

# Practice 11

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## Question 1

A study was conducted on 8 pairs on 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
1	75.25909	57.82698
2	43.47533	100.00000
3	76.59599	80.90780
4	75.44859	34.02972
5	58.29283	23.57029
6	19.20100	49.31615
7	31.42866	49.02355
8	44.10559	45.65467

1. You want to test if sport decreases the average stress level. State null and alternative hypotheses. What type of test is appropriate in this scenario?
2. Restate the hypotheses in terms of  $p$ , the probability to observe positive difference between stress levels of twins (twin 1 - twin 2).
3. What would be the test statistic for this test?
4. What would be the null distribution? Draw the null distribution.
4. What is the observed value of test statistic?
5. Find the p-value.
6. What conclusion can we draw at significance level 0.1?

## Question 2

A study was conducted on 50 male and 50 female first-year students at U of T.

The stress level for each study participant was recorded as a score from 0 to 100 and the summary statistics were computed.

```
mean(male)
```

```
## [1] 50.47862
```

```
sd(male)
```

```
## [1] 18.32589
```

```
mean(female)
```

```
## [1] 58.15811
```

```
sd(female)
```

```
## [1] 23.72332
```

1. You want to test if average stress level is different for male and female students. What test will you use? State null and alternative hypotheses in terms of the male and female population averages.
2. Well, compute degrees of freedom for this test :(
3. Compute the  $t_{df}^{\alpha/2}$  quantile for 90% confidence interval.
4. Compute 90% confidence interval for the difference in population means.
5. What conclusion can we draw from the confidence interval?
6. Now find the upper 90% CI for the difference in population means.
7. What alternative hypothesis corresponds to this CI? What conclusion can we draw from this CI?
8. Suppose that we know that the population variances for male and female stress levels are equal, i.e.  $\sigma_{male}^2 = \sigma_{female}^2$ . How can you use the summary statistics to approximate the values of the population variances?
9. Find test statistic  $t_{obs}$  for the case when  $\sigma_{male}^2 = \sigma_{female}^2$ .
10. Suppose you want to check that female students are more stressed than male students for the case when  $\sigma_{male}^2 = \sigma_{female}^2$ . What would be the p-value?
11. What conclusion can you make for the hypothesis from 10 at significance level  $\alpha = 0.05$ ?

### Question 3

A study was conducted on 50 male and 50 female first-year students at U of T.

Each study participant was asked if they feel stressed. The following results were received:

- 30 out of 50 female students are stressed
  - 25 out of 50 male students are stressed
1. You want to test if proportions of stressed male and female students are different. What test will you use? State null and alternative hypotheses.
  2. Find the value of observed statistic.
  3. Find the p-value.
  4. Can we conclude that female students stress out more often at significance level 0.05?