Assignment 4, COMP4702

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Prac 10

Question 3

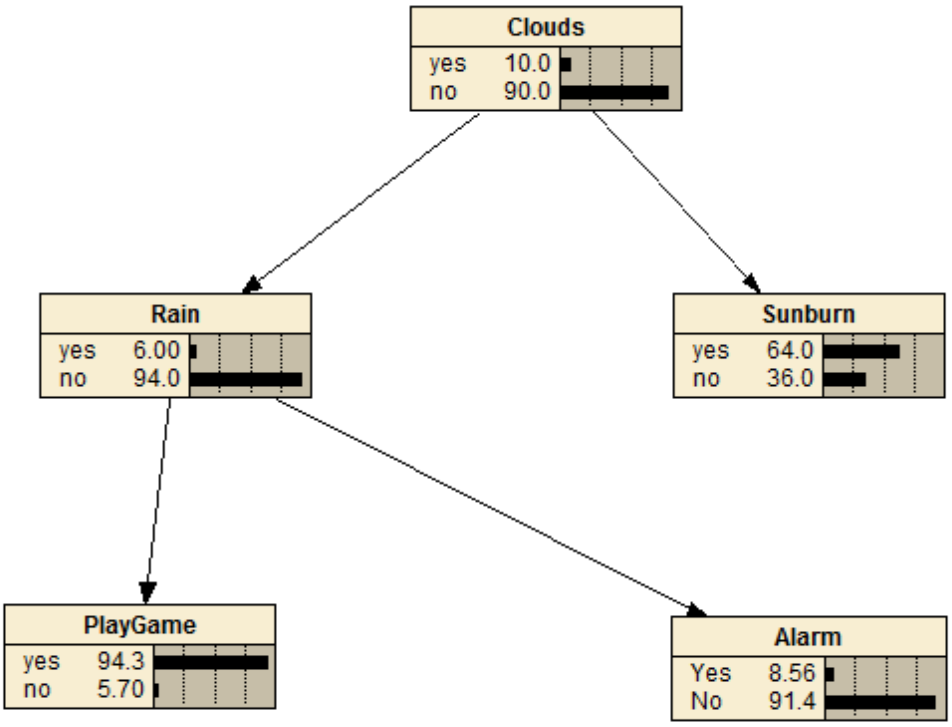

Figure 1: Network

The probabilities in the network match the course notes, thus are valid.

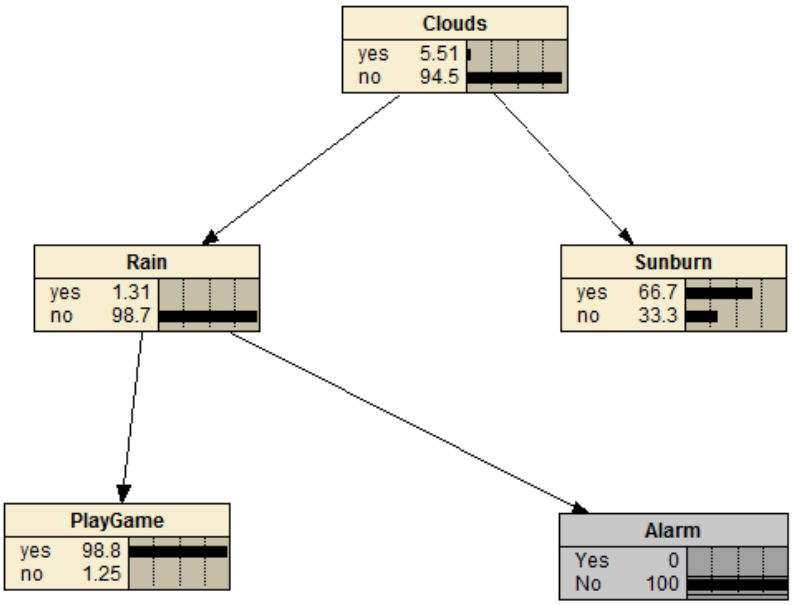

Figure 2: No Alarm

If there is no rain alarm then the chance of clouds decrease by around a half, to 5.51%. Since the alarm is not going off, there is a 99.8% chance the game will be played. Additionally the chance of sunburn increases by around 3%.

Question 4

For this question Bayes rule is required.

$$P(C|W) = \frac{P(W|C)P(C)}{P(W)}$$

Thus three parts are required, $P(W|C)$, $P(C)$ and $P(W)$.

$$P(C) = 0.5$$
$$P(\sim C) = 0.5$$

$$
\begin{aligned}
P(W|C) &= P(W|RS) \times P(R|C) \times P(S|C) \\
&\quad + P(W|\sim RS) \times P(\sim R|C) \times P(S|C) \\
&\quad + P(W|R \sim S) \times P(R|C) \times P(\sim S|C) \\
&\quad + P(W|\sim R \sim S) \times P(\sim R|C) \times P(\sim S|C) \\
&= 0.95 \times 0.8 \times 0.1 \\
&\quad + 0.9 \times 0.2 \times 0.1 \\
&\quad + 0.9 \times 0.8 \times 0.9 \\
&\quad + 0.1 \times 0.2 \times 0.9 \\
&= 0.076 + 0.018 + 0.648 + 0.018 \\
&= 0.76
\end{aligned}
$$

$$
\begin{aligned}
P(W|\sim C) &= P(W|RS) \times P(R|\sim C) \times P(S|\sim C) \\
&\quad + P(W|\sim RS) \times P(\sim R|\sim C) \times P(S|\sim C) \\
&\quad + P(W|R \sim S) \times P(R|\sim C) \times P(\sim S|\sim C) \\
&\quad + P(W|\sim R \sim S) \times P(\sim R|\sim C) \times P(\sim S|\sim C) \\
&= 0.95 \times 0.1 \times 0.5 \\
&\quad + 0.9 \times 0.9 \times 0.5 \\
&\quad + 0.9 \times 0.1 \times 0.5 \\
&\quad + 0.1 \times 0.9 \times 0.5 \\
&= 0.0475 + 0.405 + 0.045 + 0.045 \\
&= 0.5425
\end{aligned}
$$

$$
\begin{aligned}
P(W) &= P(W|C) \times P(C) + P(W|\sim C) \times P(\sim C) \\
&= 0.76 \times 0.5 + 0.5425 \times 0.5 \\
&= 0.65125
\end{aligned}
$$

Combining this all together yields the following

$$
\begin{aligned}
P(C|W) &= \frac{P(W|C)P(C)}{P(W)} \\
&= \frac{0.76 \times 0.5}{0.65125} \\
&= 0.583493
\end{aligned}
$$

Thus the probablity that it is cloudy given the grass is wet is 0.583 or 58.3%.

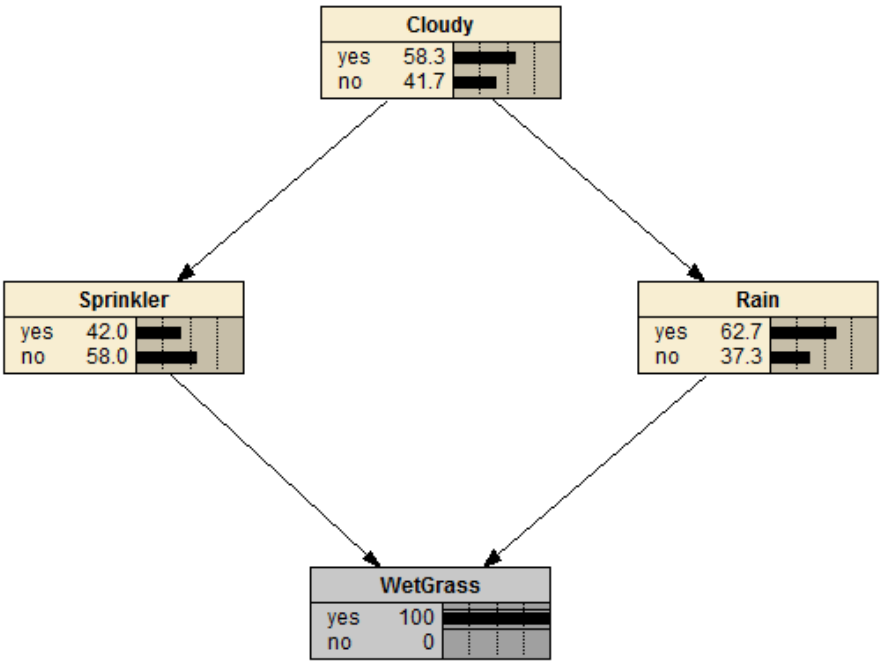

Figure 3: Network

This matches the value given by the equations, which is 58.3%.

Prac 11

Question 1

```
% Prac 11 Q1
% Roy Portas

% Get the data range
x = [-1:0.05:8];

% Sample average (m)
m = mean(data);
```

```
% mu is also the mean
mu = m;


% Number of samples (N)
d = size(data);
N = d(1);

% Get the variance of data
sigma = var(data);

hold on;
% Plot normal
% plot(x, normpdf(x, mu, sigma));

% Chosen from inspecting the chart of the prac sheet
mu0 = 2;
sigma0 = 0.4;

% Plot data
scatter(data, zeros(size(data)), 'x');

posterior_mu = (sigma / (N * sigma0 + sigma) * mu0) + (N * sigma0
    / (N * sigma0 + sigma) * m);
posterior_sigma = 1/(1/sigma0 + N/sigma);

% Posterior
plot(x, normpdf(x, posterior_mu, posterior_sigma), 'b');

% Prior
plot(x, normpdf(x, mu0, sigma0), 'r');

legend('Data', 'Posterior', 'Prior');
```

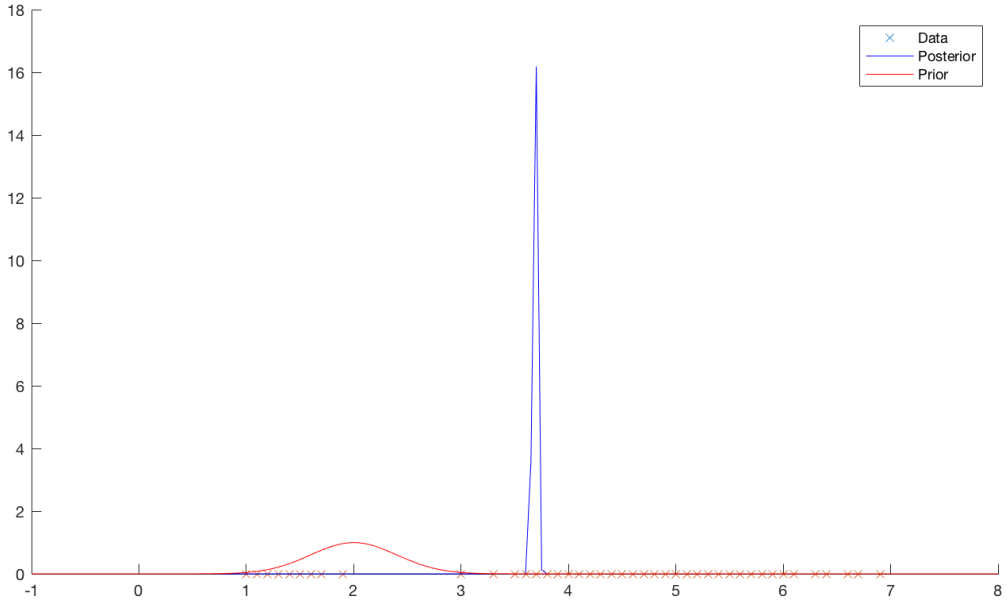

Figure 4: Model prior and posterior distributions