Exercises – Phylogenetics

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https://gi.cebitec.uni-bielefeld.de/Teaching/2016winter/Phylogenetik

Exercise Sheet 6 — 06.12.2016

Due: 13.12.2016

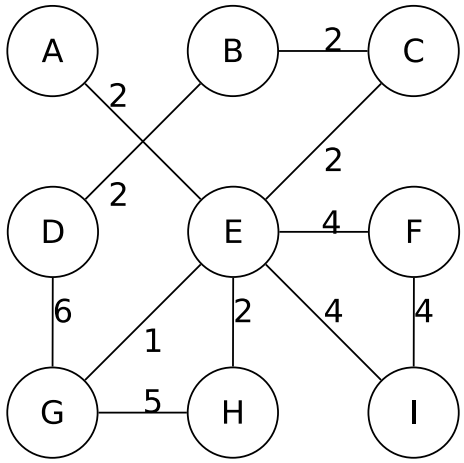
Task 1 Steiner Trees. **(2 points)**

The picture on the right shows an undirected weighted graph. Find a *minimum Steiner tree* with

(a) D, G and I, as well as

(b) A, D and F

as terminal nodes. Mark all *Steiner nodes* in your solutions.



Task 2 Spanning Trees. **(3 points)**

Find all minimum spanning trees in the graph given in Task 1. Write down the order of the edges you choose. If there are several edges that can be chosen in one step, list them all but choose one (arbitrary) edge to continue.

(a) Use Kruskal's algorithm.

(b) Use Prim's algorithm. Start with node E.

Task 3 Ackermann Function. **(3 points)**

Implement the *Ackermann function*:

$$a(0, m) = m + 1$$
$$a(n + 1, 0) = a(n, 1)$$
$$a(n + 1, m + 1) = a\big(n, a(n + 1, m)\big)$$

Compute the values of $a(i, i)$ for $i = 1, 2, \ldots$ How far do you get?

Task 4 DNA Grid Graph. **(2 points)**

What is the number of edges $|E|$ for a DNA grid graph $G = (V, E)$ for sequence length m? Derive a formula for $|E|$ that only depends on m and explain it.