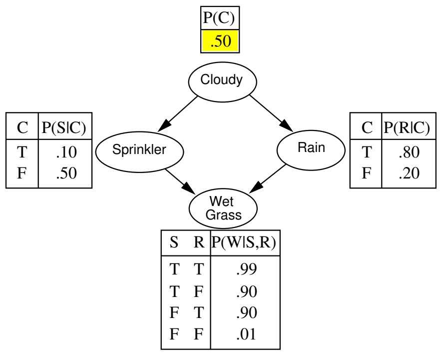
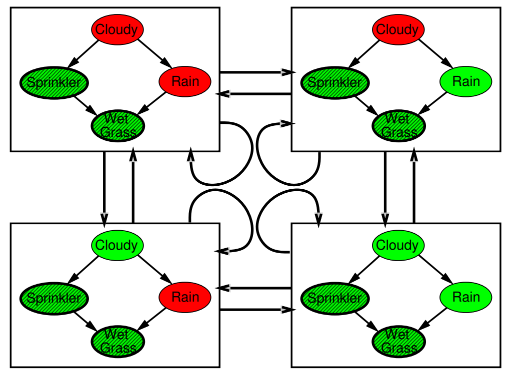
CS5811 handout - Markov Chain Monte Carlo (MCMC) sampling
The procedure to obtain the sampling distributions





The probability of a variable given its Markov blanket is proportional to the probability of the variable given its parents times the probability of each child given its respective parents:

$$P(x_i|mb(X_i)) = \alpha P(x_i|parents(X_i) \times \prod_{Y_j \in children(X_i)} P(y_j|parents(Y_j))$$

Consider the query $\mathbb{P}(R|S=t, W=t)$.
S is true from the evidence. Suppose that R is true in the state.
We will be sampling for C.

The Markov blanket of C is its parents ($\emptyset$), its children ($\{R, S\}$), and the other parents of its children ($\emptyset$). We use the following distributions to sample C.

$\mathbb{P}(C|mb(C)) = \mathbb{P}(C|R=t, S=t) = \alpha\ \mathbb{P}(C)\ \mathbb{P}(S=t|C)\ \mathbb{P}(R=t|C)$
$= \alpha < 0.5, 0.5 > < 0.1, 0.5 > < 0.8, 0.2 >$
$= \alpha < 0.04, 0.05 >$
$=< \frac{4}{9}, \frac{5}{9} >$

For the states where R is false, $\mathbf{P}\ (C|\neg R, S)$ is calculated similarly .

S is true from the evidence. Suppose that C is true in the state.
We will be sampling for R.

The Markov blanket of R is its parents ($\{C\}$), its children ($\{W\}$), and the other parents of its children ($\{S\}$). We use the following distributions to sample R.

$\mathbb{P}(R|mb(R)) = \mathbb{P}(R|C=t, S=t, W=t) = \alpha\ \mathbb{P}(R|C=t)\ \mathbb{P}(W=t|R, S=t)$
$= \alpha < 0.8, 0.2 > < 0.99, 0.90 >$
$= \alpha < 0.792, 0.18 >$
$= \alpha < \frac{0.792}{0.972}, \frac{0.18}{0.972} > < \frac{22}{27}, \frac{5}{27} >$

$\mathbb{P}(R|\neg C, S, W)$ is calculated similarly.