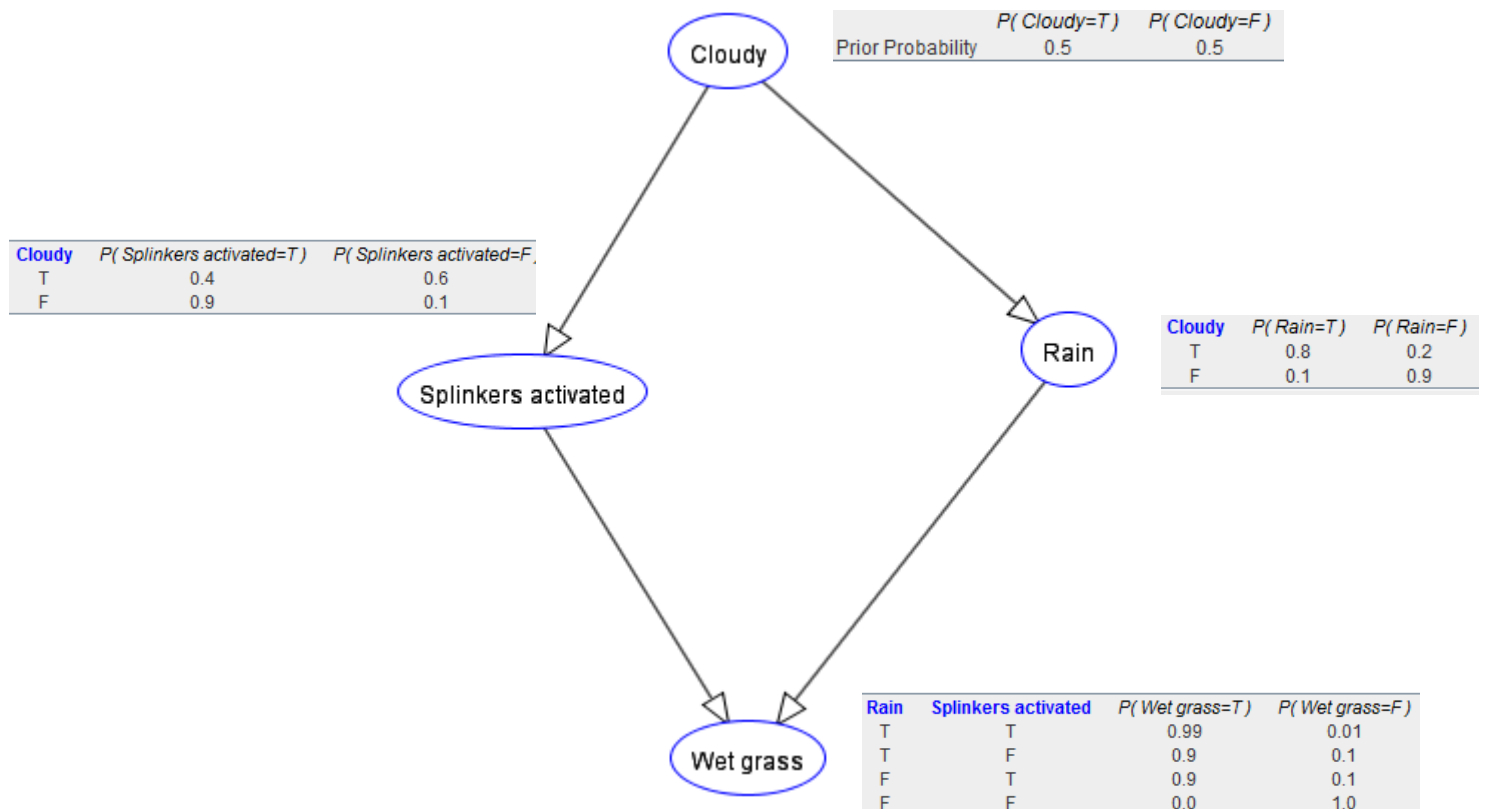


# Homework 6: Bayesian networks

## Assignment 1

Draw the Bayesian network corresponding to the following:

- There is a 0.5 probability that it is cloudy
- If it's cloudy,  $P(\text{Rain}) = 0.8$  (The probability that it rains is 0.8)
- If it's not cloudy, then  $P(\text{Rain}) = 0.1$
- If it's cloudy, the probability that the sprinklers starts (  $P(\text{Sprinklers})$  ) is only 0.4
- If it's not cloudy, then  $P(\text{Sprinklers}) = 0.9$
- If it rains and the sprinklers are activated, then  $P(\text{WetGrass}) = 0.99$
- If it rains, but the sprinklers are off, then  $P(\text{WetGrass}) = 0.9$
- If it doesn't rain, but the sprinklers work, then  $P(\text{WetGrass}) = 0.9$
- If it neither rains, nor the sprinkler works, then  $P(\text{WetGrass}) = 0$

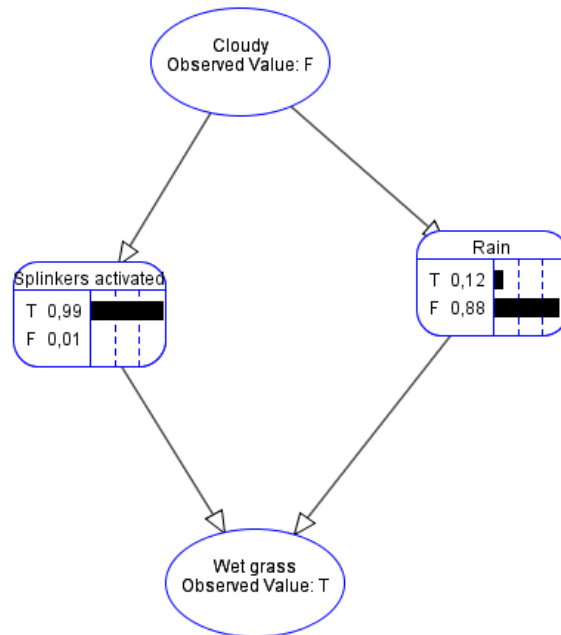


Joint probability function:

$$P(W, S, R, C) = P(W|S, R)P(S|C)P(R|C)P(C)$$

If  $WetGrass=True$  and  $Cloudy=False$ , what is the probability it rained? The probability the sprinklers were on?

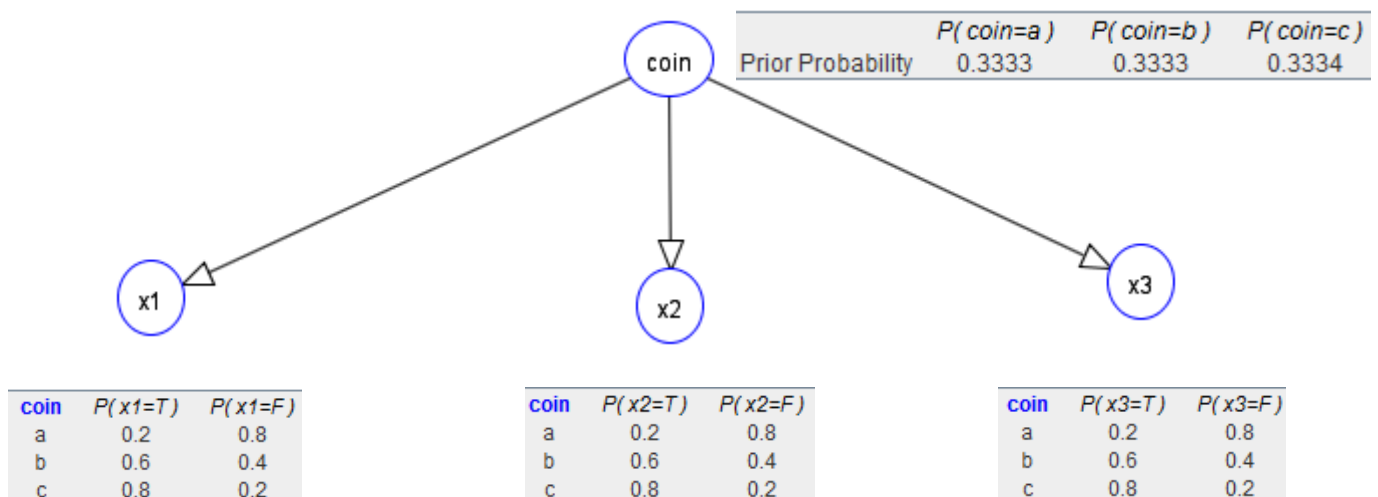
With  $Wet\ grass = T$ ,  $Cloudy = F$  we have  $P(rained) = 0.12$  and  $P(\text{Sprinklers on}) = 0.99$ .



## Assignment 2

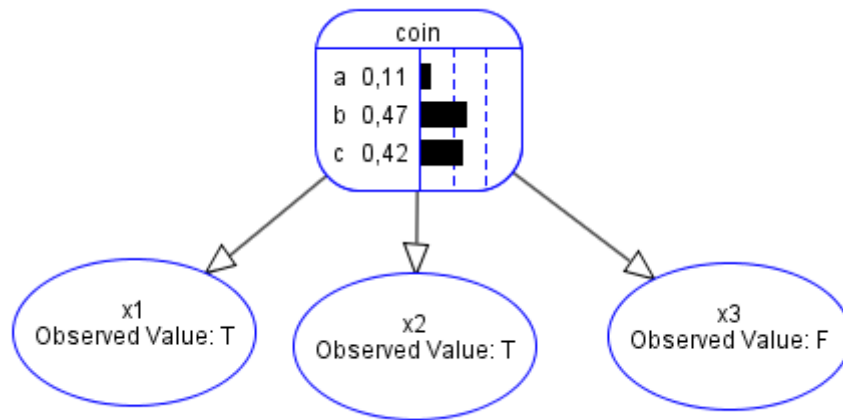
Draw the Bayesian network corresponding to the following:

- We have a bag of three biased coins a, b, and c with probabilities of coming up heads of 20%, 60%, and 80%, respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins), and then the coin is flipped three times to generate the outcomes  $X_1$ ,  $X_2$ , and  $X_3$ .



Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once

The coin searched is the b.



### Assignment 3

The joint probability function in the Fire Alarm Belief network is:

$$P(R, L, A, T, F) = P(R|L)P(L|A)P(A|T, F)P(T)P(F)$$

The modified network is:

