Chapter 4

- We’ll work with sim (nib)
- We’ll do some examples
- We’ll skip everything else

Simulation Package (nib)

- Package sim
- Implement event scheduling
- Derive classes to implement details
- See OneServer3.java for a simple sim based simulator

Problem 31 ch. 4

- State = \{Q,s1,s1\}
  - Q.len = 0-5, Q is an actual queue
  - S1,S2 = 0|1 (busy or idle)
- Events = \{A,F1,F2\}
- R_A:
  - If s1==0, set s1=1 \rightarrow create F1(t+[8+-2])
  - Else if s2==0, set s2=1 \rightarrow create F2(t+[12+-4])
  - Else if Q.len<5 enqueue
  - Else with prob. 0.3 generate A(t+[60+-20])
  - Create A(t+4.5)

Problem 31

- R_F1:
  - If Q.len>0 dequeue customer; create F1(t+[8+-2])
  - Else set s1=0
- R_F2:
  - If Q.len==0 set s2=0
  - Else if (s1==0) dequeue, set s1=1, s2=0; create F1(t+[8+-2])
  - Else dequeue, set s2=1; create F2(t+[12+-4])

Problem 31

- Statistics:
  - (a) count total turned away/total time (T)
  - (b) count turned away that didn’t come back/T
  - (c) record arrival time and departure time of each customer/total customers served
  - (d) sum all finish times/total customers served
  - (e) sum Q.len*d_t/T. d_t time between events

Problem 31

- If you implements this, FEL blows up!
- Because returning customers generate next arrivals which generate returning customers the actual arrival rate grows exponentially!
- Try it with P31.java (comment out the code which fixes this…)
- We have to generate arrivals at a fixed rate and superimpose return events on this somehow
Problem 31

Let $K$ be arrivals/hr. Initially $K_0 = 60/4.5$. Assume a fraction $r$ of the time the queue is full. This means after 1 hour $r \cdot 0.3 \cdot K_0$ people return, some of which, say some number $0 < s < 1$, will return the next hour. This means $K_1 = K_0 + s \cdot r \cdot 0.3 \cdot K_0 \Rightarrow \text{Exponential growth!}$

Problem 31: fixed

- State = \{Q,s1,s1\}
  - Q.len = 0-5, Q is an actual queue
  - S1,S2 = 0|1 (busy or idle)
- Events = (A,F1,F2)
  - A has a field indicating if is return customer
- $R_A$:
  - If $s1 = 0$, set $s1 = 1 \Rightarrow \text{create F1(t+\[8+-2\])}$
  - Else if $s2 = 0$, set $s2 = 1 \Rightarrow \text{create F2(t+\[12+-4\])}$
  - Else if Q.len=5 enqueue
  - Else with prob. 0.3 generate A(\[60+-20\])
    - Mark this newly generated A as a return customer
  - Create A(t+4.5) only if customer was not a returning one

Problem 54 from ed.3

- A 1-server 1-queue system where jobs arrive every $X\pm0.5X$ seconds and are processed in $80\pm80$ seconds at the server. Determine $X$ such that server utilization is 90%
- See P54.java