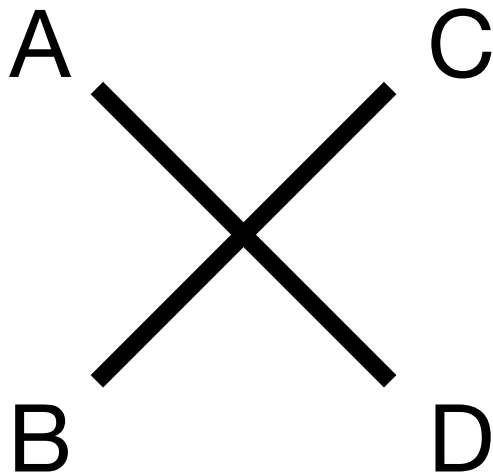
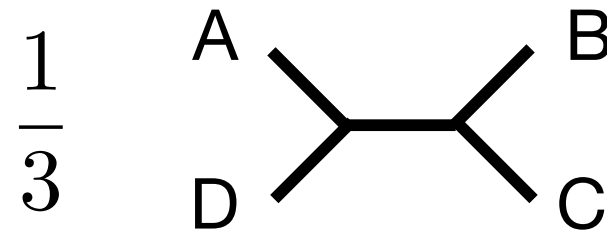
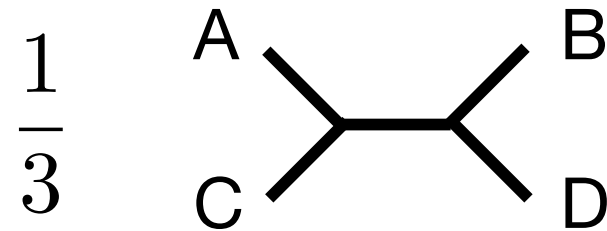
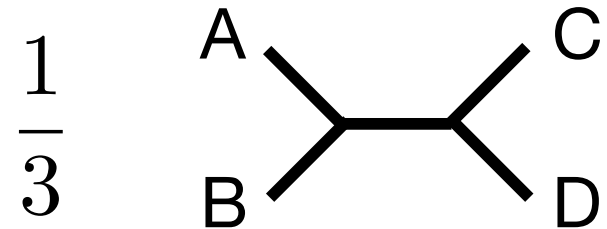


Polytomies and rjMCMC

Simulate data on the star tree. Is marginal posterior on topology uniform?



Data simulated from this tree



Marginal posterior uniform?

1 site sampled

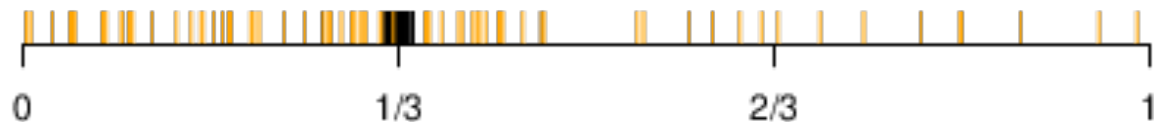
0.3405	0.3242	0.3353
0.3410	0.3279	0.3311
0.3308	0.3327	0.3365
0.3318	0.3329	0.3353
0.3302	0.3367	0.3331
0.3380	0.3343	0.3277
0.3324	0.3357	0.3319
0.3348	0.3293	0.3359
0.3344	0.3291	0.3365
0.3367	0.3320	0.3313
0.3355	0.3262	0.3383
0.3367	0.3318	0.3315
0.3358	0.3310	0.3332
0.3466	0.3211	0.3323
0.3429	0.3295	0.3276
0.3216	0.3390	0.3394
0.3318	0.3321	0.3361
0.3369	0.3374	0.3257
0.3348	0.3332	0.3320
0.3284	0.3407	0.3309
0.3288	0.3370	0.3342
0.2660	0.4605	0.2735
0.3345	0.3358	0.3297
0.3355	0.3267	0.3378
0.3430	0.3339	0.3231

100,000 sites sampled

0.2990	0.3288	0.3722
0.3172	0.0464	0.6364
0.1584	0.7969	0.0447
0.4625	0.3600	0.1775
0.7077	0.0881	0.2042
0.0884	0.0262	0.8854
0.9551	0.0422	0.0027
0.1826	0.5511	0.2663
0.3043	0.4224	0.2733
0.6559	0.0707	0.2734
0.0073	0.9892	0.0035
0.3029	0.2922	0.4049
0.4607	0.1362	0.4031
0.6704	0.0975	0.2321
0.6120	0.1852	0.2028
0.3605	0.3570	0.2825
0.5455	0.2505	0.2040
0.4253	0.4254	0.1493
0.1595	0.7465	0.0940
0.4436	0.1697	0.3867
0.3994	0.3904	0.2102
0.1151	0.5912	0.2937
0.8333	0.0951	0.0716
0.8317	0.0736	0.0947
0.2703	0.4112	0.3185

Most extreme posteriors in red for each case

1 site sampled in **black**
100K sites sampled in **orange**



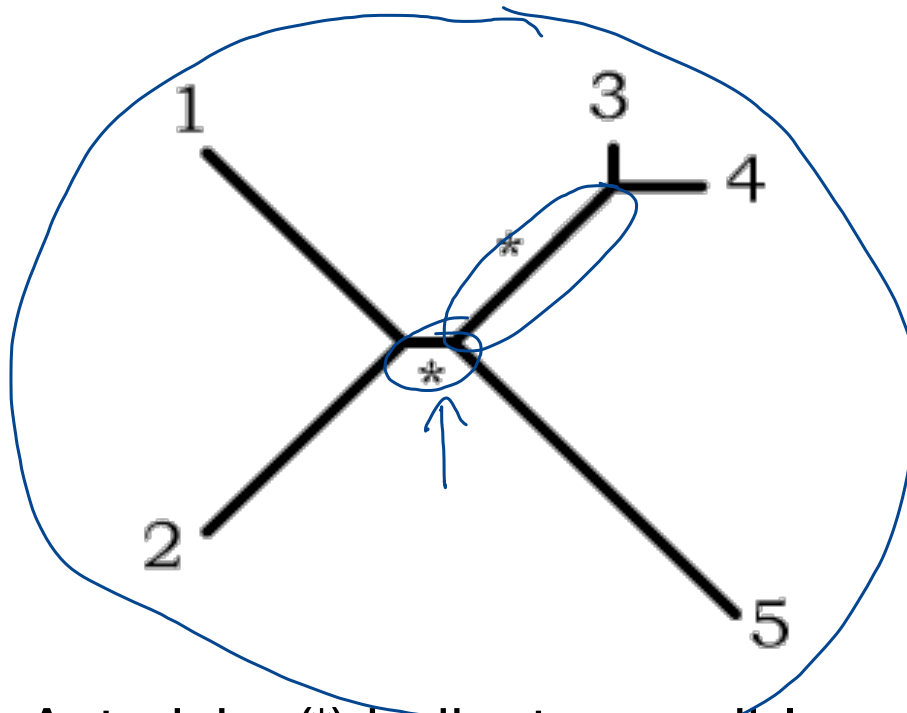
Reversible-jump MCMC

Green 1995

- Used when the **complexity** of the model changes during an MCMC analysis
- Requires inventing proposal mechanisms ("moves") that change the **dimension** of the model

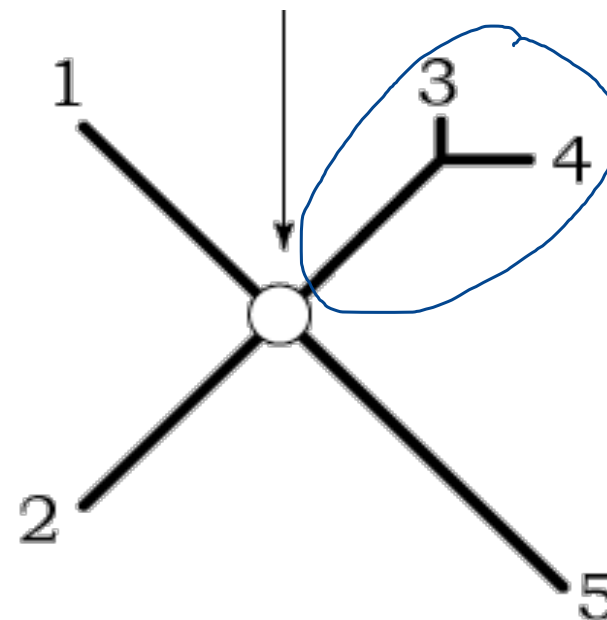
more **complex** models have higher **dimension**
(i.e. more parameters)

Delete-edge Proposal



Asterisks (*) indicate possible internal edges to delete; one of these is chosen at random

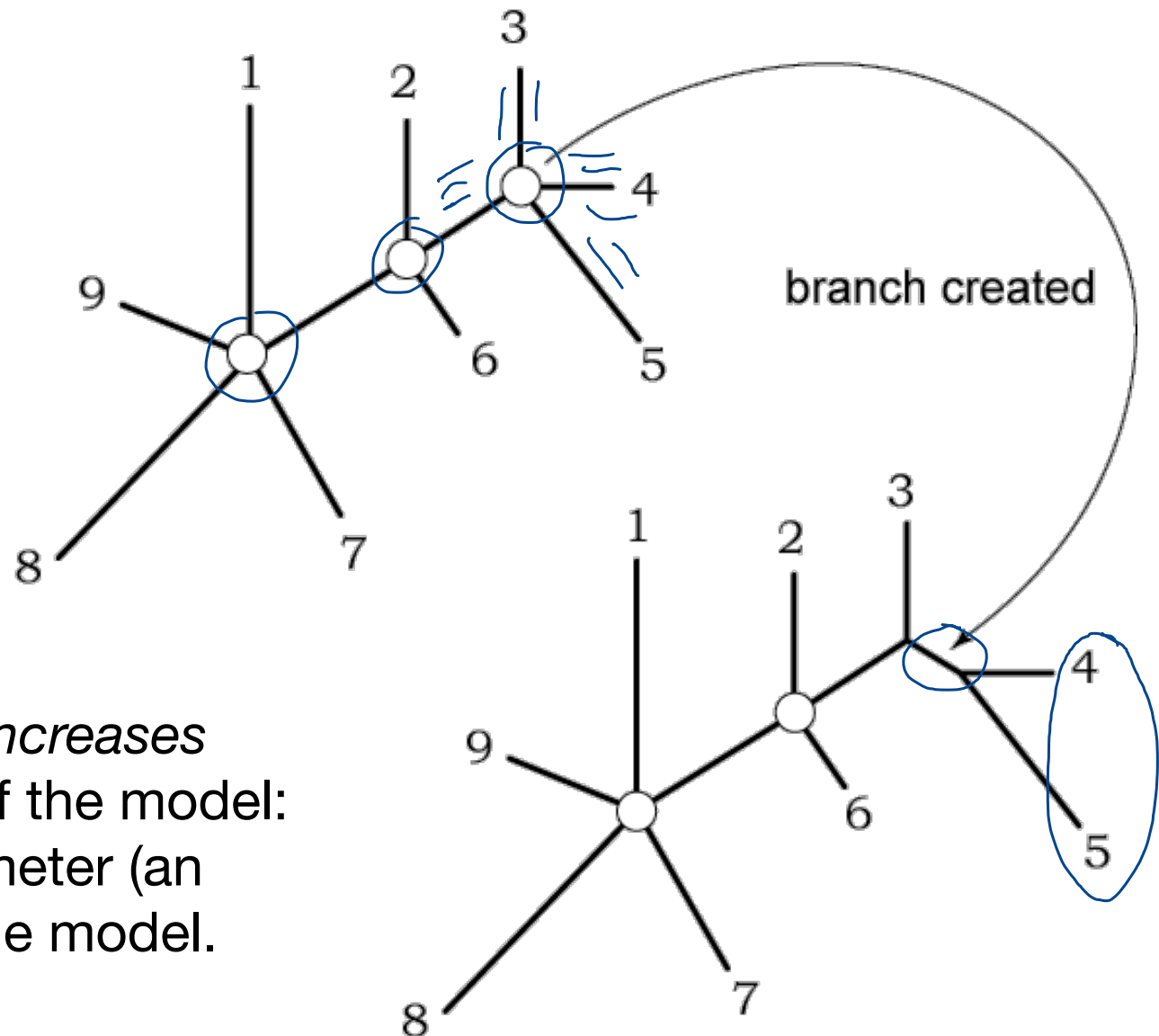
Edge deleted,
creating a new
polytomy



Deleting an edge *reduces* the dimension of the model because it removes one parameter (an edge length) from the model.

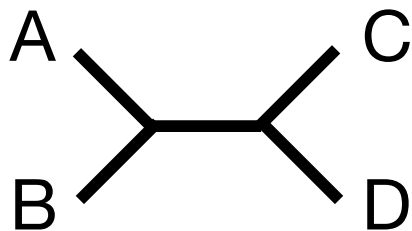
Open circles indicate existing polytomies that could be reduced in size by adding an internal edge; one of these polytomies is chosen at random, and an internal edge added that sequesters a random subset of the taxa involved in the polytomy

Add-edge Proposal

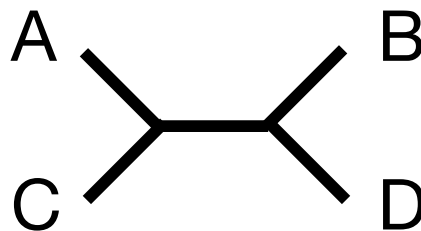


Adding an edge *increases* the complexity of the model: it adds one parameter (an edge length) to the model.

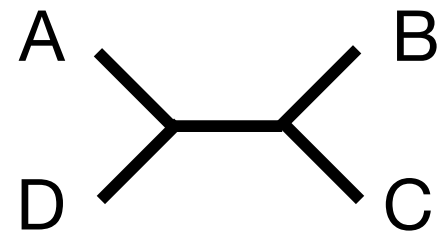
Priors: tree topologies



$$\frac{1}{3}$$



$$\frac{1}{3}$$

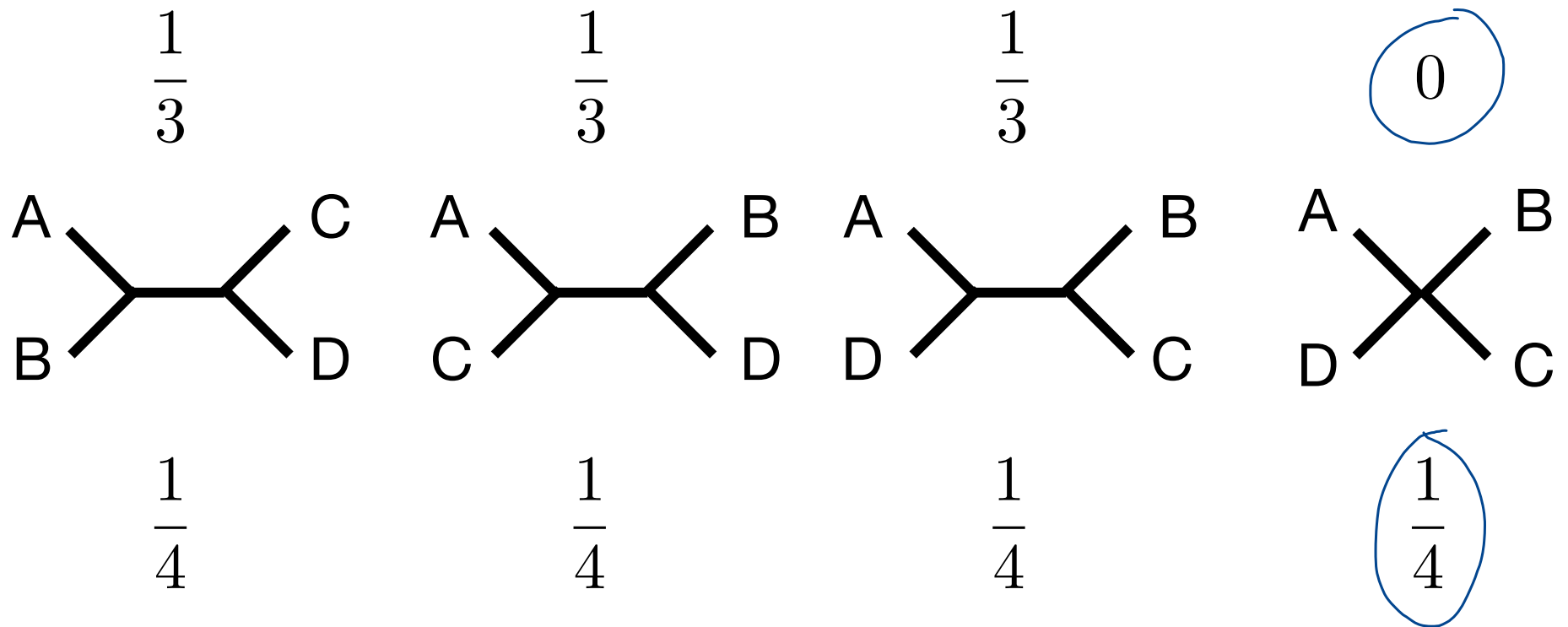


$$\frac{1}{3}$$

Usually, every possible tree topology is given equal prior probability in a Bayesian analysis

Priors: tree topologies

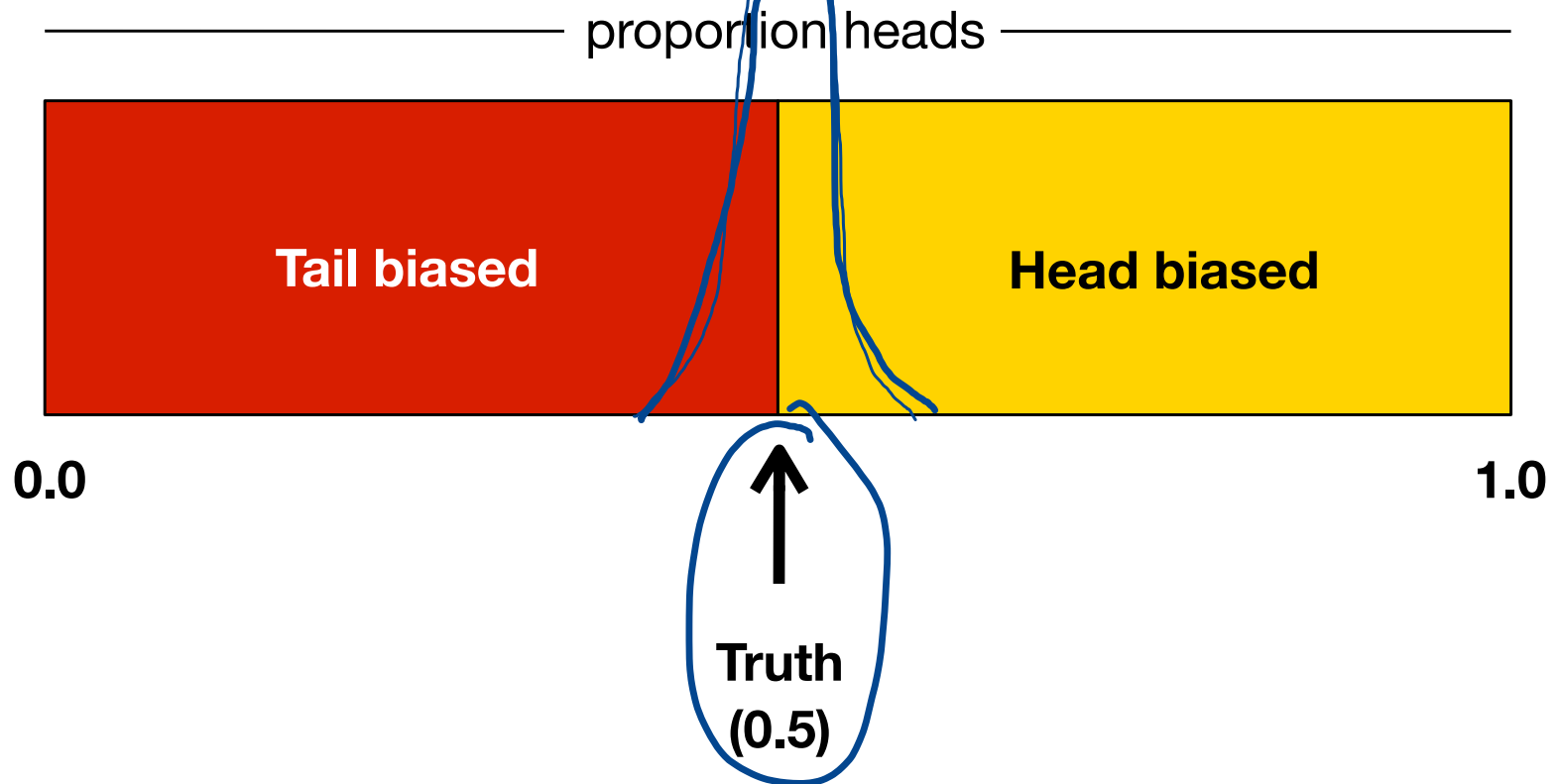
Standard prior is not really flat if polytomies are considered.



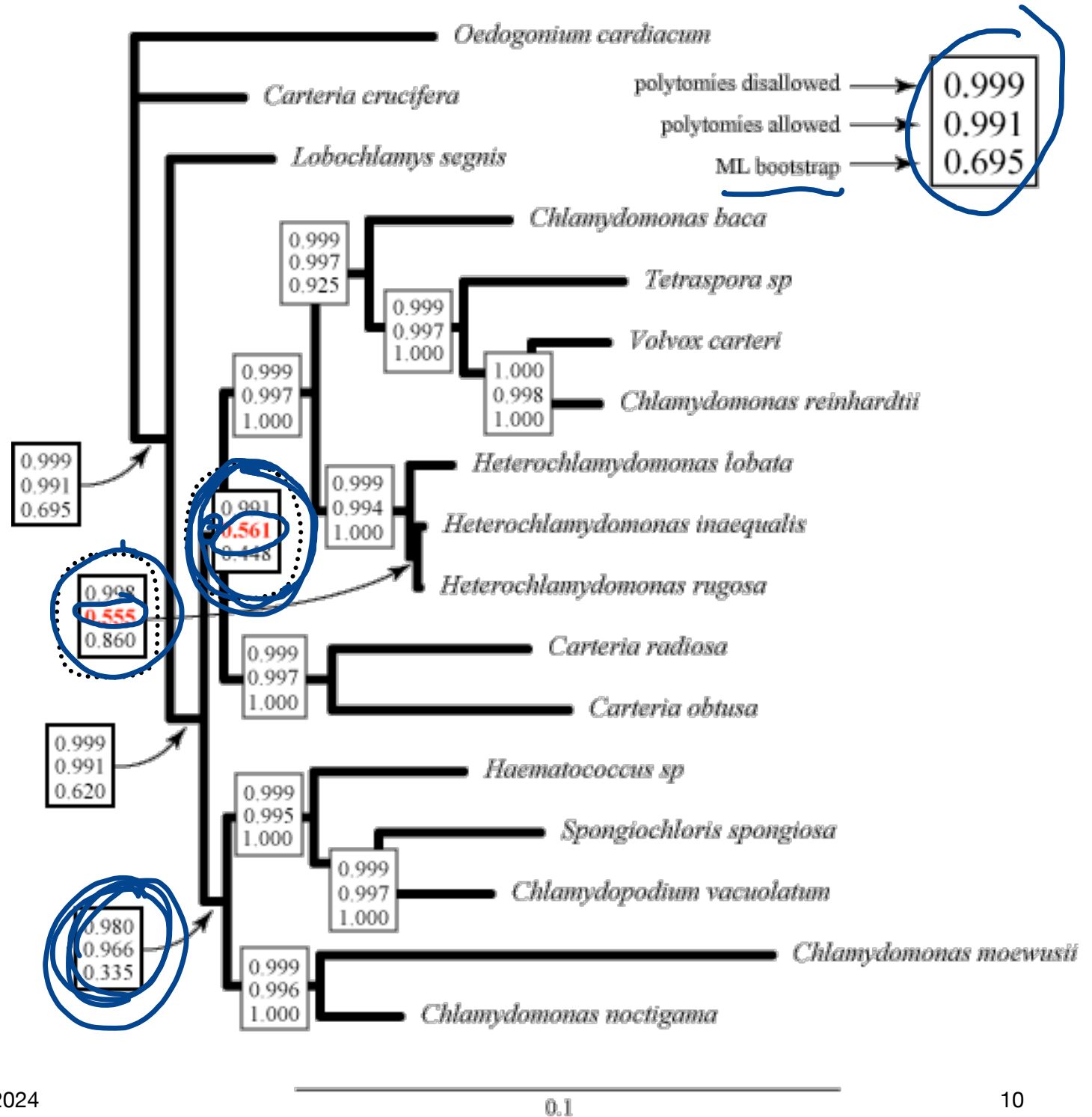
A “polytomy prior” allows trees containing polytomies to receive some posterior support.

Fair Coin Analogy

The phylogenetic problem is analogous to a coin flipping problem in which the only hypotheses considered are *tail biased* or *head biased*, and the hypothesis *fair coin* is given zero prior probability



Two cases where the posterior split probabilities did not agree with ML bootstrap proportions. In both of these cases, short edge lengths made high split posteriors suspicious.



Lewis, Holder, and Holsinger 2005