Exercise 2

1. Within a sector we have $N = 12.100$ single firms. Since there is no total official statistic we have drawn a random sample of $n = 225$ and collected the single profit G of each firm. Within this sample we obtained an average profit of 600.000 € with a standard deviation of $\hat{\sigma}$ of 90.000 €.
   (a) Calculate the standard deviation of the average profit?
   (b) Calculate a confidence interval of μ for probability of error of $\alpha = 5\%$
   (c) Extrapolate for a probability of error $\alpha = 1\%$ a confidence intervall for the whole sector.

2. A machine is cutting steel rods of a specific length. Out of the total production of $N = 150$, we take a random sample of $n = 9$. Measuring their length, we obtain:
   184,2 mm, 182,6 mm, 185,3 mm, 184,5 mm, 186,2 mm, 183,9 mm, 185,0 mm, 187,1 mm, 184,4 mm.
   Due to experience, we know that the parent distribution is normally distributed.
   (a) Calculate unbiased estimators for mean and variance of the parent distribution.
   (b) Calculate for μ a cofidence interval for the confidence leveles 0,9 and 0,99.

3. Within a random sample of 144 persons in WHV 75% answered, they would like to shop on sundays.
   (a) Calculate a confidence interval for the proportion of inhabitants of WHV, who would prefer a general shop opening on sundays for a probability of error of $\alpha = 0,05$ and $\alpha = 0,1$).
   (b) Calculated the confidence level, if the confidence interval would be represented by 75%±10%.

4. A provider of mobile games collected the playing time of $n = 120$ randomly drawn users. We suppose, that the playing times x_i are realizations of a normally distributed variable and obtain the following data:
$$\sum_{i=1}^{120} x_i = 21840 \quad \sum_{i=1}^{120} x_i^2 = 4868856$$
   (a) Calculate a confidence interval for the variance of the playing time given a confidence level of 99 %.
   (b) Calculate the confidence interval of the standard deviation for a probability of error of $\alpha = 1\%$.