Assignment 2 Question 3

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```
install.packages("markovchain", repos = "https://cran.r-project.org")
```

```
## Installing package into 'C:/Users/muhammadazzazy/AppData/Local/R/win-library/4.4'
## (as 'lib' is unspecified)

## package 'markovchain' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##  C:\Users\muhammadazzazy\AppData\Local\Temp\RtmpUV0DDZ\downloaded_packages
```

```
install.packages("diagram", repos = "https://cran.r-project.org")
```

```
## Installing package into 'C:/Users/muhammadazzazy/AppData/Local/R/win-library/4.4'
## (as 'lib' is unspecified)

## package 'diagram' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##  C:\Users\muhammadazzazy\AppData\Local\Temp\RtmpUV0DDZ\downloaded_packages
```

```
library(markovchain)
```

```
## Package:  markovchain
## Version:  0.9.5
## Date:     2023-09-24 09:20:02 UTC
## BugReport: https://github.com/spedygiorgio/markovchain/issues
```

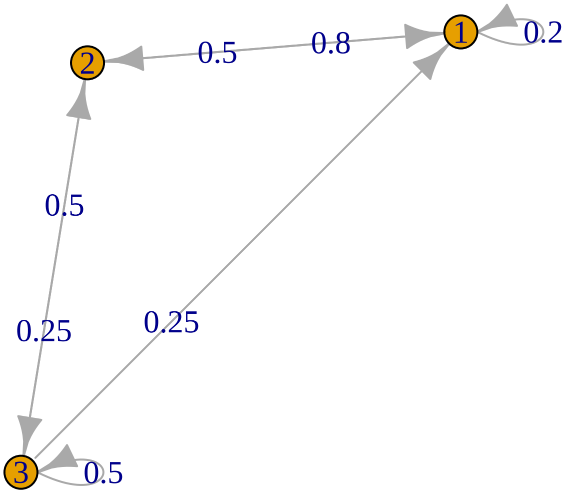
```
library(diagram)
```

```
## Loading required package: shape
```

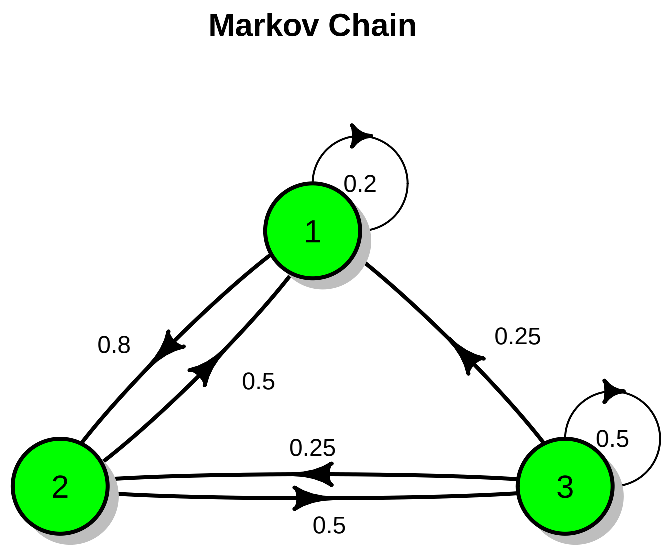
```
###### Simulate discrete-time Markov chain ########################
# Simulates n steps of a Markov chain
# markov(init,mat,n,states)
# Generates X0, ..., Xn for a Markov chain with initial
#  distribution init and transition matrix mat
# Labels can be a character vector of states; default is 1, .... k

markov <- function(init,mat,n,labels) {
  if (missing(labels)) labels <- 1:length(init)
  simlist <- numeric(n+1) #creating a vector of zeros

  states <- 1:length(init)
  simlist[1] <- sample(states,1,prob=init)
  for (i in 2:(n+1))
  { simlist[i] <- sample(states,1,prob=mat[simlist[i-1],]) }
  labels[simlist]
}
# define a transition matrix
tmQ1 <- matrix(c(0.2,0.8,0,0.5,0,0.5,0.25,0.25,0.5),nrow = 3, byrow = TRUE)
# create the DTMC
dtmcQ1 <- new("markovchain",transitionMatrix=tmQ1, states=c("1","2","3"),
              name="MarkovChain")
dtmcQ1
```

```
## MarkovChain
##  A  3 - dimensional discrete Markov Chain defined by the following states:
##  1, 2, 3
##  The transition matrix  (by rows)  is defined as follows:
##      1    2   3
## 1 0.20 0.80 0.0
## 2 0.50 0.00 0.5
## 3 0.25 0.25 0.5
```

```
plot(dtmcQ1)
```



```
stateNames <- c("1","2","3")
row.names(tmQ1) <- stateNames; colnames(tmQ1) <- stateNames
plotmat(t(tmQ1), pos = c(1, 2), box.type = "circle", main = "Markov Chain",
        box.col = "green", box.size=0.047, cex.txt=0.75, dtext=0.75)
```



```
# It is possible to simulate states distribution after n-steps
init<-c(1,0,0)
steps<-4
finalState<-init*dtmcQ1^steps #using power operator
finalState
```

```
##           1      2     3
## [1,] 0.3496 0.2844 0.366
```

```
finalState[2]
```

```
## [1] 0.2844
```