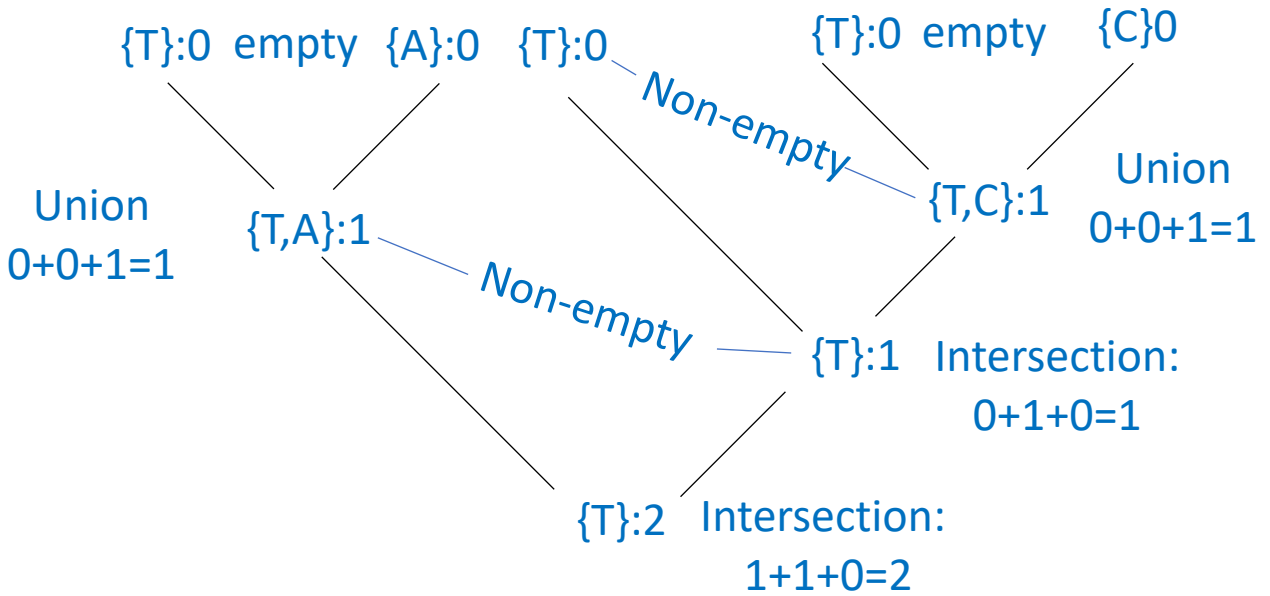
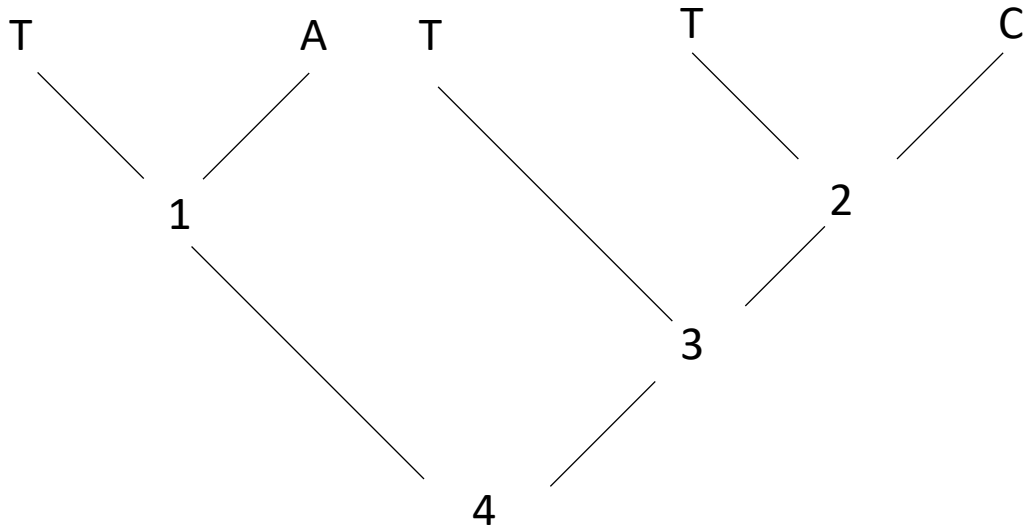


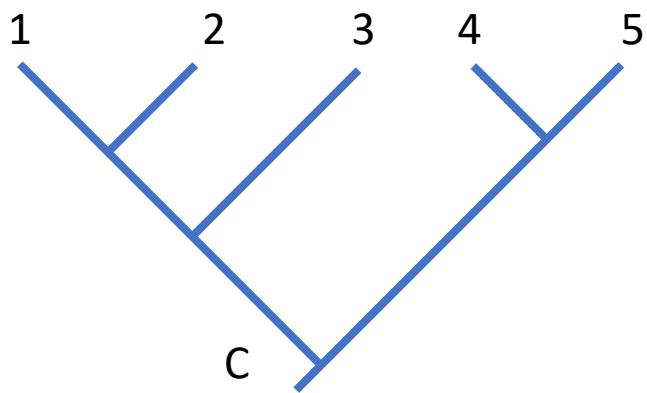
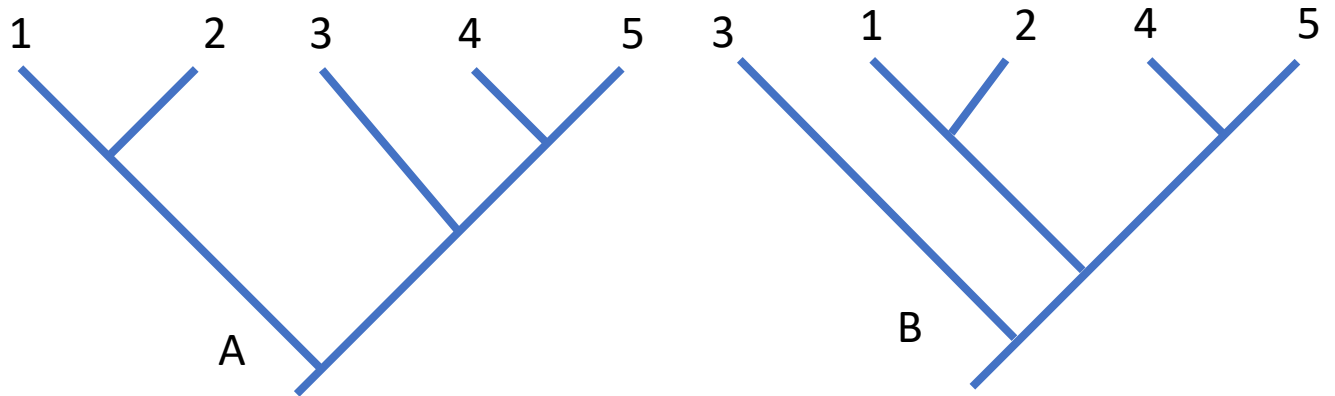
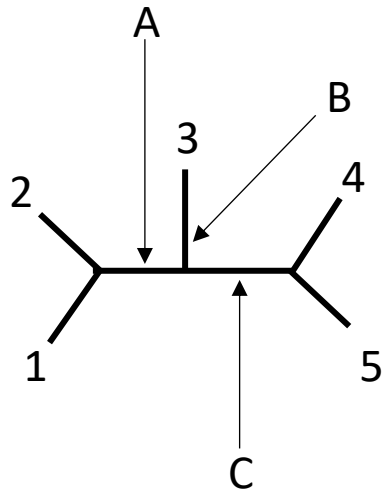
Biology 545 Problem Set 1

1. Use Fitch Optimization to find the length of this character on this tree. Show all state sets and accumulated lengths at all nodes.

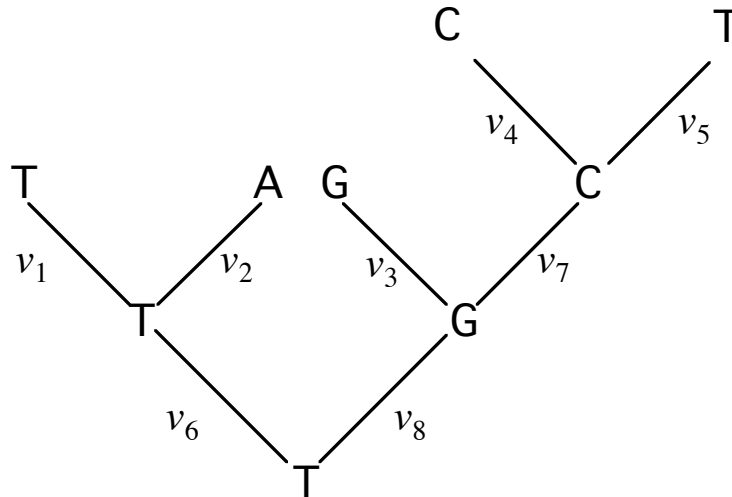


Two Steps

2. Consider the following unrooted 5-taxon tree. Please show the rooted tree were we to root on the internal branch indicated by the arrows.



3. Write the likelihood function for the tree and character-state reconstruction shown:



$$\Pr(R | \tau) = \pi_T \times P_{(T,T)} v_6 \times P_{(T,T)} v_1 \times P_{(T,A)} v_2 \times P_{(T,G)} v_8 \times P_{(G,G)} v_3 \times P_{(G,C)} v_7 \times P_{(C,C)} v_4 \times P_{(C,T)} v_5$$

4. The likelihood for a tree is given below.

$$L_{(\tau)} = P(D | \tau, m)$$

Please describe in words each of the terms of the equation.

$L_{(\tau)}$ : Likelihood of tree  $\tau$

$P(D | \tau, m)$ : probability of the data, given tree  $\tau$  and assuming model  $m$

5. What feature(s) do MP (maximum parsimony) and ML (maximum likelihood) share?  
They're both character based.

6. What feature(s) do ME (minimum evolution) and MP share?

They both minimize the length of the tree.

7. What feature(s) do ME and ML share?

They both rely on models of character (sequence) evolution.

8. Show the trees generated by the two NNI swaps of the internal branch in bold.

