Practice problem set
Systematics
April 2, 2009

1. Decide whether each of the following processes satisfy the Markov property.

a. Brownian motion

b. $x_i = x_{i-1} + N(0,1)$

c. $x_i = \frac{x_{i-1}}{x_{i-2}}$

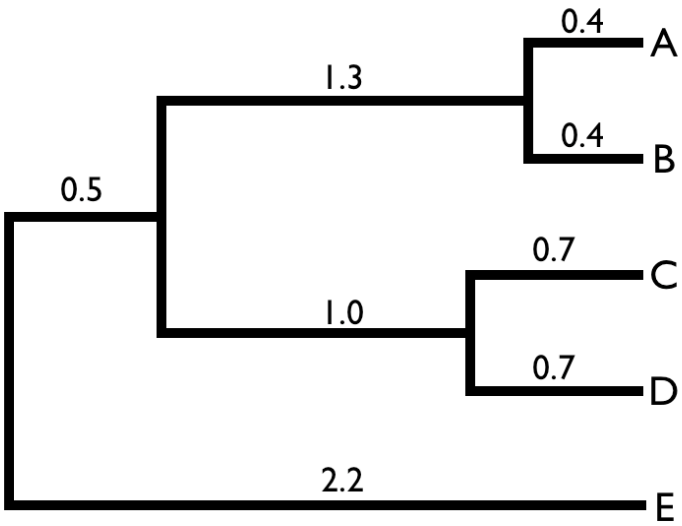
d. Birth-death model

e. A person shooting free throws

f. Flipping a coin

2. There is a five-species phylogeny with branch lengths below.

a. Calculate the imbalance of this tree



b. What is the probability of obtaining the (1,4) split observed at the root node of this tree in an ERM model?

3. You fit pure-birth and birth-death models to a large phylogeny of lizards, and obtain the following results:

pure-birth model, lnL = -123.4

birth death model, lnL = -110.8

Carry out a model selection test on these results (there are two possibilities). What do you conclude?

4. Data corresponding with the tree in question 2 are below.

Species	Trait value
A	2.3
B	3.1
C	4.5
D	3.2
E	6.0

a. Calculate a set of standardized independent contrasts for these data.

b. Estimate the rate of evolution in this clade (σ^2), assuming a Brownian motion model.