

Seminar 12

1. In a hypothetical hospital there were recorded 33 newborn boys out of 80 children. Test a hypothesis that the probability of having a male and a female child is the same.
 - (a) Use the exact binomial test. Firstly, use a built-in function `binom.exact`, then use a manual computation of the test statistic and p-value (see the lecture 8 slides) and finally compute the approximate confidence interval for the probability parameter.
 - (b) Test the same hypothesis using the Monte Carlo simulation. Generate the random sample (from the Bernoulli distribution) 1000 times and for each repetition compute the test statistic realization (sum of the sample). Create a histogram of the simulated test statistics, visualize your test statistic and compute the simulated empirical confidence interval for it.
 - (c) Finally, try to estimate the p-value using the Monte Carlo simulation 100 times and look at the distribution of the resulting p-values. Again, compute the simulated empirical confidence interval for the p-value.
 - (d) In the R script You can find the original data sample of our observations from the Bernoulli distribution $Be(p)$. Try to estimate the probability parameter p using the non-parametric bootstrap with 1000 repetitions. For the computation of new data samples use the `sample()` function with replacement, then create a histogram of different realizations of the estimation of parameter p and compute the empirical confidence interval.