OTH Regensburg
B. Sc. courses KI + MA

Prof. Dr. Jan-Philipp Weiß
Modeling and Simulation

Exercise 4

Use your intuition, some online resources and your knowledge from a course on probability theory and statistics to answer the subsequent questions. Try to use your own words and give short and concise anwers. Try to come up with examples where appropriate.

4.1 What is a general definition of statistics? What is it good for?

4.2 What could be the role of statistics for our purpose in modeling and simulation? Give an example.

4.3 What is the difference between descriptive and inferential statistics?

4.4 In contrast, what is the definition of probability theory?

4.5 What are two major results in probability theory (that we will use later on)?

4.6 What is a random variable?

4.7 What is an equally distributed random variable?

4.8 What is a random experiment? What are useful definitions to describe it?

4.9 What is the difference between a continuous probability distribution and a discrete probability distribution? Give an example for a discrete probability distribution and for a continuous probability distribution.

4.10 What is a probability density function? How does it relate to a probability distribution? What are basic properties of these?

4.11 What is the probability that there is a man on this planet that is exactly 1.80 m tall? How would you get an reasonable estimate for this quantity (in a meaningful sense, that needs to be defined)?

4.12 What is and how to describe a mean value? Give an example.

4.13 What is the difference between an arithmetic mean and a geometric mean? Give an example. What is the harmonic mean and how is it motivated?

4.14 What is the empirical variance? What is the empirical standard deviation? What is the difference? Give examples.

4.15 Use a programming environment to visualize an example for a density function and for a probability distribution.

4.16 Write a computer progamm (in a programming environment of your choice) that returns a probability for a given density function and a given set of events (how to define these?). Put this into the context of an example of your choice.

4.17 How can you generate random numbers (integer random numbers and real random numbers in a given interval) within the programming environment of your choice?

4.18 How could you generate random numbers by hand? Is that reliable (in what sense?)?