

3. Continuous Probability Distributions

1. A bus goes each 20 minutes. Suppose you have just arrived at a station and you do not know the bus' timetable.

- Give a mathematical expression for the probability density function $f(x)$ of your waiting time (x – waiting time).
- Provide the expected waiting time μ .
- What is the probability that you wait less than 5 minutes $P(x < 5)$?

2. The volume of a liquid in bottles of one company is distributed normally with an expected value of 0.33 liter, and standard deviation of 0.01.

- Based on your knowledge about normal distribution, estimate the probability to buy a bottle containing less than 0.32 liters of the liquid.
- Estimate the interval, in which the volumes of 95% bottles is lying (*many correct solutions exist, as the question is incomplete!*)

3. A population of marine gastropods has shell lengths that are normally distributed with mean $\mu = 7$ mm and variance $\sigma^2 = 2.25$ mm². What proportion of the population will have a shell length between 5.5 mm and 8.5 mm?

4. Eurasian Least Shrew (*Sorex minutissimus*), also called Musaraigne naine (fr.) or Knirpspitzmaus (ger.), 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 of 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 a factor of 5. Calculate the probability to die of starvation for Eurasian Least Shrew in this situation.

5. The length of adult *Rana temporaria* is normally distributed, with 90% population between 50 and 90 mm (assume the central part of the distribution is considered).

- Estimate the parameters of the normal distribution (mean, st.dev.).
- What is the probability to catch a frog longer than 80 mm?

6. An instructor is administering a final examination. She tells her class that she will give an A grade to the 10% of the students who earn the highest marks. Past experience with the same examination has yielded grades that are normally distributed with a mean of 70 and a standard deviation of 10. If the present class runs true to form, what numerical score would a student need to earn to get an A grade?