```
#ERIC AGYEMANG
#MAT 455 LAST HOME WORK
#QUESTION# 7.6
#Parts A
Q = matrix(c(-2,1,1,0,1,-3,1,1,2,2,-4,0,1,2,3,-6), nrow=4,byrow=T)
colnames(Q)<-1:4
rownames(Q) <- 1:4
Q
P <- function(t) {expm(t*Q)}
P(1000)

#QUESTION 7.6
#Part B
P_0 = diag(4)
# P_1 is the embedded transition matrix
P_1 <- matrix (c(0,1/2,1/2,0, 1/3,0,1/3,1/3, 1/2,1/2,0,0, 1/6,1/3,1/2,0), nrow = 4, byrow = T)
for (i in 1:100) {
  P_0 <- P_0%*%P_1
}
P_0

#QUESTION# 7.6
#Part C
P_1 = P(1)
P_1[1,3]


#QUESTION# 7.6
#Part D
P_4 = P(4)
P_4[3,1]*P_1[3,4]

#QUESTION# 7.39
lamda <- 16
mu <- 6
c <-3 #Number of Servers
#number of simulations
n <- 1000000
visitor <-0
syst <- rep(0,n)
t <- rep(0,n)

for (j in 1:n) {
  arrivalTime <- rexp(1,lamda)
  departure <- ifelse(visitor == 0, arrivalTime + 1, rexp(1,mu*visitor))
  change <- ifelse(arrivalTime < departure, 1, -1)
  visitor <- visitor + change
  syst[j] <- visitor
  t[j] <- ifelse(arrivalTime < departure, arrivalTime, departure)

}
syst[1:100]
round(t[1:100],3)
#Total Time
sum(t)

#Average number of visitors in the system
sum(syst)/n
```