Part I - Foundations

Nature makes trees put down deep roots before having them bear fruit, and even this is done gradually[1].

Saint Vincent de Paul, French Catholic Priest, 1581-1660.

This part of the book contains two chapters:

- Chapter 2: Markov decision process fundamentals
- Chapter 3: Examples and applications

These chapters provide an important foundation for the rest of the book. As the above quote suggests, developing this foundation is critical to understanding and using the methods presented subsequently.

Chapter **??** introduces and discusses the core elements of a Markov decision process including basic components, derived quantities, and optimality criteria. Moreover, it introduces two simple Markov decision process models that provide a foundation for much of the material in this book:

1. The simple *one-period model* that highlights the fundamental trade-off between immediate and future rewards. It lays the groundwork for understanding a key feature of more complex, multi-period decision models.
2. The *two-state model* is a numerical example of a Markov decision process with two states. The two-state model recurs frequently throughout the book to illustrate key ideas and algorithms.

[1] de Paul [1995].

Familiarity with these models is crucial. They provide intuitive and concrete illustrations of the main Markov decision process and reinforcement learning concepts.

To make the model components in Chapter **??** concrete, Chapter **??** presents a broad range of illustrative applications drawn from diverse disciplines. Each explicitly identifies the key model components: states, actions, transition probabilities and rewards. As readers engage with these examples, they are encouraged to reflect on examples from their experience that can be formulated as Markov decision processes.

A strong grasp of model fundamentals is essential for successfully applying MDPs in new domains. For this reason, readers must take the time to carefully study the examples in Chapter **??**, paying particular attention to how the abstract model components are defined in each context.

Bibliography

V. de Paul. Letter 1796 to Charles Ozenne, 13 Nov. 1654. In Sr. Marie Poole et al., editors, *Correspondence, Conferences, Documents*, volume 5, page 219. New City Press, Brooklyn, NY, 1995. Translated by Sr. Marie Poole and Rev. Francis Germovnik.

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