Practical 2: Bayesian Network Inference

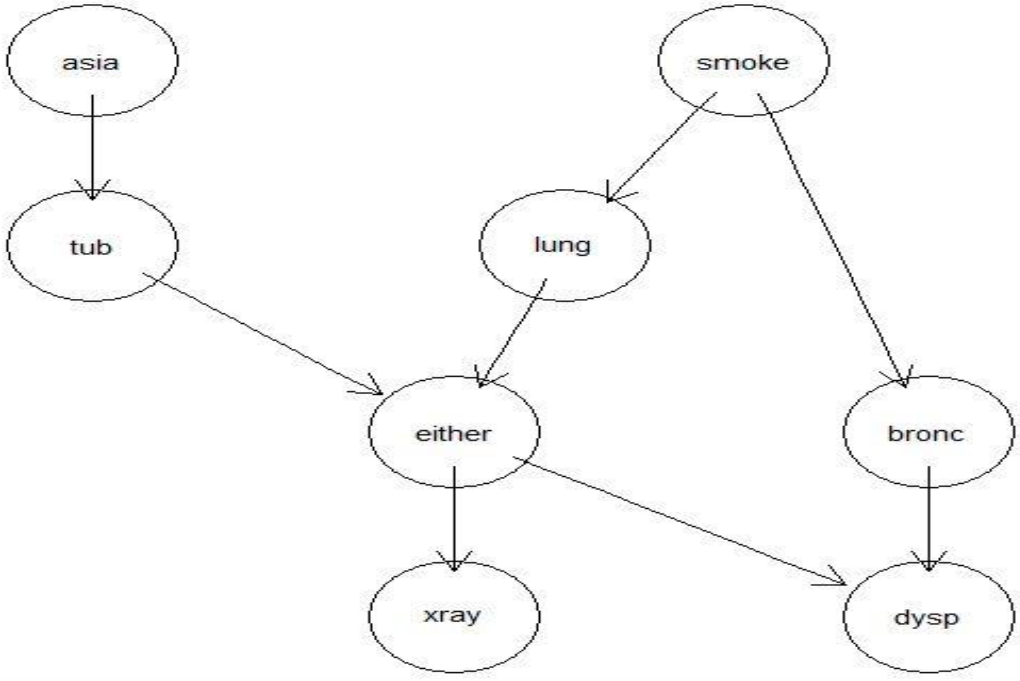
I. Bayesian network inference with gRain

1. Start R or Rstudio (Recommended).
2. Install the *gRain* package.
   - Select Tools→ install packages→specify the name of the package you want to install.
   - Tick the "Install dependencies" box to install all the dependent packages.
   - Click "Install".
3. Run the following codes to create the conditional probability table for the Asia network

```
library(gRain)
yn <- c("yes","no")
a <- cptable(~asia, values=c(1,99),levels=yn)
t.a <- cptable(~tub|asia, values=c(5,95,1,99),levels=yn)
s <- cptable(~smoke, values=c(5,5), levels=yn)
l.s <- cptable(~lung|smoke, values=c(1,9,1,99), levels=yn)
b.s <- cptable(~bronc|smoke, values=c(6,4,3,7), levels=yn)
e.lt <-
cptable(~either|lung:tub,values=c(1,0,1,0,1,0,0,1),levels=yn)
x.e <- cptable(~xray|either, values=c(98,2,5,95), levels=yn)
d.be <- cptable(~dysp|bronc:either, values=c(9,1,7,3,8,2,1,9),
levels=yn)
plist <- compileCPT(list(a, t.a, s, l.s, b.s, e.lt, x.e, d.be))
plist

#Checking the (conditional) probability of some nodes
plist$tub
plist$either
```

4. Draw the network: `net1=grain(plist) (in R: plot(net1))`



5. Query the marginal probabilities P(lung) and P(bronc):
```
querygrain(net1, nodes=c("lung","bronc"), type="marginal")
```
6. Query the joint probability P(lung, bronc):
```
querygrain(net1, nodes=c("lung","bronc"), type="joint")
```

7. Query the conditional probability P(lung|bronc)
```
querygrain(net1, nodes=c("lung","bronc"), type="conditional")
```

8. Calculate the following probabilities:
    - P(lung=yes,bronc=yes)
    - P(bronc=yes)
    - P(lung=yes|smoke=yes)
    - P(xray=yes|smoke=yes)
    - P(xray=yes|smoke=yes, asia=yes)
    - P(lung=yes|asia=yes)
    - P(bronc=yes|smoke=yes, asia=yes)