Lab 5

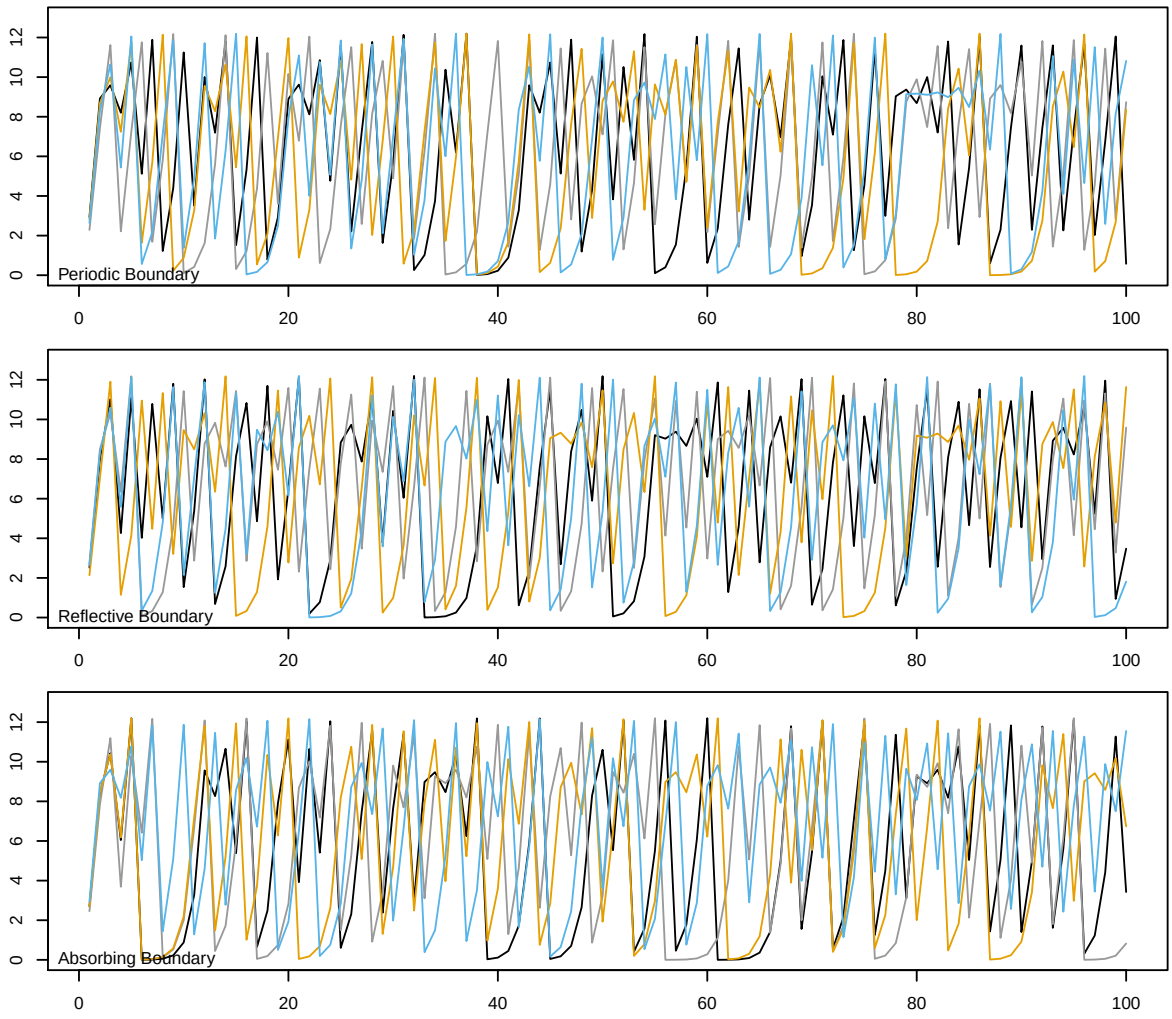
Clint Valentine

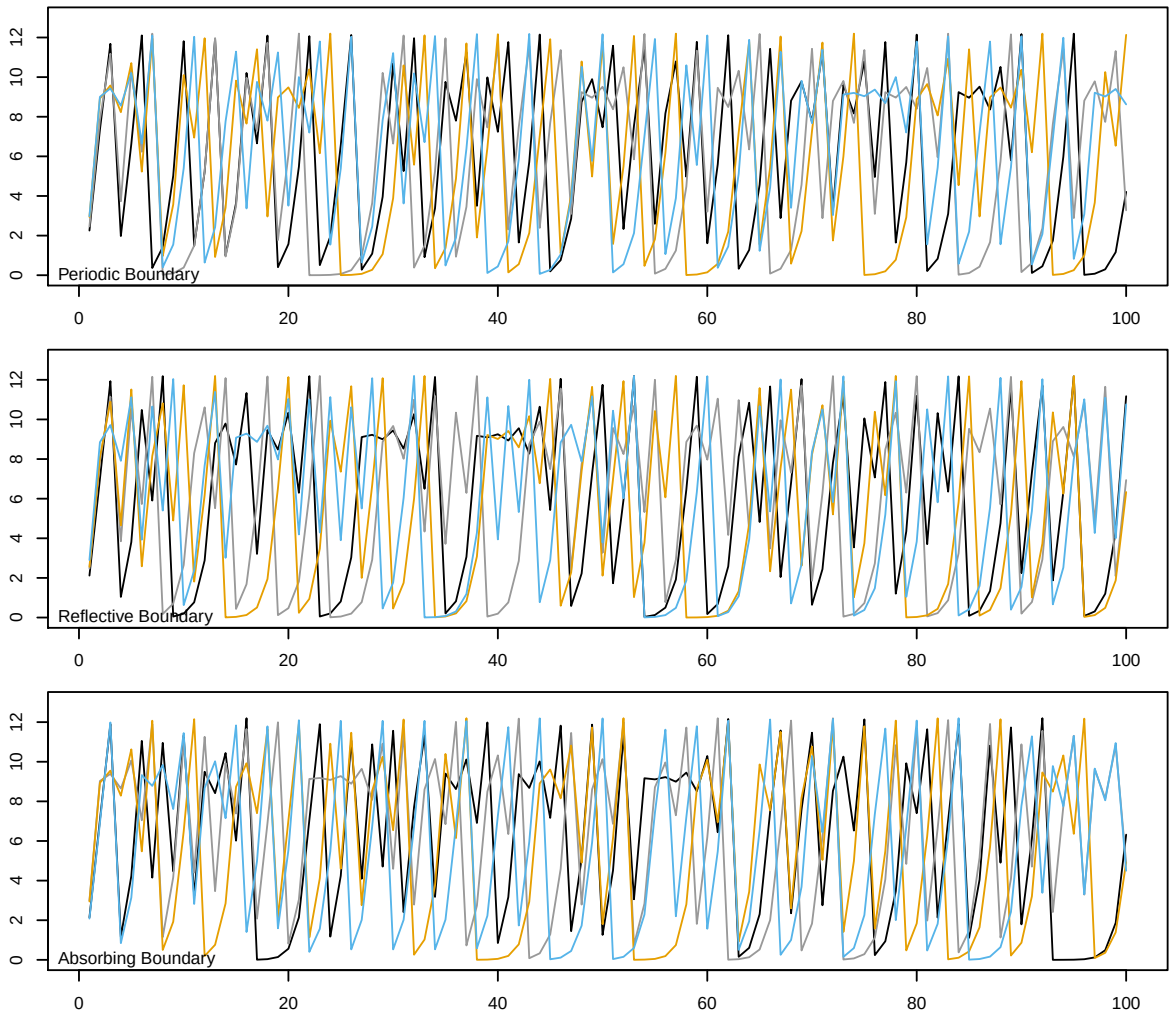
Spatial Models

```
find.neighbors.periodic <- function(npops) {
  neighs <- matrix(nrow=npops, ncol=2, dimnames=list(NULL, c('left', 'right')))

  neighs[1, ] <- c(npops, 2)
  neighs[npops, ] <- c(npops - 1, 1)

  for (loc in 2:(npops - 1)) {
    neighs[loc, ] <- c(loc - 1, loc + 1)
  }
  return(neighs)
}

find.neighbors.reflective <- function(npops) {
  neighs <- matrix(nrow=npops, ncol=2, dimnames=list(NULL, c('left', 'right')))

  neighs[1, ] <- c(1, 2)
  neighs[npops, ] <- c(npops - 1, npops)

  for (loc in 2:(npops - 1)) {
    neighs[loc, ] <- c(loc - 1, loc + 1)
  }
  return(neighs)
}

find.neighbors.absorbing <- function(npops) {
  neighs <- matrix(nrow=npops, ncol=2, dimnames=list(NULL, c('left', 'right')))

  neighs[1, ] <- c(0, 2)
  neighs[npops, ] <- c(npops - 1, 0)

  for (loc in 2:(npops - 1)) {
    neighs[loc, ] <- c(loc - 1, loc + 1)
  }
  return(neighs)
}
```

```
library('deSolve')
library('fields')
source('http://faraway.neu.edu/data/cb.R')
set.seed(42)

npops = 4
d = 0
h = 0
R = 3
```

```
K = runif(1, min=0, max=10)
maxtime = 100

solve.discrete.spatial = function (x, maxtime=100, neighs) {
  N = matrix(nrow=maxtime, ncol=x)
  N[1, ] = runif(x, 2, 3)

  for (i in 2:maxtime) {
    E = d * N[i-1,]
    I = d * 0.5 * rowSums(matrix(N[i-1, neighs[, 1:2]], ncol=2))
    N[i,] = N[i-1,] * (1 + R * (1 - (N[i-1,] / K))) - h * N[i-1,] + I - E
    N[i, N[i,] <= 0] = 0
  }
  return(N)
}

par(mfrow=c(3, 1))
par(cex=0.6)
par(mar=c(3, 3, 0, 0), oma=c(1, 2, 1, 1))

for (j in 1:3) {
  matplot(1:maxtime, solve.discrete.spatial(npops, neighs=find.neighbors.periodic(npops)), xlab='', ylab
  text(-2, 0, 'Periodic Boundary', adj=0)

  matplot(1:maxtime, solve.discrete.spatial(npops, neighs=find.neighbors.reflective(npops)), xlab='', yl
  text(-2, 0, 'Reflective Boundary', adj=0)

  matplot(1:maxtime, solve.discrete.spatial(npops, neighs=find.neighbors.absorbing(npops)), xlab='', yla
  text(-2, 0, 'Absorbing Boundary', adj=0)
}
```


Periodic Boundary
Reflective Boundary
Absorbing Boundary
0
2
4
6
8
10
12
0
20
40
60
80
100


Periodic Boundary
Reflective Boundary
Absorbing Boundary
0
2
4
6
8
10
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20
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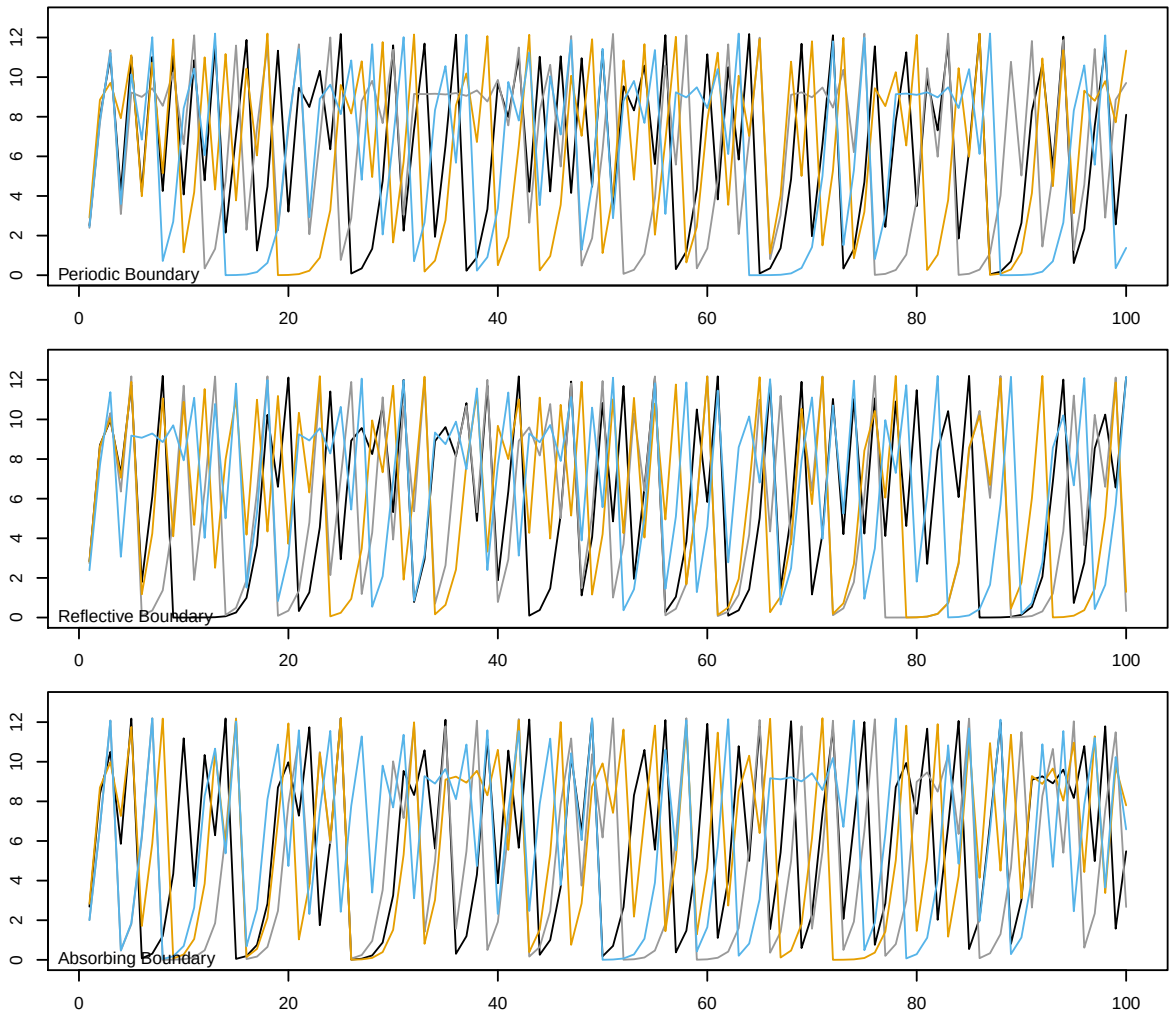
60
80
100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