

Exercises – Phylogenetics

Universität Bielefeld, WS 2017/2018,
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<https://gi.cebitec.uni-bielefeld.de/Teaching/2017winter/Phylogenetik>

Exercise Sheet 4 — 2.11.2017

Due: 9.11.2017

Task 1 Perfect Phylogeny: Construction.

(3 points)

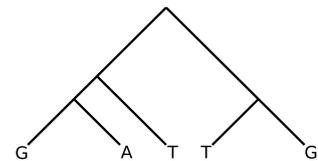
Use the $\mathcal{O}(mn)$ algorithm (lecture notes, pages 22–23) to create a perfect phylogeny for the given matrix. Indicate all intermediate results after steps 1 and 2.

	1	2	3	4	5
A	1	0	0	1	1
B	1	0	0	0	1
C	1	0	1	0	0
D	0	1	0	0	0
E	1	0	1	0	0

Task 2 Small Parsimony – Fitch-Algorithm.

(3 points)

- (a) 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).



- (b) Now, we have a look at the original work of Walter M. Fitch: “Towards Defining the Course of Evolution: Minimum Change for a Specific Tree Topology”, published in the journal “Systematic Zoology”. You can find this article online: <http://www.jstor.org/stable/2412116>. In this article, Fitch introduces an extra step after the bottom-up phase such that the top-down phase will find *all* optimal labelings.

Use this algorithm to enrich the set S for the tree above. Are there new solutions that were not found in task (a)? Indicate all such solutions and their parsimony costs.

Task 3 Small Parsimony – Sankoff-Algorithm.

(3 points)

Apply the Sankoff-Algorithm (**with unit costs**) on the tree from Task 2 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	4	4
C	2	0	4	4
G	4	4	0	2
T	4	4	2	0