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:

c	1	2	3	4	5
$p(c)$	.03	.15	.35	.34	.13

   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:

x	\$0	\$100	\$500	\$1000	\$10,000
$p(x)$	.39	.03	.11	.24	.23

   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))
```

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]
```