Lecture 2

L2.1. Discrete probability distribution

a. From the past experience you know, that the probability of a successful implantation of human glioblastoma into mouse brain is 60% (so called xenograph experiment). The ethical committee asks you to present the clear proof of minimal number of animals needed for the study.

- Estimate the probability to have at least 3 successful implantations in the group of 5 mice.
- How many mice should you take to be > 90% sure that you get 3 or more mice with xenograph tumors at the end?

dbinom

L2.2. Continuous probability distribution

a. Assume, that by pipetting 200 μl of some substance using a 500 μl pipette you may introduce an error with standard deviation of 1 μl. Calculate the probability to put less than 199 μl of your substance.

pnorm

b. Eurasian Least Shrew *(Sorex minutissimus*) is the second-smallest mammal in the world after the Etruscan Shrew. The Eurasian Least Shrew weighs only 1.2 – 4 grams and has a body less than 4 cm long, with a 2.5 cm tail. Because of its small size for a mammal, the Eurasian Least Shrew has an extremely high metabolic rate and must eat frequently to avoid starvation (in captivity it has been reported to eat 120 meals a day, consuming three to four times its own weight each day). On average without food it can **survive 5.5 hours** before dying of starvation. In nature it finds food and **eats 78 times a day** (experimental observation).

- Find the average time between the meals in nature.
- Calculate the probability for Eurasian Least Shrew to die of starvation in nature.
- Assume that due to human activity the quantity of accessible food (insects) is reduced by 5 times. Calculate the probability to die of starvation for Eurasian Least Shrew in this situation.

pexp

L2.3. Sampling and sampling distribution

a. Test the central limit theorem. Try to add 6 uniform random vectors and visualize the distribution. Do the same for 6 and 20 exponential random vectors
runif, rexp, plot(density(…))

L2.4. Interval estimation

a. To determine the frequency of type O blood (universal donor) in a population, a random sample of 100 people were blood typed for the ABO group. Of this 100, 42 were found to be type O. Using normal approximation, calculate 95% confidence interval for the proportion of the population that has type O blood. How many donors are needed to have marginal error at the level of ±1% (E=0.01)?

qnorm, sqrt

b. An apiculturist investigating nutritional causes of differences in bee morphology weighed 16 working bee pupae from a commercial hive. She found their average weight to be 530 mg with a standard deviation of 36 mg. Construct 90% confidence interval for the population mean of worker bee pupal weight. Visualize the distribution of bee weight.

qt, sqrt