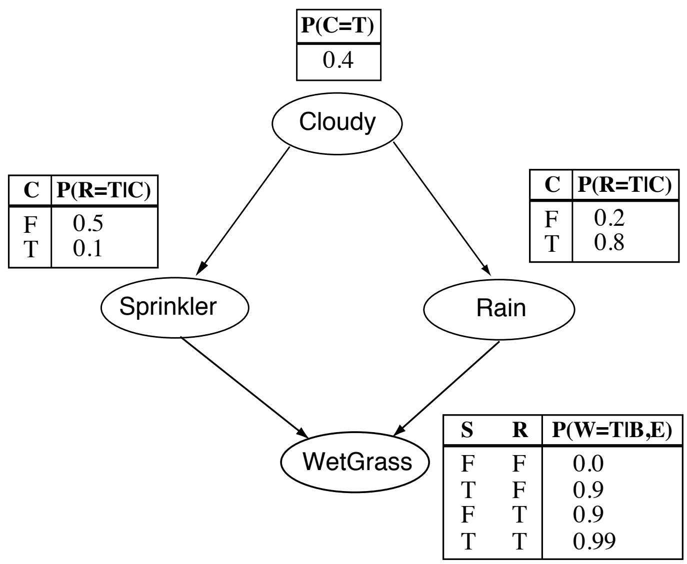
CSCI4155/CSCI6505: Assignment 5

This is an individual assignment. This assignment must be submitted on paper at the beginning of the class on Tuesday, November 10, or left in my mailbox (talk to Barbara at the front desk in the CS building). Late submissions are not accepted.

1. In the alarm example discussed in the manuscript, calculate the probability that there was a burglary, given that John and Marry called.

2. The graph below shows another famous example. Implement this model with the BNT toolbox and calculate the probability that the sprinkler is on given that the grass is wet. Also calculate the probability that the sprinkler is on given that the grass is wet and that it rains.



Additional questions for 6505 (grad) students

3. (From Thrun, Burgard and Fox, Probabilistic Robotics) A robot uses a sensor that can measure ranges from $0m$ to $3m$. For simplicity, assume that the actual ranges are distributed uniformly in this interval. Unfortunately, the sensors can be faulty. When the sensor is faulty it constantly outputs a range below $1m$, regardless of the actual range in the sensor's measurement cone. We know that the prior probability for a sensor to be faulty is $p = 0.01$.
   Suppose the robot queries its sensors N times, and every single time the measurement value is below $1m$. What is the posterior probability of a sensor fault, for $N = 1, 2, ..., 10$. Formulate the corresponding probabilistic model.

4. Given are four Bernoulli distributed random variables X_1, X_2, X_3 and Y. The conditional probability of random variables X_i on Y is given by $p(x_i|y) = 0.2$ and $p(x_i|\neg y) = 0.6$, and all x_i are conditionally independent of each other given Y. The marginal probability of Y is $p(y) = 0.3$. What is the probability of Y given X_1 =true and X_2 =true and X_3 =false ?