Statistics – A

Summer term 2022

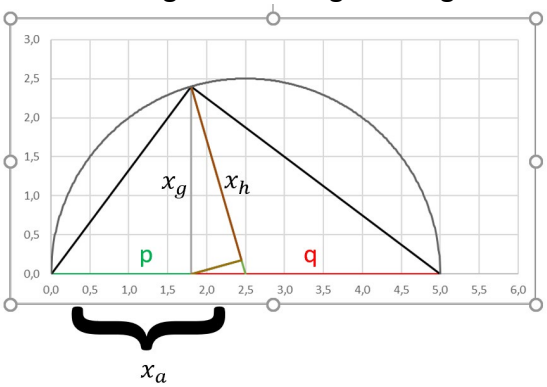
Exercise 1

1) A country exhibits the following distribution of educational qualifications

Approved higher educational level		
	Gender	
Sector of Qualification	Men	Female
Industrial	5256	982
Agricultural	3221	432
Public	1001	602
Financial	2231	1820
Trade	872	1512

a) Calculate the relative probabilities, the marginal distributions and provide the contingency table.
b) Compare the descriptive result with the theoretical probabilities. Are the attributes statistically independent?
c) Calculate the conditional probabilities of P(Gender|Sector of Qualification) and P(Sector of Qualification|Gender).

2) Show for two numbers $a, b > 0 \in \mathbb{R}$ that the geometric mean x_{g} of a, b equals the geometric mean of the harmonic mean x_{h} of a, b and the arithmetic mean x_{a} of a, b. This means: $x_{\mathrm{g}} = \sqrt{x_{\mathrm{h}} \cdot x_{\mathrm{a}}}$
This can also be shown in the diagram of an right triangle



3) Within a manufacturing process on average 75% of the tools are correct.
a) Calculate the probability, that within a sample of n = 12 you have exactly 3 correct tools.
b) Calculate the probability, that within a sample of n = 9 you have at least 8 correct tools.
c) Calculate the expected value, variance and standard variation of a sample of n=25.

4) A producer of cocoa knows from experience, that the weight of the 125g-packs is normally distributed with $\mu = 125$ g and variance of $\sigma^2 = 25$ g.

a) What is the probability that the weight of a pack is exactly 125 g (argue)?
b) What is the probability, that the weight of a pack is within 120 g and 130 g?
c) What is the probability, that the weight of a pack is less than 110 g?
d) What is the probability, that the weight of a pack is more than 140 g?
e) Calculate the symmetric interval around the expected value, such that with a probability of 95% the true weight of a pack is within this interval.
f) Sketch your results graphically with the given distribution and the standard normal distribution.

5) The annual yield [%] of stock investment can be approximated with a normally distributed random variable with $\mu=10$ and $\sigma=2$.

a) What is the probability that the yield is within 8% und 14% liegt?
b) Assume that the yields oft wo different years are statistically independent.
    i. What is the probability that the yields in two following years is at least 8%?
    ii. What is the probability that the yields in the next 10 years will be exactly three times less than 11%?
c) Which yield can be maximally expected with a probability of 99%?