

# Practice 10

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## Question

A study was conducted on 50 pairs of twins. In each pair:

- twin 1 regularly exercised
- twin 2 was not involved in any sport activities.

The stress level for each study participant was recorded as a score from 0 to 100.

pair	twin1	twin2	difference
1	75.25909	65.98412	9.274965
2	43.47533	46.69892	-3.223586
3	76.59599	100.00000	-23.404015
4	75.44859	34.13983	41.308760
5	58.29283	56.35368	1.939153
6	19.20100	65.50424	-46.303241
7	31.42866	76.54730	-45.118640
8	44.10559	52.82129	-8.715704
9	49.88466	0.00000	49.884656
10	98.09307	20.09157	78.001499
11	65.27187	68.76187	-3.489998
12	34.01982	57.66864	-23.648821
13	27.04686	29.78053	-2.733665
14	44.21077	54.52524	-10.314472
15	44.01570	33.55094	10.464759
16	41.76978	65.26790	-23.498121
17	55.04447	15.24705	39.797421
18	32.16158	68.97823	-36.816656
19	58.71367	65.45238	-6.738714
20	25.24923	59.95865	-34.709414
21	45.51464	58.57469	-13.060049
22	57.54791	65.72015	-8.172238
23	52.66673	38.52970	14.137030
24	66.08379	54.42494	11.658853
25	48.85786	77.92407	-29.066206
26	60.07216	91.02907	-30.956914
27	71.71539	62.31314	9.402243
28	36.18092	54.46739	-18.286469
29	24.30801	30.63795	-6.329936
30	50.93452	14.87241	36.062111

pair	twin1	twin2	difference
31	45.28587	34.08731	11.198555
32	39.14223	95.62249	-56.480258
33	41.33379	81.16427	-39.830472
34	37.01057	51.41453	-14.403964
35	64.53501	45.25569	19.279323
36	73.03824	45.43060	27.607638
37	69.84321	87.90961	-18.066398
38	41.40974	49.72666	-8.316921
39	74.76608	95.68056	-20.914482
40	44.41307	77.40023	-32.987157
41	85.15806	96.97937	-11.821307
42	61.21492	31.80214	29.412785
43	40.94432	58.25113	-17.306808
44	33.35913	31.57385	1.785286
45	26.66859	75.88777	-49.219181
46	28.68819	61.59153	-32.903341
47	18.72436	49.53478	-30.810425
48	73.13074	100.00000	-26.869260
49	66.64094	64.87059	1.770355
50	45.45343	87.89632	-42.442892

The difference variable in the data set represents stress level of twin 1 minus stress levels of twin 2. Here are the sample mean and standard deviation for the difference.

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mean(difference)
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## [1] -7.679487
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sd(difference)
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## [1] 27.98065
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1. You want to test if sport influences average stress level. State null and alternative hypotheses in terms of the population average of the difference  $\mu_d$ .
2. Compute the 90% confidence interval for the difference.
3. Does the confidence interval cover zero? What conclusion can be drawn?
4. Now find the test statistics and estimate the p-value.
5. Draw a conclusion using p-value from 4. What significance level we need to use to make the results consisted with the conclusion from 3?
6. Perform statistical testing to check if sport reduces the stress level, use significance level  $\alpha = 0.01$ .
7. Suppose we know that sport has no influence on stress. What type of error did we make in 3?
8. Provide the reason why we may made this error.
9. Suppose we know that sport reduces the stress level. What type of error did we make in 6?
10. How can we reduce the probability to make this error?