Procesos Estocásticos y Series Temporales

Entregable Práctica 1

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Problema 1

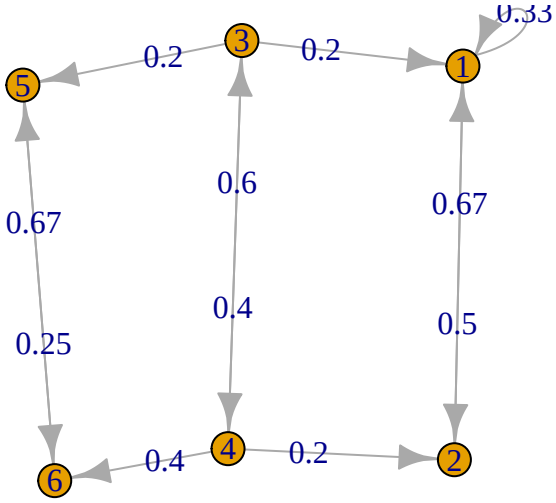
Apartado (a)

```
library(markovchain)
set.seed(1234)

estados <- as.character(1:6) # Definimos los estados
P <- rbind(c(1/3, 2/3, 0, 0, 0, 0),
           c(1/2, 1/2, 0, 0, 0, 0),
           c(1/5, 0, 0, 3/5, 1/5, 0),
           c(0, 1/5, 2/5, 0, 0, 2/5),
           c(0, 0, 0, 0, 1/3, 2/3),
           c(0, 0, 0, 0, 1/4, 3/4))

mc <- new("markovchain", states = estados, transitionMatrix = P)

plot(mc)
```




```
summary(mc)
```

```
## Unnamed Markov chain  Markov chain that is composed by:
## Closed classes:
## 1 2
## 5 6
## Recurrent classes:
## {1,2},{5,6}
## Transient classes:
## {3,4}
## The Markov chain is not irreducible
## The absorbing states are: NONE
```

Apartado (b)

```
meanAbsorptionTime(mc)
```

```
##        3        4
```

```
## 2.105263 1.842105
```

Apartado (c)

```
X0 <- "3"
conditionalDistribution(mc, X0)
```

```
##   1   2   3   4   5   6
## 0.2 0.0 0.0 0.6 0.2 0.0
```

Apartado (d)

```
X0 <- "4"
conditionalDistribution(mc, X0)
```

```
##   1   2   3   4   5   6
## 0.0 0.2 0.4 0.0 0.0 0.4
```

Problema 2

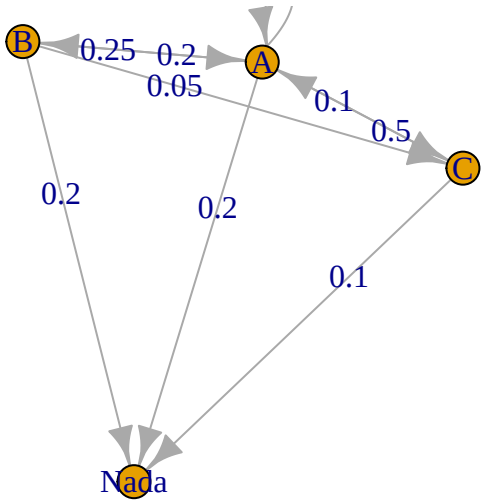
Apartado (a)

```
estados <- c("A", "B", "C", "Nada") # Invierte en uno de los tres o en ninguno

P <- rbind(c(0.5, 0.2, 0.1, 0.2),
           c(0.25, 0.5, 0.05, 0.2),
           c(0.5, 0, 0.4, 0.1),
           c(0, 0, 0, 1))

mc.inversion <- new("markovchain", states <- estados, transitionMatrix = P, name = "Inversiones")

set.seed(1234)
plot(mc.inversion)
```



Apartado (b)

```
library(expm)
P %^% 1
```

```
##      [,1] [,2] [,3] [,4]
## [1,] 0.50  0.2 0.10  0.2
## [2,] 0.25  0.5 0.05  0.2
## [3,] 0.50  0.0 0.40  0.1
## [4,] 0.00  0.0 0.00  1.0
```

```
P %^% 4
```

```
##         [,1]  [,2]   [,3]    [,4]
## [1,] 0.22250 0.140 0.0700 0.56750
## [2,] 0.21025 0.152 0.0632 0.57455
```

```
## [3,] 0.27950 0.141 0.0961 0.48340
## [4,] 0.00000 0.000 0.0000 1.00000
```

```
P %^% 8
```

```
##            [,1]      [,2]       [,3]      [,4]
## [1,] 0.09850625 0.0623000 0.03115000 0.8080438
## [2,] 0.09640303 0.0614502 0.03039742 0.8117494
## [3,] 0.11869395 0.0741121 0.03771141 0.7694825
## [4,] 0.00000000 0.0000000 0.00000000 1.0000000
```

Apartado (c)

Apartado (d)

```
inversores_totales <- 400 + 350 + 250 # clientes que han invertido este año en algún producto
distribucion_inicial <- c(400, 350, 250, 6000 - inversores_totales) / 6000

# Dentro de 8 años
distribucion_8_años <- distribucion_inicial %*% (P %^% 8)
inversores_8_años <- (distribucion_8_años[1] + distribucion_8_años[2] + distribucion_8_años[3]) *
↪  6000
cat("Clientes que inviertan en los próximos 8 años:", round(inversores_8_años))
```

```
## Clientes que inviertan en los próximos 8 años: 200
```

Problema 3

Apartado (a)

```
# Definición de los estados
estados <- c("A", "B", "C", "D", "E", "F", "G")

# Definimos la matriz de transición
P <- rbind(c(0, 1/2, 1/2, 0, 0, 0, 0),
           c(0, 0, 0, 1/3, 0, 1/3, 1/3),
           c(1, 0, 0, 0, 0, 0, 0),
           c(0, 1, 0, 0, 0, 0, 0),
           c(0, 0, 1/3, 1/3, 0, 1/3, 0),
           c(0, 1/2, 1/2, 0, 0, 0, 0),
           c(0, 0, 0, 1, 0, 0, 0))

mc.pageRank <- new("markovchain", states = estados,
                   transitionMatrix = P, name = "PageRak")

is.irreducible(mc.pageRank)
```

```
## [1] FALSE
```

Apartado (b)

```
d <- 0.7
n <- 7
M <- d*P + (1-d)*(1/n)*matrix(1, n, n)
M
```

```
##            [,1]       [,2]       [,3]       [,4]       [,5]       [,6]
## [1,] 0.04285714 0.39285714 0.39285714 0.04285714 0.04285714 0.04285714
## [2,] 0.04285714 0.04285714 0.04285714 0.27619048 0.04285714 0.27619048
## [3,] 0.74285714 0.04285714 0.04285714 0.04285714 0.04285714 0.04285714
## [4,] 0.04285714 0.74285714 0.04285714 0.04285714 0.04285714 0.04285714
## [5,] 0.04285714 0.04285714 0.27619048 0.27619048 0.04285714 0.27619048
## [6,] 0.04285714 0.39285714 0.39285714 0.04285714 0.04285714 0.04285714
## [7,] 0.04285714 0.04285714 0.04285714 0.74285714 0.04285714 0.04285714
##            [,7]
## [1,] 0.04285714
## [2,] 0.27619048
```

```
## [3,] 0.04285714
## [4,] 0.04285714
## [5,] 0.04285714
## [6,] 0.04285714
## [7,] 0.04285714
```

```
mc.pageRank <- new("markovchain", states = estados,
                   transitionMatrix = M, name = "PageRak")
is.irreducible(mc.pageRank)
```

```
## [1] TRUE
```

```
period(mc.pageRank)
```

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

Apartado (c)

```
steadyStates(mc.pageRank)
```

```
##              A         B        C         D          E         F         G
## [1,] 0.1429424 0.2643918 0.142979 0.1877325 0.04285714 0.1145486 0.1045486
```

Problema 4