Chapter 1
Introduction

1.1 Introduction

I have heard many people over the years say that Python is an easy language to lean and that Python is also a simple language.

To some extent both of these statements are true; but only to some extent.

While the core of the Python language is easy to lean and relatively simple (in part thanks to its consistency); the sheer richness of the language constructs and flexibility available can be overwhelming. In addition the Python environment, its eco system, the range of libraries available, the often competing options available etc., can make moving to the next level daunting.

Once you have learned the core elements of the language such as how classes and inheritance work, how functions work, what are protocols and Abstract Base Classes etc. Where do you go next?

The aim of this book is to delve into those next steps. The book is organised into eight different topics:

1. **Computer Graphics**. The book covers Computer Graphics and Computer Generated Art in Python as well as Graphical User Interfaces and Graphing/Charting via MatPlotLib.
2. **Games Programming**. This topic is covered using the `pygame` library.
3. **Testing and Mocking**. Testing is an important aspect of any software development; this book introduces testing in general and the PyTest module in detail. It also considers mocking within testing including what and when to mock.
4. **File Input/Output**. The book covers text file reading and writing as well as reading and writing CSV and Excel files. Although not strictly related to file input, regulator expressions are included in this section as they can be used to process textual data held in files.
5. **Database Access**. The book introduces databases and relational database in particular. It then presents the Python DB-API database access standard and

J. Hunt, *Advanced Guide to Python 3 Programming*,
Undergraduate Topics in Computer Science,
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one implementation of this standard, the PyMySQL module used to access a MySQL database.

6. **Logging**. An often missed topic is that of logging. The book therefore introduces logging the need for logging, what to log and what not to log as well as the Python logging module.
7. **Concurrency and Parallelism**. The book provides extensive coverage of concurrency topics including Threads, Processes and inter thread or process synchronisation. It also presents Futures and AsyncIO.
8. **Reactive Programming**. This section of the book introduces Reactive Programming using the PyRx reactive programming library.
9. **Network Programming**. The book concludes by introducing socket and web service communications in Python.

Each section is introduced by a chapter providing the background and key concepts of that topic. Subsequent chapters then cover various aspects of the topic.

For example, the first topic covered is on Computer Graphics. This section has an introductory chapter on Computer Graphics in general. It then introduces the Turtle Graphics Python library which can be used to generate a graphical display.

The following chapter considers the subject of Computer Generated Art and uses the Turtle Graphics library to illustrate these ideas. Thus several examples are presented that might be considered art. The chapter concludes by presenting the well known Koch Snowflake and the Mandelbrot Fractal set.

This is followed by a chapter presenting the MatPlotLib library used for generating 2D and 3D charts and graphs (such as a line chart, bar chart or scatter graph).

The section concludes with a chapter on Graphical User Interfaces (or GUIs) using the `wxpython` library. This chapter explores what we mean by a GUI and some of the alternatives available in Python for creating a GUI.

Subsequent topics follow a similar pattern.

Each programming or library oriented chapter also includes numerous sample programs that can be downloaded from the GutHub repository and executed. These chapters also include one or more end of chapter exercises (with sample solutions also in the GutHub repository).

The topics within the book can be read mostly independently of each other. This allows the reader to dip into subject areas as and when required. For example, the File Input/Output section and the Database Access section can be read independently of each other (although in this case assessing both technologies may be useful in selecting an appropriate approach to adopt for the long term persistent storage of data in a particular system).

Within each section there are usually dependencies, for example it is necessary to understand the `pygame` library from the 'Building Games with pygame' introductory chapter, before exploring the worked case study presented by the chapter on the StarshipMeteors game. Similarly it is necessary to have read the Threading and Multiprocessing chapters before reading the Inter Thread/Process Synchronisation chapter.