< Previous Next >

15.1.1 Terminology

Bookmark this page

MO2.13 MO2.14 MO2.15

In Chapter 14, we introduced probabilistic thinking using the Martian lander example. In this chapter, we will further develop many of the concepts introduced in that previous chapter.

We'll start this deeper exploration of the fundamentals of probability and statistics by defining some terminology. We will make these definitions in the context of performing a Monte Carlo simulation like the example of the Martian Lander given in Chapter 14.

- Consider a system with randomness. For example, the Martian lander with randomness in C_{Dl}, θ_e, $V(t_I)$, and f_ρ.
- Assume a *computer model* exists that can approximate the behavior of the system for a particular *instance* of the random system. In the context of the Martian lander:
  - The *computer model* would be the `IVP.py` and `lander.py` Python modules.
  - An *instance* would be running this computer model to determine the parachute opening altitude z_p with a specific set of values of C_{Dl}, θ_e, $V(t_I)$, and f_ρ, e.g. $C_{Dl} = 1.64$, $\theta_e = 81.2°$, $V(t_I) = 5812.4$ m/s, and $f_\rho = 0.0314$.
- *Simulate* the randomness of the system by running the computer model on randomly drawn instances and calculating *statistics* on the *sample* to infer the behavior of the *population*.
  - The *sample* is the set of all of the instances run in the computer model. The size of the sample, N, is the number of instances in the sample.
  - The *population* is the set of all possible instances. In general, problems in CSE will involve populations which have infinitely many instances because the random variables are often real variables. However, some CSE problems may have only discrete random variables, meaning there are only finite numbers of values. In this case, the population size will be finite (an enumeration of all the possible

instances in the sample for which $z_p < 9$ km. Then, the fraction N_p/N is a statistic of the sample. Further, we will use this fraction to