Exercises – Phylogenetics

Universität Bielefeld, SS 2019
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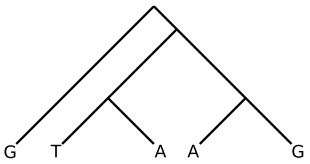
https://gi.cebitec.uni-bielefeld.de/Teaching/2019summer/Phylogenetik

Exercise Sheet 4 — 02.05.2019

Due: 09.05.2019

Task 1 Small Parsimony – Fitch-Algorithm. **(2 points)**

Apply the Fitch-Algorithm (as presented in the lecture / lecture notes) on the tree on the right. Write down all solutions and their parsimony cost that can be found with the algorithm. Specify the set S for each internal node (see figure on page 28).



Task 2 Small Parsimony – Sankoff-Algorithm. **(3 points)**

Apply the Sankoff-Algorithm (**with unit costs**) on the tree from Task 1 in order to determine a most parsimonious labeling for the internal nodes. Specify the values for $C(u, a)$ for each internal node (like in the figure on page 30).

Write down all solutions.

1.5 Bonus Points:
Repeat the exercise with the following cost function:

cost	A	C	G	T
A	0	2	1	2
C	2	0	2	1
G	1	2	0	2
T	2	1	2	0

Task 3 Maximum Parsimony Column-wise **(2 points)**

Find a binary most parsimonious tree for the given matrix considering unit costs. We know that, for four taxa, these three topologies exist:

1. ((A,B),(C,D)); 2. ((A,C),(B,D)); 3. ((A,D),(B,C));

	1	2	3	4
A	d	b	x	z
B	d	b	x	y
C	c	a	e	z
D	c	a	e	y

Use the *Column-wise approach* to decide which topology allows for minimal costs. Write down all intermediate steps. If you can stop at some point explain why. (**Hint:** The order of the given topologies and states makes it a bit easier.)