For our discussion this week, we will discuss the use of compuational tools to obtain probabilities following from some of the probability models that are useful in categorical data analysis.

Data analysis

The table below contains the days on which 350 randomly sampled births occured.

(a) Is there evidence at significance level 0.05 to conclude that the days of the week differ in the proportions of births that occur in them?

(b) Do any of the days of the week stand out to you as seemingly notable in this respect?

Day	Observed births
Sunday	33
Monday	41
Tuesday	63
Wednesday	63
Thursday	47
Friday	56
Saturday	47

Exam review

1. A salesperson will cold-call ten phone numbers independently chosen from the phonebook. Suppose that, when called, $\frac{1}{100}$ of the numbers in the phone book will result in a big sale, $\frac{9}{100}$ of the numbers will result in a small sale, and the result will result in no sale whatsoever.

   (a) What is the probability that the salesperson will make nine no-sales, one small sale, and no big sales?

   (b) What is the probability that the salesperson will make nine no-sales, one big sale, and no small sales?

   (c) If the numbers are chosen from the phonebook without replacement, what will be the distribution of the numbers of no sales, small sales, and big sales?

   (d) If the phone book has a large number of numbers, would the probabilities in (a) and (b) differ by much when sampling without replacement?

2. Give a (new) example of a situation when a Poisson model may exhibit overdispersion.

3. Suppose that a Binomial exact test is carried out with $n = 12$ and $\pi_0 = 0.5$.

   (a) Using significance level $\alpha = 0.03$, if the null hypothesis is true, what is the probability of rejecting the null hypothesis?

   (b) Using significance level $\alpha = 0.02$, if the null hypothesis is true, what is the probability of rejecting the null hypothesis?

   (c) Using significance level $\alpha = 0.01$, if the null hypothesis is true, what is the probability of rejecting the null hypothesis?