

BMI/CS 576 – Day 23

- Today
 - Intro to biological and Bayesian networks
 - Notebook: Bayesian network implementation
- Next week
 - Bayesian network structure learning

HW

- HW4 due Wednesday
- HW5 (clustering) released shortly, due 12/6

Questions

- How do we determine the structure of a Bayesian network?
 - Stay tuned: this is the topic for the remainder of the semester!

Counting the # of “free” parameters

$Pr (lacI\text{-unbound} \mid L, I)$

L	I	true	false
absent	absent	0.9	0.1
absent	present	0.1	0.9
present	absent	0.9	0.1
present	present	0.9	0.1

Once these values have been specified, the CPD is completely defined.

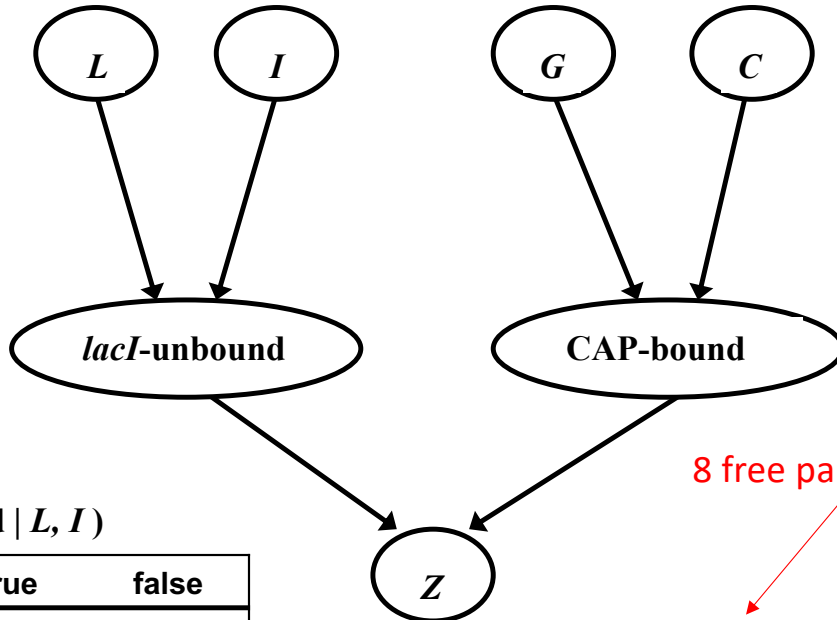
- There are eight probabilities in this CPD table but only **four** free parameters.
- Let k be the number of possible values for the target random variable
 - In this case the target random variable is *lacI-unbound* which has $k = 2$ (true or false)
- Each row must sum to one because it is a discrete probability distribution
 - Thus -> once you have specified the first $k - 1$ probabilities in each row, the last probability is automatically determined

A Bayesian Network for the lac System

$Pr(L)$

absent	present
0.9	0.1

1 free parameter



8 free parameters

$Pr(lacI\text{-unbound} | L, I)$

<i>L</i>	<i>I</i>	true	false
absent	absent	0.9	0.1
absent	present	0.1	0.9
present	absent	0.9	0.1
present	present	0.9	0.1

4 free parameters

$Pr(Z | lacI\text{-unbound}, CAP\text{-bound})$

<i>lacI</i> -unbound	CAP-bound	absent	low	high
true	false	0.1	0.8	0.1
true	true	0.1	0.1	0.8
false	false	0.8	0.1	0.1
false	true	0.8	0.1	0.1