The Theory of Computation
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Solution Manual
Chapter 3, Problem 3.22

In spite of its rating, this is an easy exercise. The main problem is to define what is a legal expression in that context. Since we have banished parentheses and unary operators, we are left with two binary operators. Precedence and order of evaluation do not affect the legality of an expression, although they certainly affect the language the expression represents. Thus it is enough to ensure that each operator has two operands, which simply means that we have a three-state DFA: it starts in a rejecting state (the expression cannot be empty) q_0 and has a rejecting trap q_r and an accepting state q_F. From the start state, the machine moves to the trap on reading an operator, but to the accepting state on reading 0 or 1. From the accepting state, the machine moves back to the start state on reading an operator; it stays in the accepting state on reading a 0 or 1. In the trap, of course, the machine stays trapped for any input.