

# Chapter 26

stevenjin8

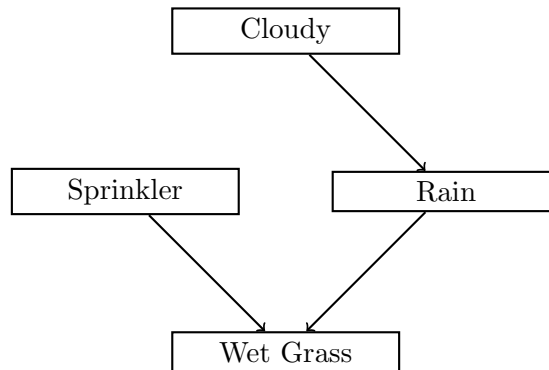
July 18, 2021

## Comments and Proofs

### Exercises

#### Exercise 1

- a. By conditioning on  $\text{do}(W = T)$ , the graph becomes



The marginal for  $R$  uniform (but if we were in Vancouver,  $p(R = T) = 1$ ).  
Thus,

$$\begin{aligned} p(W = T | \text{do}(S = T)) &= p(W = T, R = T | \text{do}(S = T)) + p(W = T, R = F | \text{do}(S = T)) \\ &= p(W = T | R = T, \text{do}(S = T))p(R = T | \text{do}(S = T)) \\ &\quad + p(W = T | R = F, \text{do}(S = T))p(R = F | \text{do}(S = T)) \\ &= p(W = T | R = T, \text{do}(S = T))p(R = T) \\ &\quad + p(W = T | R = F, \text{do}(S = T))p(R = F) \\ &= 0.9 \times 0.5 + 0.99 \times 0.5 \\ &= 0.945 \end{aligned}$$

**b.** Similarly, we have

$$\begin{aligned} p(W = T | \text{do}(S = F)) &= p(W = T | R = T, \text{do}(S = F))p(R = T) \\ &\quad + p(W = T | R = F, \text{do}(S = F))p(R = F) \\ &= 0 \times 0.5 + 0.9 \times 0.5 \\ &= 0.45 \end{aligned}$$

**c.** Since  $C$  is the root of the DAG, performing do-calculus makes no difference. Thus

$$p(S = T | \text{do}(C = T)) = p(S = T | C = T) = 0.1.$$

Unsurprisingly, we find out that sprinklers cause grass to become wet.