

CS 188 SECTION 8

ABOUT ME

- Daylen Yang
- daylen@berkeley.edu (but use Piazza!)
- Sections MW 4-5pm in 310 Soda
- Office Hours Thursdays 4-6pm in 411 Soda

UPCOMING DEADLINES

- HW 4 due this **Wednesday** @ 11:59
- Project 4 due this **Friday** 7/22 @ 5pm
- Midterm 2 **in 9 days** on 7/27

BAYES NETS: SAMPLING

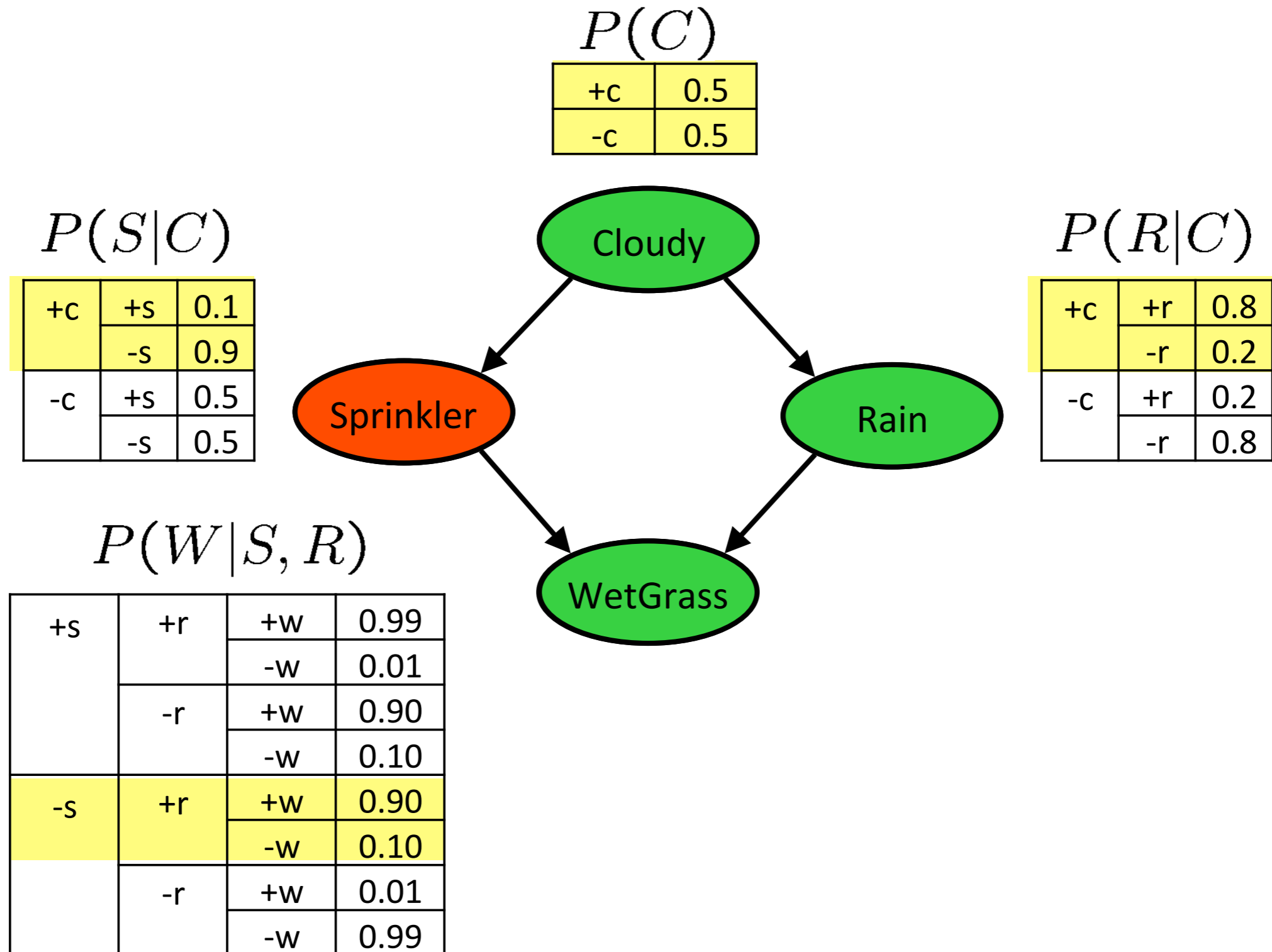
- Prior Sampling
- Rejection Sampling
- Likelihood Weighting

PRIOR SAMPLING

- Sample according to the conditional probability tables!
- Creates an estimate of the joint distribution

- For $i=1, 2, \dots, n$
 - Sample x_i from $P(X_i \mid \text{Parents}(X_i))$
- Return (x_1, x_2, \dots, x_n)

PRIOR SAMPLING EXAMPLE

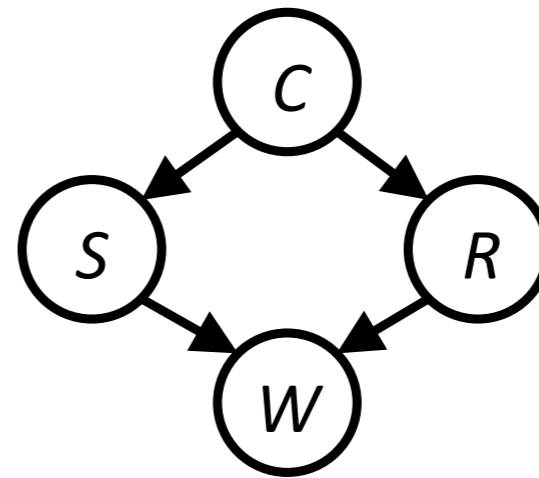


REJECTION SAMPLING

- What if you want to incorporate evidence? E.g. $S = +s$
- Same as prior sampling, but ignore samples that don't have $S = +s$

- IN: evidence instantiation
- For $i=1, 2, \dots, n$
 - Sample x_i from $P(X_i \mid \text{Parents}(X_i))$
 - If x_i not consistent with evidence
 - Reject: Return, and no sample is generated in this cycle
- Return (x_1, x_2, \dots, x_n)

REJECTION SAMPLING EXAMPLE



Let's say we want $P(C | +s)$

- ~~+C, +S, +r, +W~~
- +C, +S, +r, +W
- C, +S, +r, -W
- ~~+C, -S, +r, +W~~
- ~~-C, -S, -r, +W~~

LIKELIHOOD WEIGHTING

- Problem with rejection sampling: if the evidence is unlikely, you'll end up rejecting lots of samples
- Solution: fix the evidence variables and weight by the probability of the evidence

- IN: evidence instantiation
- $w = 1.0$
- for $i=1, 2, \dots, n$
 - if X_i is an evidence variable
 - $X_i = \text{observation } x_i \text{ for } X_i$
 - Set $w = w * P(x_i | \text{Parents}(X_i))$
 - else
 - Sample x_i from $P(X_i | \text{Parents}(X_i))$
- return $(x_1, x_2, \dots, x_n), w$



LIKELIHOOD WEIGHTING

$$P(C)$$

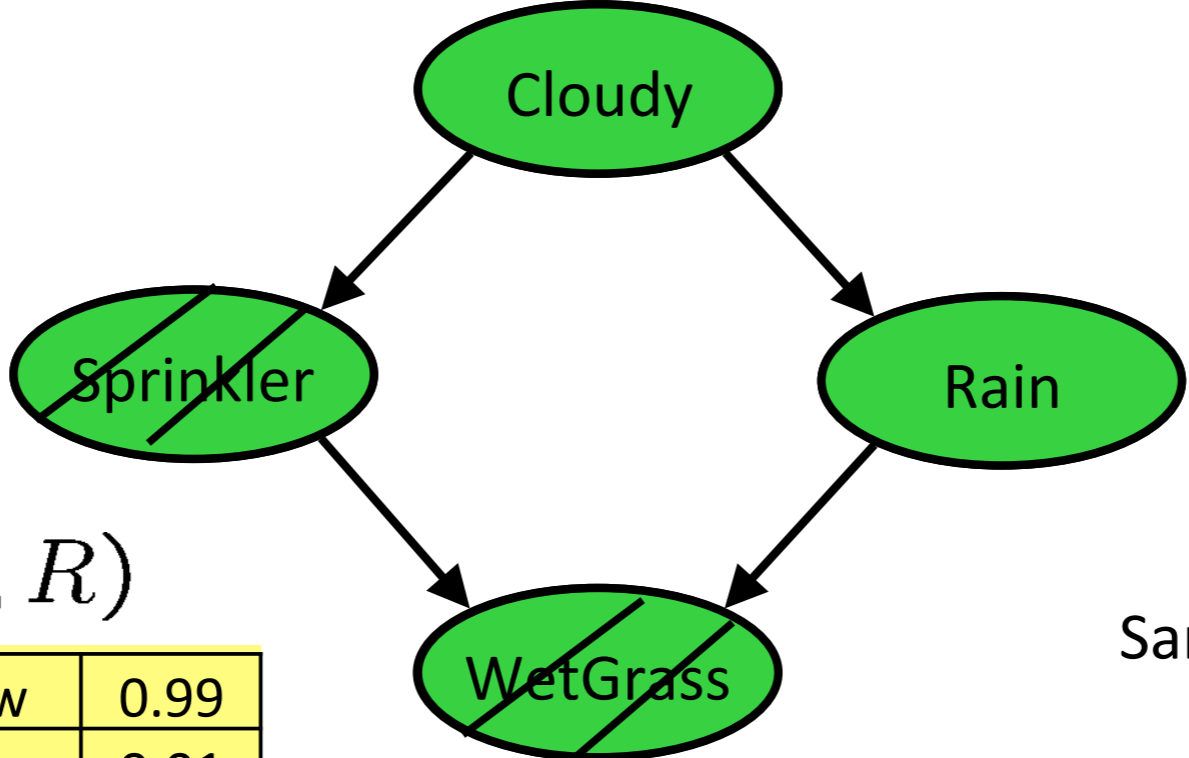
+c	0.5
-c	0.5

$$P(S|C)$$

+c	+s	0.1
	-s	0.9
-c	+s	0.5
	-s	0.5

$$P(R|C)$$

+c	+r	0.8
	-r	0.2
-c	+r	0.2
	-r	0.8



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

+s	+r	+w	0.99
		-w	0.01
-s	-r	+w	0.90
		-w	0.10
	+r	+w	0.90
		-w	0.10
-r	+w	0.01	
	-w	0.99	

Samples:

+c, +s, +r, +w
...

$$w = 1.0 \times 0.1 \times 0.99$$

SAMPLING SUMMARY

Prior Sampling

No evidence

Less efficient

Rejection Sampling

Likelihood Weighting

More efficient

Have evidence

WORKSHEET