

BIOL 325 – Plant Systematics  
Dr. Chris Hardy

**Cladistics & Phenetics Practice Problems**

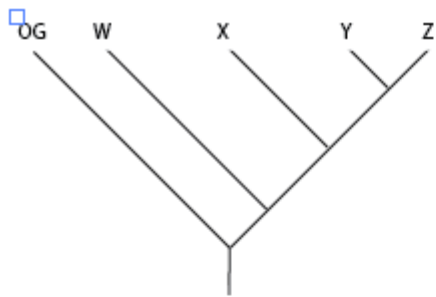
1. For two taxa (a and b), draw all possible dendrograms relating the two.
2. For three taxa (a, b and c), draw all possible rooted and bifurcating (dichotomously branched) dendrograms.
3. For four taxa (a, b, c and d), draw 5 of the 15 possible rooted and bifurcating dendrograms.

4. Use the following data matrix of 4 species (w, x, y and z) and 5 characters (1-5) to construct a phenogram. Draw the phenogram below.

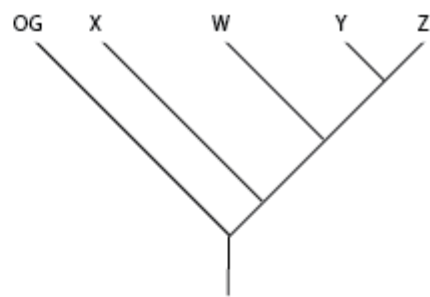
	<b>Char. 1</b>	<b>Char. 2</b>	<b>Char. 3</b>	<b>Char. 4</b>	<b>Char. 5</b>
<b>w</b>	0	1	0	1	0
<b>X</b>	1	0	1	0	0
<b>Y</b>	1	0	1	0	1
<b>Z</b>	0	1	1	0	1

5. Below is the same matrix for the ingroup of W, X, Y, and Z as was used above, but this time with an outgroup taxon. Find the most parsimonious cladogram of those possible ones below.

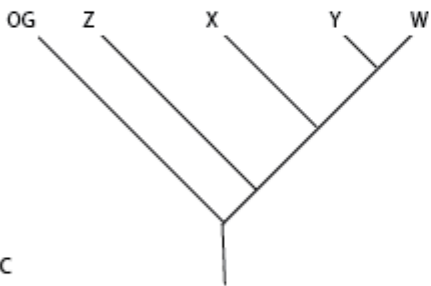
	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5
<b>w</b>	0	1	0	1	0
<b>X</b>	1	0	1	0	0
<b>Y</b>	1	0	1	0	1
<b>Z</b>	0	1	1	0	1
<b>OG</b>	0	0	0	1	1



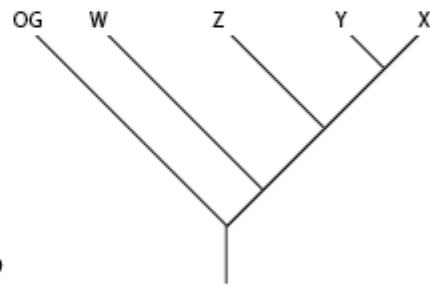
A



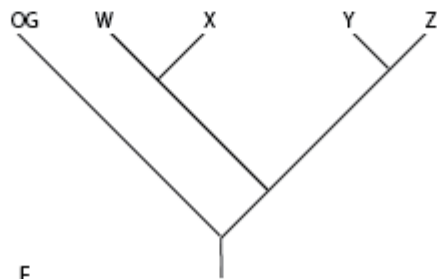
B



C



D



E

6. Name the sister species from the most parsimonious cladogram above.

7. Name the character(s) and character state(s) that are synapomorphies supporting this sister group relationship.

Name the symplesiomorphic state(s) for the same characters.

8. Of the ingroup, which is the most distantly related species?

9. How many steps was the most parsimonious cladogram above?

10. How many steps was the second most parsimonious cladogram above?

11. Is the topology of the most parsimonious cladogram the same as that of the best phenogram?

What does this say about the correlation between similarity and phylogenetic relationship?

12. To the same data matrix above (outgroup excluded) I've added several additional characters (6-8).

	<b>Char. 1</b>	<b>Char. 2</b>	<b>Char. 3</b>	<b>Char. 4</b>	<b>Char. 5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>w</b>	0	1	0	1	0	1	1	1
<b>X</b>	1	0	1	0	0	0	0	0
<b>Y</b>	1	0	1	0	1	1	1	1
<b>Z</b>	0	1	1	0	1	1	1	1
<b>OG</b>	0	0	0	1	1	1	1	1

Would these change the resulting phenogram (don't include the OG in a phenetic analysis)? If so or if not, why?

Would they change the choice of cladogram? If so or if not, why?