B$
28	8	2.29	13	2.51	$\sigma_A < \sigma_B$
29	41	2.37	5	0.82	$\sigma_A < \sigma_B$
30	9	1.41	10	2.80	$\sigma_A < \sigma_B$
31	21	2.98	16	0.64	$\sigma_A < \sigma_B$
32	10	4.99	9	0.55	$\sigma_A < \sigma_B$
33	9	2.35	121	0.67	$\sigma_A > \sigma_B$
34	25	1.43	21	4.70	$\sigma_A \neq \sigma_B$
35	21	7.56	11	16.26	$\sigma_A < \sigma_B$
36	5	3.50	10	2.88	$\sigma_A > \sigma_B$
37	41	1.27	21	0.67	$\sigma_A < \sigma_B$
38	61	1.89	31	9.78	$\sigma_A < \sigma_B$
39	7	1.03	121	6.93	$\sigma_A > \sigma_B$
40	41	3.91	5	0.86	$\sigma_A \neq \sigma_B$
41	8	2.60	21	0.12	$\sigma_A \neq \sigma_B$
42	31	4.14	21	0.46	$\sigma_A < \sigma_B$
43	8	4.30	6	4.73	$\sigma_A < \sigma_B$
44	61	2.74	31	1.03	$\sigma_A > \sigma_B$
45	11	1.54	16	5.95	$\sigma_A \neq \sigma_B$
46	10	5.99	7	1.65	$\sigma_A > \sigma_B$
47	10	1.47	41	2.16	$\sigma_A \neq \sigma_B$
48	6	14.15	21	1.17	$\sigma_A > \sigma_B$
49	61	5.91	25	0.56	$\sigma_A < \sigma_B$
50	7	1.18	13	5.43	$\sigma_A < \sigma_B$

Solutions:

	Data					F_{obs}	Reject if F_{obs} is		Result
	n_A	s_A^2	n_B	s_B^2	H_a		below	above	
1	6	4.07	10	1.16	$\sigma_A \neq \sigma_B$	3.509	0.15	4.48	Reject
2	16	7.91	121	2.61	$\sigma_A > \sigma_B$	3.031	0.00	1.75	
3	8	5.94	16	0.70	$\sigma_A < \sigma_B$	8.486	0.28	Inf	
4	6	1.14	13	5.42	$\sigma_A < \sigma_B$	0.210	0.21	Inf	Reject
5	13	0.69	31	2.18	$\sigma_A > \sigma_B$	0.317	0.00	2.09	
6	7	7.54	10	3.07	$\sigma_A \neq \sigma_B$	2.456	0.18	4.32	
7	11	3.86	6	3.67	$\sigma_A < \sigma_B$	1.052	0.30	Inf	Reject
8	31	0.54	6	0.26	$\sigma_A \neq \sigma_B$	2.077	0.33	6.23	
9	41	2.28	41	5.07	$\sigma_A < \sigma_B$	0.450	0.59	Inf	
10	11	9.15	9	3.43	$\sigma_A \neq \sigma_B$	2.668	0.26	4.30	Reject
11	13	1.36	7	0.10	$\sigma_A < \sigma_B$	13.600	0.33	Inf	
12	7	4.26	31	1.66	$\sigma_A < \sigma_B$	2.566	0.26	Inf	
13	25	1.93	121	3.18	$\sigma_A \neq \sigma_B$	0.607	0.50	1.76	Reject
14	6	1.24	31	3.93	$\sigma_A < \sigma_B$	0.316	0.22	Inf	
15	121	11.40	16	1.00	$\sigma_A \neq \sigma_B$	11.400	0.51	2.46	
16	6	6.29	5	1.50	$\sigma_A > \sigma_B$	4.193	0.00	6.26	Reject
17	9	4.79	21	7.26	$\sigma_A \neq \sigma_B$	0.660	0.25	2.91	
18	10	5.22	6	8.84	$\sigma_A \neq \sigma_B$	0.590	0.22	6.68	
19	61	7.01	61	4.56	$\sigma_A < \sigma_B$	1.537	0.65	Inf	Reject
20	9	0.07	31	8.52	$\sigma_A > \sigma_B$	0.008	0.00	2.27	
21	25	3.13	16	2.83	$\sigma_A > \sigma_B$	1.106	0.00	2.29	
22	21	6.81	8	0.89	$\sigma_A < \sigma_B$	7.652	0.40	Inf	Reject
23	5	1.55	41	1.88	$\sigma_A < \sigma_B$	0.824	0.17	Inf	
24	5	2.64	16	3.37	$\sigma_A \neq \sigma_B$	0.783	0.12	3.80	
25	9	4.53	5	3.14	$\sigma_A < \sigma_B$	1.443	0.26	Inf	

	Data					F_{obs}	Reject if F_{obs} is		Result
	n_A	s_A^2	n_B	s_B^2	H_a		below	above	
26	9	1.67	25	5.56	$\sigma_A > \sigma_B$	0.300	0.00	2.36	
27	31	3.24	9	1.63	$\sigma_A < \sigma_B$	1.988	0.44	Inf	
28	8	2.29	13	2.51	$\sigma_A < \sigma_B$	0.912	0.28	Inf	
29	41	2.37	5	0.82	$\sigma_A < \sigma_B$	2.890	0.38	Inf	
30	9	1.41	10	2.80	$\sigma_A < \sigma_B$	0.504	0.30	Inf	
31	21	2.98	16	0.64	$\sigma_A < \sigma_B$	4.656	0.45	Inf	
32	10	4.99	9	0.55	$\sigma_A < \sigma_B$	9.073	0.31	Inf	
33	9	2.35	121	0.67	$\sigma_A > \sigma_B$	3.507	0.00	2.02	Reject
34	25	1.43	21	4.70	$\sigma_A \neq \sigma_B$	0.304	0.43	2.41	Reject
35	21	7.56	11	16.26	$\sigma_A < \sigma_B$	0.465	0.43	Inf	
36	5	3.50	10	2.88	$\sigma_A > \sigma_B$	1.215	0.00	3.63	
37	41	1.27	21	0.67	$\sigma_A < \sigma_B$	1.896	0.54	Inf	
38	61	1.89	31	9.78	$\sigma_A < \sigma_B$	0.193	0.61	Inf	Reject
39	7	1.03	121	6.93	$\sigma_A > \sigma_B$	0.149	0.00	2.18	
40	41	3.91	5	0.86	$\sigma_A \neq \sigma_B$	4.547	0.32	8.41	
41	8	2.60	21	0.12	$\sigma_A \neq \sigma_B$	21.667	0.22	3.01	Reject
42	31	4.14	21	0.46	$\sigma_A < \sigma_B$	9.000	0.52	Inf	
43	8	4.30	6	4.73	$\sigma_A < \sigma_B$	0.909	0.25	Inf	
44	61	2.74	31	1.03	$\sigma_A > \sigma_B$	2.660	0.00	1.74	Reject
45	11	1.54	16	5.95	$\sigma_A \neq \sigma_B$	0.259	0.28	3.06	Reject
46	10	5.99	7	1.65	$\sigma_A > \sigma_B$	3.630	0.00	4.10	
47	10	1.47	41	2.16	$\sigma_A \neq \sigma_B$	0.681	0.29	2.45	
48	6	14.15	21	1.17	$\sigma_A > \sigma_B$	12.094	0.00	2.71	Reject
49	61	5.91	25	0.56	$\sigma_A < \sigma_B$	10.554	0.59	Inf	
50	7	1.18	13	5.43	$\sigma_A < \sigma_B$	0.217	0.25	Inf	Reject