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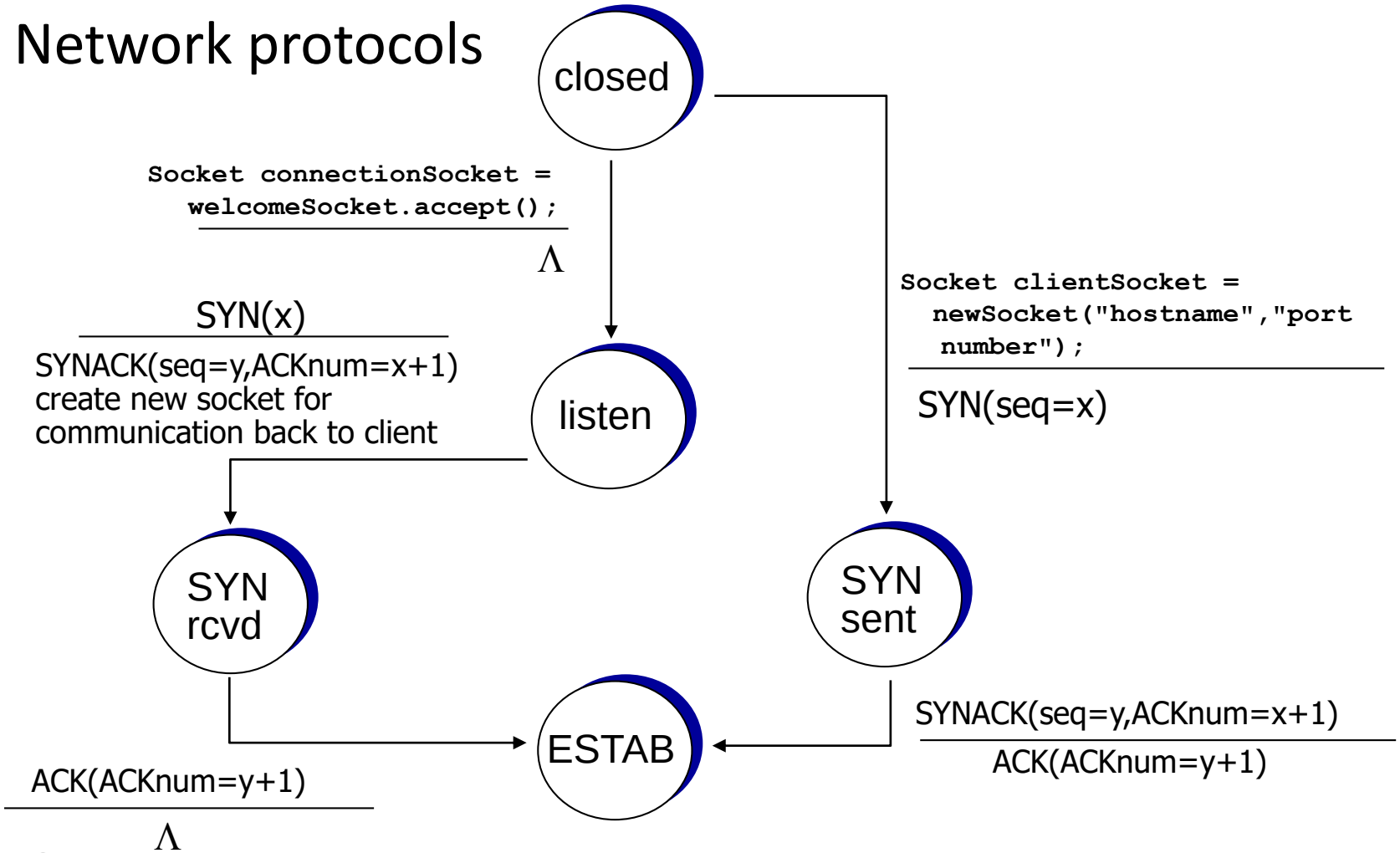
Introduction to State Machines

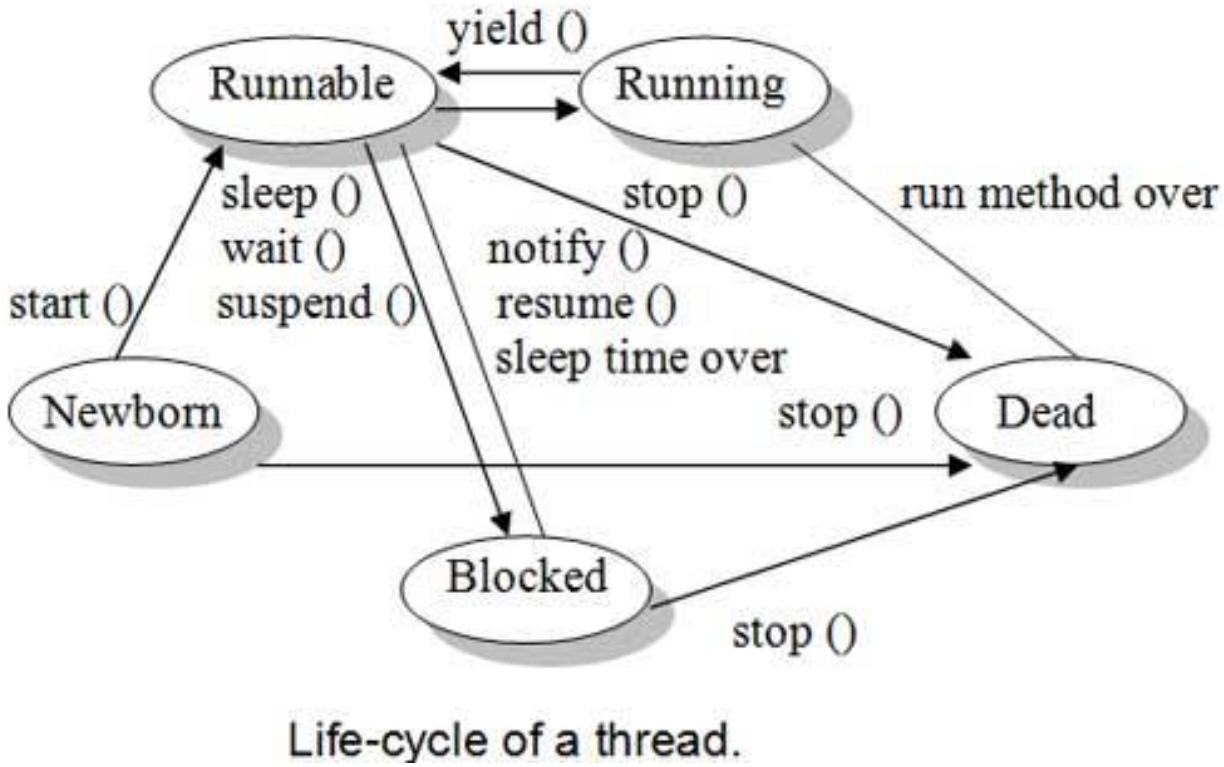
Control the states

- Example - Network protocols



Control the states

- Example - Threads

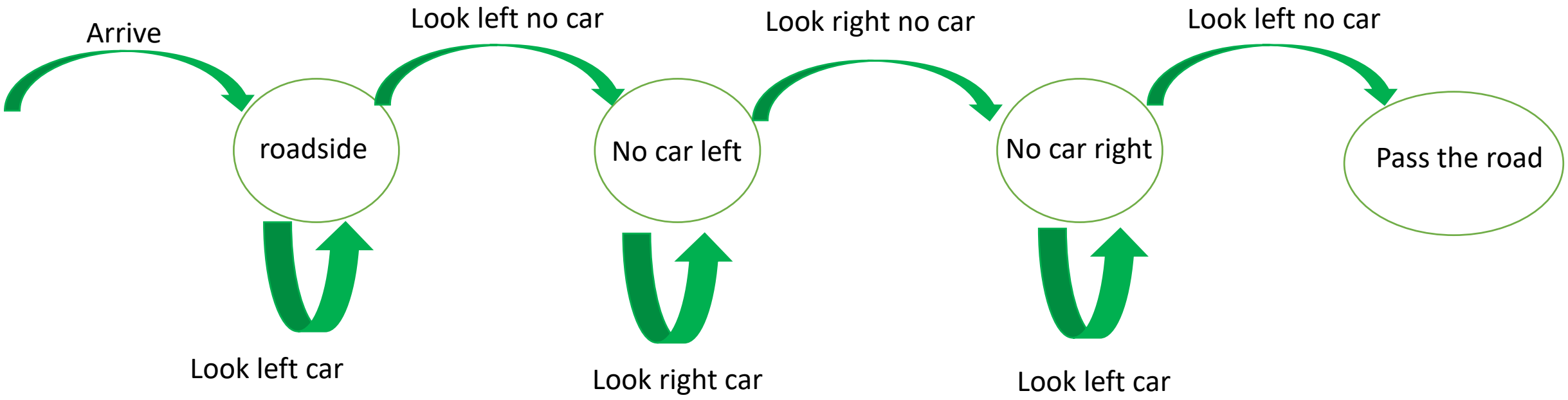


Life-cycle of a thread.

http://ecomputernotes.com/java/multithreading/thread-life-cycle

Control the states

- Example – Passing Road (Denmark)



Paper for state machines

- The following slides are based on
  - MITOpenCourseWare
    - https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-1-software-engineering/state-machines/
  - Chapter 4: State Machines
    - https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-1-software-engineering/state-machines/MIT6_01SCS11_chap04.pdf

Example State Machines

Goal: have a sequence of abcabcabc….

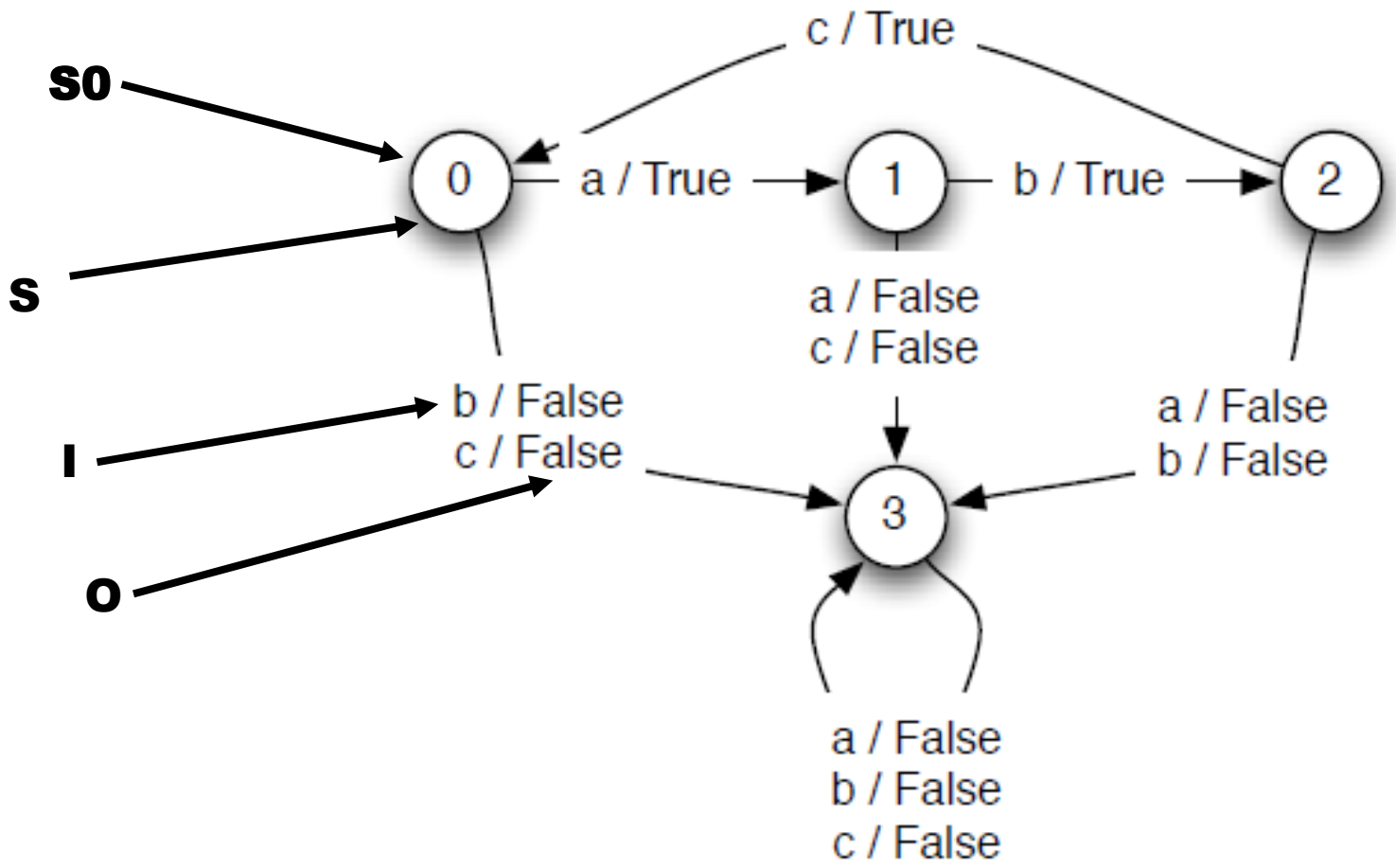


Figure 4.1 State transition diagram for language acceptor.

Example State Machines

- Other Simple state machines (mentioned in paper)
  - Up and down counter
  - Delay
  - Accumulator
  - Average

Python State Machines

Template Design Pattern

Python State Machines 2

```
class Accumulator(SM):
   def __init__(self, initialValue):
      self.startState = initialValue
   def getNextValues(self, state, inp):
      return state + inp, state + inp
```

```
>>> c = Accumulator(100)
>>> c.start()
>>> c.step(20)
120
>>> c.step(2)
122
```

Python State Machines 3

```
class SM:
    def start(self):
        self.state = self.startState
    def step(self, inp):
        (s, o) = self.getNextValues(self.state, inp)
        self.state = s
        return o
    def transduce(self, inputs):
        self.start()
        return [self.step(inp) for inp in inputs]
```

Simple parking gate controller

- Three sensors
  - gatePosition -- ’top’, ’middle’, ’bottom’
  - carAtGate -- True, False
  - carJustExited -- True, False

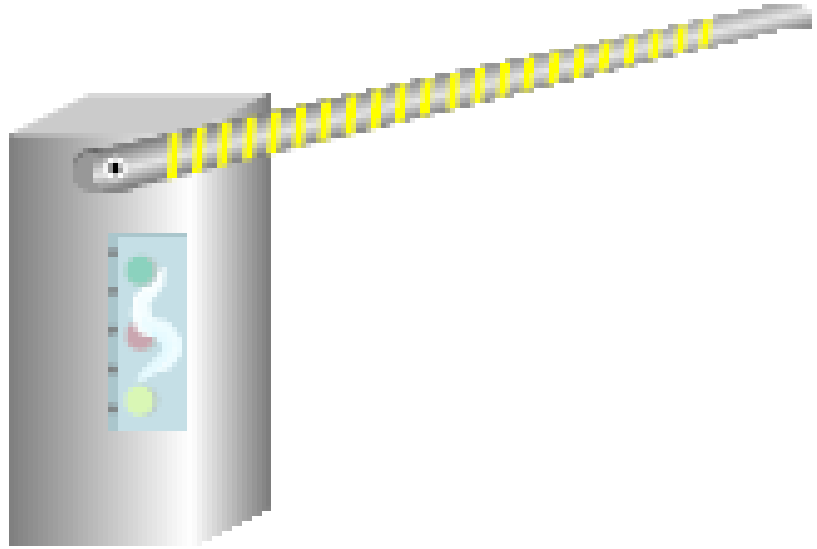


Image by MIT OpenCourseWare.

Simple parking gate controller 2

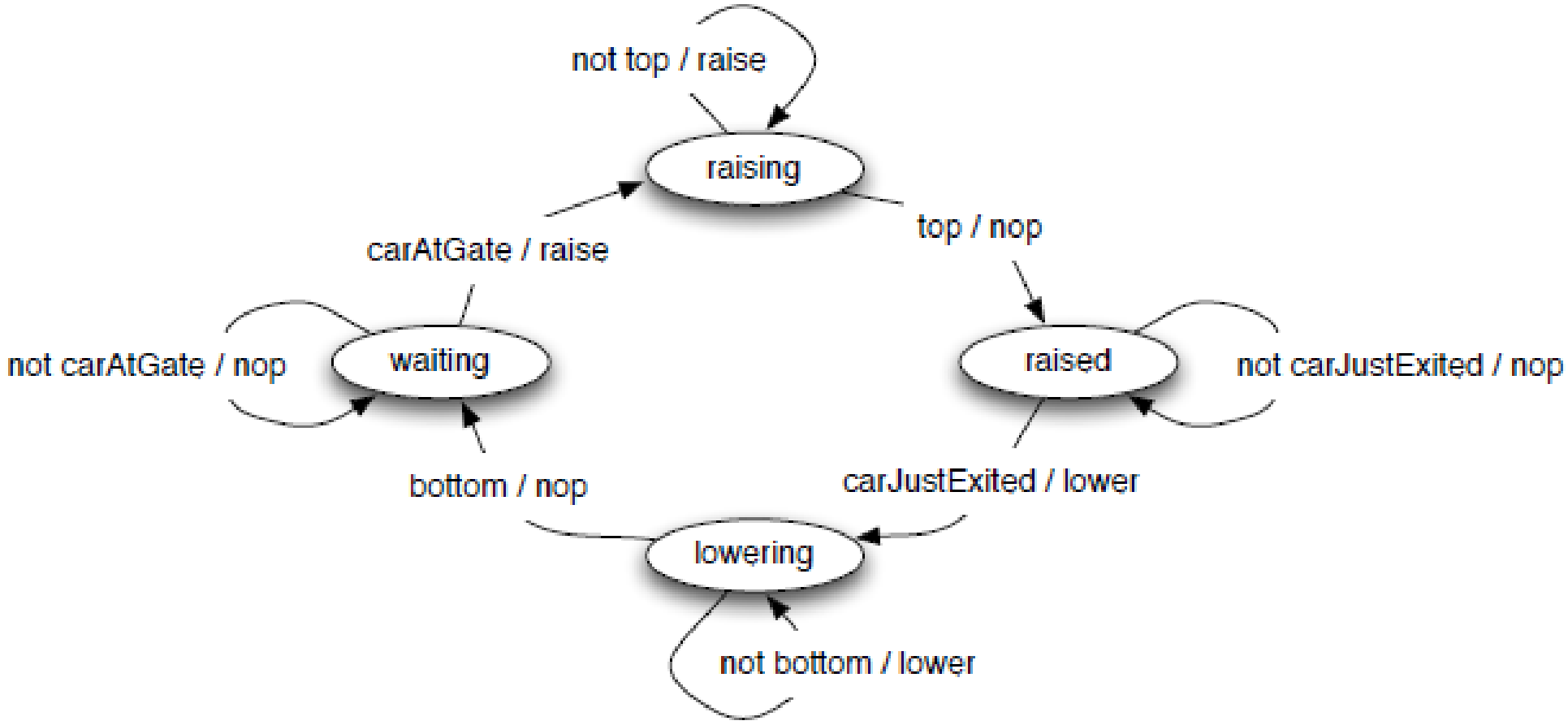


Figure 4.3 State transition diagram for parking gate controller.

Simple parking gate controller 3

```
def getNextValues(self, state, inp):
    (gatePosition, carAtGate, carJustExited) = inp
    if state == 'waiting' and carAtGate:
        nextState = 'raising'
    elif state == 'raising' and gatePosition == 'top':
        nextState = 'raised'
    elif state == 'raised' and carJustExited:
        nextState = 'lowering'
    elif state == 'lowering' and gatePosition == 'bottom':
        nextState = 'waiting'
    else:
        nextState = state
    return (nextState, self.generateOutput(nextState))
```

NOW

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