Math 262

Section 2.8 Day 18

1. The video for today presented a discrete-time queue simulation. At time 0, the queue contains one individual. In each time interval, X individuals enter the queue and Y individuals exit the queue, where both X and Y are Poisson random variables with mean 5. The code from the video is available on the course web site and on the back of this page.

- (a) Modify the code so that the queue has a maximum size of 100. That is, if 100 individuals are in the queue, no more may join until some leave.
- (b) Let T be the first time at which the queue is empty. Estimate E(T).
- (c) Let Z be the time at which the size of the queue reaches 20. Estimate E(Z).

2. Suppose that C, the number of chips awarded in the game Plinko, has the following distribution:

Use simulation to estimate the mean and standard deviation of C.

3. Suppose that X, the winnings from one chip in Plinko, has the following distribution:

Write a simulation of Plinko, taking into account both the number of chips a contestant earns and the amount of money won on each chip. What is the probability that a contestant wins more than \$11,000?

Queue Simulation in R:

```
queueSize <- 1
time <- 0
while(queueSize > 0){
  x <- rpois(1, 5)
  queueSize <- queueSize + x
  y <- rpois(1, 5)
  if(y > queueSize){
    queueSize <- 0
  } else {
    queueSize <- queueSize - y
  }
  time <- time + 1
  print(sprintf("at time %s the queue contains %s items", time, queueSize))
}
print(sprintf("time until the queue is empty: %s", time))</pre>
```

Queue Simulation in Mathematica:

```
queueSize = 1;
time = 0;
While[queueSize > 0,
    time += 1;
    x = RandomVariate[PoissonDistribution[5]];
    queueSize = queueSize + x;
    y = RandomVariate[PoissonDistribution[5]];
    If[y > queueSize, queueSize = 0, queueSize = queueSize - y];
    Print["at time ", time, " the queue contains: ", queueSize]
]
Print["time until the queue is empty: ", time]
```