BAYESIAN NETWORKS 4th Exercise Block 3

Jeremy Williams

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```
#install.packages("bnlearn")
#install.packages("gRain")
#source("http://bioconductor.org/biocLite.R")
#biocLite("Rgraphviz")
#biocLite("RBGL")

suppressMessages(suppressWarnings(library("bnlearn")))
suppressMessages(suppressWarnings(library("gRain")))
suppressMessages(suppressWarnings(library("gRbase")))
suppressMessages(suppressWarnings(library("Rgraphviz")))
suppressMessages(suppressWarnings(library("RBGL")))


DATA <- load("C:/Users/Nonika/Desktop/DVM_Block_3/datos_generados_ejercicio_7.rdata")

data <- subset(datos_generados_ejercicio_7,!(X=="NA" | Y=="NA" | Z=="NA"))

# Now we create a empty network:
names<-c("Z","Y","X")
net=empty.graph(names)
net
```

```
##
##   Random/Generated Bayesian network
##
##   model:
##    [Z][Y][X]
##   nodes:                                 3
##   arcs:                                  0
##     undirected arcs:                     0
##     directed arcs:                       0
##   average markov blanket size:           0.00
##   average neighbourhood size:            0.00
##   average branching factor:              0.00
##
##   generation algorithm:                  Empty
```

```
class(net)
```

```
## [1] "bn"
```

```
# we see that "net" is a bn object.
# Now introduce the arrows:

arcs(net)=  matrix(c("X","Z","Y","Z"), ncol=2, byrow=TRUE, dimnames=list(c(),c("from","to")))

data <- data.frame(lapply(data, as.factor))

colnames(data)<-c("Z","Y","X")
```

```
net.estimated=bn.fit(net,data, method="mle")
net.estimated
```

```
##
##   Bayesian network parameters
##
##   Parameters of node Z (multinomial distribution)
##
## Conditional probability table:
##
## , , X = 0
##
##    Y
## Z           0         1
##   0 0.7468354 0.6193182
##   1 0.2531646 0.3806818
##
## , , X = 1
##
##    Y
## Z           0         1
##   0 0.3043478 0.1848739
##   1 0.6956522 0.8151261
##
##
##   Parameters of node Y (multinomial distribution)
##
## Conditional probability table:
##         0        1
## 0.297619 0.702381
##
##   Parameters of node X (multinomial distribution)
##
## Conditional probability table:
##          0         1
## 0.6071429 0.3928571
```

```
class(net.estimated)
```

```
## [1] "bn.fit"      "bn.fit.dnet"
```

```
coef<-coefficients(net.estimated)
coef
```

```
## $Z
## , , X = 0
##
##    Y
## Z           0         1
##   0 0.7468354 0.6193182
##   1 0.2531646 0.3806818
##
## , , X = 1
##
##    Y
## Z           0         1
```

```
##   0 0.3043478 0.1848739
##   1 0.6956522 0.8151261
##
##
## $Y
##        0        1
## 0.297619 0.702381
##
## $X
##         0         1
## 0.6071429 0.3928571
```

```
# Estimations of the parameters are:

#X values

# theta_11=P(X=true)=
dx<-coef$X
coef.mx<-as.matrix(dx)
coef.mx
```

```
##        [,1]
## 0 0.6071429
## 1 0.3928571
```

```
theta_11<-coef.mx[2]

#Y values

# theta_21=P(Y=true)=
dy<-coef$Y
coef.my<-as.matrix(dy)
coef.my
```

```
##       [,1]
## 0 0.297619
## 1 0.702381
```

```
theta_21<-coef.my[2]

#Z values

dz<-coef$Z
coef.mz<-as.matrix(dz)
coef.mz
```

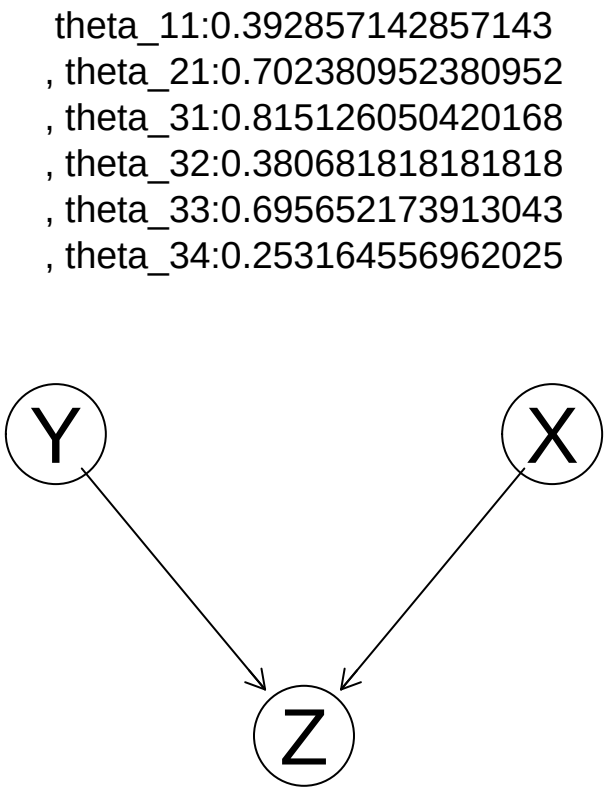
```
##           [,1]
## [1,] 0.7468354
## [2,] 0.2531646
## [3,] 0.6193182
## [4,] 0.3806818
## [5,] 0.3043478
## [6,] 0.6956522
## [7,] 0.1848739
## [8,] 0.8151261
```

```r
# theta_31=P(Z=1/X=1,Y=1)
theta_31<-coef.mz[8]
# theta_32=P(Z=1|X=0,Y=1)
theta_32<-coef.mz[4]
# theta_33=P(Z=1|X=1,Y=0)
theta_33<-coef.mz[6]
# theta_34=P(Z=1|X=0,Y=0)
theta_34<-coef.mz[2]

theta.all<-cbind(theta_11,theta_21,theta_31,theta_32,theta_33,theta_34)
theta.all
```

```
##       theta_11 theta_21  theta_31  theta_32  theta_33  theta_34
## [1,] 0.3928571 0.702381 0.8151261 0.3806818 0.6956522 0.2531646
```

```r
par(mfrow=c(1,1))
dnum<-paste0(colnames(theta.all),":",as.character(theta.all),sep = "\n")
BNLplot<-graphviz.plot(net,main=toString(dnum))
```




```r
BNLplot
```

```
## A graphNEL graph with directed edges
## Number of Nodes = 3
## Number of Edges = 2
```