

Exercise sheet 12: Quartet Tree Puzzling

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 ?

Hide

Solution Edge - “C”
Taxon - “Y”