

CHAPTER 5

NEXT-EVENT SIMULATION

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The three sections in this chapter all concern the *next-event* approach to discrete-event simulation. Section 5.1 defines the fundamental terminology used in next-event simulation such as system state, events, simulation clock, event scheduling, and event list (which is also known as the *calendar*), and provides an introduction to this fundamental approach as it applies to the simulation of a single-server service node with and without feedback. The algorithm associated with next-event simulation initializes the simulation clock (typically to time zero), event list (with an initial arrival, for example, in a queuing model), and system state to begin the simulation. The simulation model continues to (1) remove the next event from the event list, (2) update the simulation clock to the time of the next event, (3) process the event, and (4) schedule the time of occurrence of any future events spawned by the event, until some terminal condition is satisfied.

Section 5.2 provides further illustrations of this approach relative to the simulation of a simple inventory system with delivery lag and a multi-server service node. The multi-server service node provides an illustration of an event list which can have an arbitrarily large number of elements.

As the simulations in Sections 5.1 and 5.2 illustrate, an *event list* is an integral feature of the next-event approach. The data structures and algorithms that are used to manage the event list are crucial to the efficiency of a next-event simulation. Section 5.3 provides a sequence of examples associated with the management of an event list that begin with a naive and inefficient data structure and algorithm and iterate toward a more efficient scheme.