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15 April 2016

BI 471

Homework 2 (Questions 2 and 3)

2a)

```
library(deSolve)
log.growth <- function(t, y, p) {
  N<-y[1]
  with(as.list(p),{
    dN.dt<-r*N*(1-(N/K))
    return(list(dN.dt))
  })
}
##Make a vector of parameters called 'P', with the given variables:
p<-c('r'=0.25, 'K'= 100)
p2<-c('r'=0.25, 'K'= 50)
p3<-c('r'= 0.25, 'K'= 25)

##Set your intitial conditions, called 'y0', using the function runif to assign random initial conditions:
y0<-c('N'=runif(1, min = 0.001, max = 0.1))

##Above, this just generated 1 random number, with the minimum value of 0.01 and maximum value of 0.1.

##Define t:
t<-1:100

sim<- ode(y=y0, times=t, func=log.growth, parms = p, method = 'lsoda')
sim<-as.data.frame(sim)
```

```
sim2<- ode(y=y0, times=t, func=log.growth, parms = p2, method = 'lsoda')
sim2<-as.data.frame(sim2)
sim3<- ode(y=y0, times=t, func=log.growth, parms = p3, method = 'lsoda')
sim3<-as.data.frame(sim3)

##Plot my simulation
sim$deriv<- c(diff(sim$N), NA)
sim2$deriv<- c(diff(sim2$N), NA)
sim3$deriv<- c(diff(sim3$N), NA)
plot(deriv ~ N, data = sim, type = 'l', lwd = 2, bty = 'l', col ='purple')
```

2b)

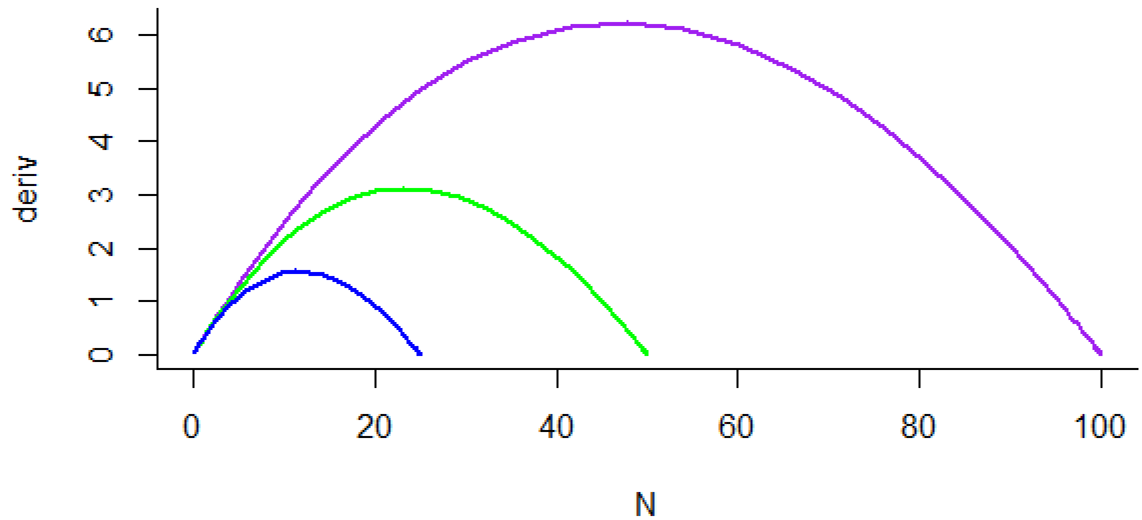
```
lines(deriv ~ N, data = sim2, type = 'l', lwd = 2, bty = 'l', col ='green')
lines(deriv ~ N, data = sim3, type = 'l', lwd = 2, bty = 'l', col ='blue')
```

2c)

```
max(sim$deriv, na.rm = TRUE)
which(sim$derive == max(sim$deriv, na.rm = TRUE))
sim$N[(sim$derive == max(sim$deriv, na.rm = TRUE))]

max(sim2$deriv, na.rm = TRUE)
which(sim2$derive == max(sim2$deriv, na.rm = TRUE))
sim2$N[(sim2$derive == max(sim2$deriv, na.rm = TRUE))]

max(sim3$deriv, na.rm = TRUE)
which(sim3$derive == max(sim3$deriv, na.rm = TRUE))
sim3$N[(sim3$derive == max(sim3$deriv, na.rm = TRUE))]
```



3.

```
library(deSolve)


log.growth <- function(t, y, p) {
  N<-y[1]
  with(as.list(p),{
    dN.dt<-r*N*(1-((N/K)^j))
    return(list(dN.dt))
  })
}




##Make a vector of parameters called 'P', with the given variables:
p<-c('r'=0.25, 'K'= 100, 'j'=0.5)
p2<-c('r'=0.25, 'K'= 100, 'j'=1)
```

p3<-c('r'=0.25, 'K'= 100, 'j'=1.8)

##Above, this just generated 1 random number, with the minimum value of 0.01 and maximum value of 0.1.

##Define t:

t<-1:100

sim<- ode(y=y0, times=t, func=log.growth, parms = p, method = 'lsoda')

sim<-as.data.frame(sim)

sim$deriv<- c(diff(sim$N), NA)

sim2<- ode(y=y0, times=t, func=log.growth, parms = p2, method = 'lsoda')

sim2<-as.data.frame(sim2)

sim2$deriv<- c(diff(sim2$N), NA)

sim3<- ode(y=y0, times=t, func=log.growth, parms = p3, method = 'lsoda')

sim3<-as.data.frame(sim3)

sim3$deriv<- c(diff(sim3$N), NA)

plot(deriv ~ N, data = sim, type = 'l', lwd = 2, bty = 'l', col ='purple')

lines(deriv ~ N, data = sim2, type = 'l', lwd = 2, bty = 'l', col ='green')

lines(deriv ~ N, data = sim3, type = 'l', lwd = 2, bty = 'l', col ='yellow')

max(sim$deriv, na.rm = TRUE)

which(sim$derive == max(sim$deriv, na.rm = TRUE))

sim$N[(sim$derive == max(sim$deriv, na.rm = TRUE))]

max(sim2$deriv, na.rm = TRUE)

which(sim2$derive == max(sim2$deriv, na.rm = TRUE))

sim2$N[(sim2$derive == max(sim2$deriv, na.rm = TRUE))]

```
max(sim3$deriv, na.rm = TRUE)

which(sim3$derive == max(sim3$deriv, na.rm = TRUE))

sim3$N[(sim3$derive == max(sim3$deriv, na.rm = TRUE))]
```

Species C (yellow), with theta = 1.8, will be maintained at the highest population: