16 Asia: a simple expert system

16.1 Evidence propagation

Lauritzen and Spiegelhalter (1988) introduce a fictitious "expert system" representing the diagnosis of a patient presenting to a chest clinic, having just come back from a trip to Asia and showing dyspnoea (shortness-of-breath). A graphical model for the underlying process is shown in the Figure 23, where each variable is binary. The BUGS code is shown below and the conditional probabilities used are given in Lauritzen and Spiegelhalter (1988).
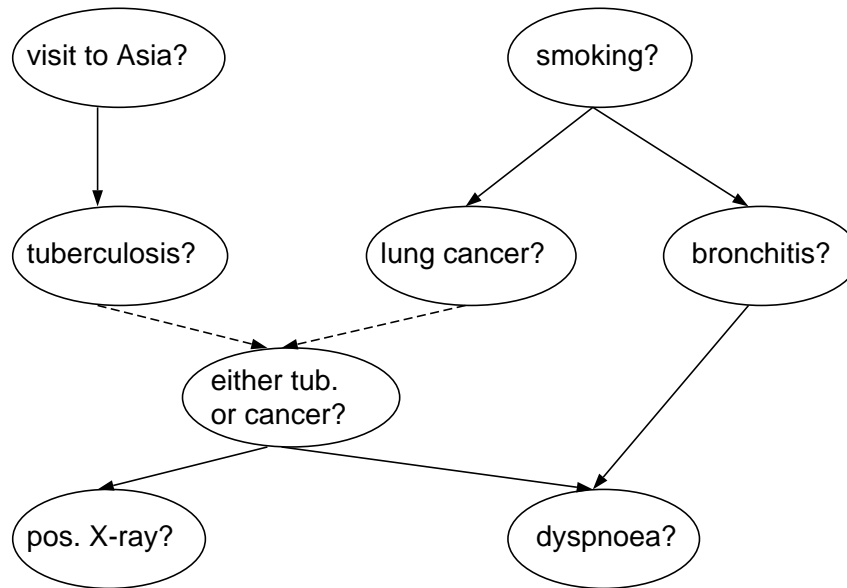

Figure 23: Graphical model for asia example

Asia: **model specification in** BUGS

```
model Asia;
var
    asia,smoking,tuberculosis,lung.cancer,bronchitis,either,xray,dyspnoea,
    p.asia[2],p.smoking[2],p.tuberculosis[2,2],p.bronchitis[2,2],
    p.lung.cancer[2,2],p.xray[2,2],p.dyspnoea[2,2,2];
data in "asia.dat";
{
    smoking       ~ dcat(p.smoking[]);
    tuberculosis ~ dcat(p.tuberculosis[asia,]);
    lung.cancer   ~ dcat(p.lung.cancer[smoking,]);
    bronchitis    ~ dcat(p.bronchitis[smoking,]);
    either        <- max(tuberculosis,lung.cancer);
    xray          ~ dcat(p.xray[either,]);
    dyspnoea      ~ dcat(p.dyspnoea[either,bronchitis,])
}
```