

## Exercise sheet 12: Quartet Tree Puzzling

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### Exercise 1 - Quartet Tree Basics

1a)

How many possible quartet trees can you produce with six taxa of any specific topology?

**Hide**

**Formula**

**Solution**

1b)

What does a set of quartet trees tell you, in a biological sense?

**Hide**

**Formula**

- ☐ It tells you which of the quartet trees are likelier than others.
- ☐ It tells you which of the taxa are closer related than others.
- ☐ It tells you the exact distance between each set of four taxa.

**Solution**

- ☐ It tells you which of the quartet trees are likelier than others.
- ☒ It tells you which of the taxa are closer related than others.
- ☐ It tells you the exact distance between each set of four taxa.

## Exercise 2 - Quartet Tree Reconstruction

You are given a set of quartet trees and an initial topology. You want to include a new taxa P. Where does the P belong to? (We are only using five quartet trees, but there are more possible as you determined in exercise 1 a.)

Quartet Trees:

$$N_1(P, Y|Q, W)$$

$$N_2(X, P|Z, W)$$

$$N_3(X, Z|P, W)$$

$$N_4(P, Y|Z, Q)$$

$$N_5(X, Z|Q, P)$$

Initial Topology:

The letters a-g denote the edges in the topology and represent the **violation counter**.

**2a)**

Add  $N_1(P, Y|Q, W)$  to the initial topology. How does the violation counter look after adding  $N_1$ ?

**Hide**

**Solution**

**2b)**

Add  $N_2(X, P|Z, W)$  to the initial topology. How does the violation counter look after adding  $N_2$ ?

**Hide**

**Solution**

**2c)**

Add  $N_3(X, Z|P, W)$  to the initial topology. How does the violation counter look after adding  $N_3$ ?

**Hide**

**Solution**

**2d)**

Add  $N_4(P, Y|Z, Q)$  to the initial topology. How does the violation counter look after adding  $N_4$ ?

**Hide**

**Solution**

**2e)**

Add  $N_5(X, Z|Q, P)$  to the initial topology. How does the violation counter look after adding  $N_5$ ?

**Hide**

**Solution**

**2f)**

To which edge will taxon  $P$  be attributed, after adding quartet trees  $N_1$  to  $N_5$ . What is the closest taxon to the newly added taxon  $P$ ?

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**Solution** Edge - “C”

Taxon - “Y”