In-class exercise week 4
Topic: hypothesis tests, p-value

1) Statistical tests, p-values, confidence intervals

Which of the following statements are correct?

a) That a test gets significant (i.e. $p < \alpha$, with e.g. $\alpha = 0.05$), means that the data shows evidence against the Null hypothesis and one rejects H_0

□True □ False

b) When using a t-test for detecting a truly existing effect, it is more likely that the tests gets significant when using a larger sample.

□True □ False

c) If a test does not get significant, one can conclude that there is no effect.

□ True □ False

d) The confidence interval for the expected value which results from a t-test does always contain the mean of the sample.

□ True □ False

e) Two 99% CIs for the population mean are determined from two independent samples. If the two confidence intervals do not overlap, then a two-sample t-test will provide a p-value ≤ 2%.

□ True □ False

2) Hypothesis tests

a) A randomized clinical study with 500 patients in each of the two treatment groups, A and B, should check if a newly developed drug B leads to a better pain reduction for arthritis patients than the gold standard treatment drug A. We abbreviate the expected value of pain reduction with drug A or B with μ_A or μ_B.
- Is it a paired (dependent) or unpaired (independent) study design?

- Formulate the H_0 and H_A for this clinical study

- Name the statistical test, which you plan to use, to test your hypothesis.

- Write down the test statistic T (which can be derived from the data)

- What is the distribution of the test statistic T under H_0?

b) Reaction times on 500 patients in the morning (t_m) and in the evening (t_e) were measured, to investigate if the reaction time changes with the time of day.
- Is it a paired (dependent) or unpaired (independent) study design?

- Formulate the H_0 and H_A for this study
We compute first for each patient the difference in reaction time $d_i = t_{e_i} - t_{m_i}$ and from these numbers we compute the mean $\bar{d}$

- Name the statistical test, which you plan to use, to test your Hypothesis.

- Write down the test statistic T (which can be derived from the data)

$$T = \frac{\bar{d}}{se(\bar{d})} \sim t_{n-1}$$

- What is the distribution of the test statistic T under H_0?