Earth 101 – Cladistics Exercise

Write your answers on a separate sheet and turn them in at the end of class. You may want to work on a rough draft of the cladogram (in part 3) before writing a clean, final version on your answers.

Part 1. Examine the following cladogram and answer the questions.

1. What is the synapomorphy of the clade containing species D and E?
2. What is a plesiomorphic character of that clade?
3. What is the synapomorphy of the clade containing species A and B?
4. Which taxa have a sulfurous odor?
5. What character distinguishes species D from species E?
6. Are adorable eyelashes a synapomorphy or an autapomorphy?

Part 2. Use the previous cladogram to answer the questions.

7. Traditionally, the five taxa are grouped into three families. Family 1 contains species A. Family 2 contains species B and C. Family 3 contains species D and E. Determine if each family is monophyletic, paraphyletic, or polyphyletic.
8. More recently, species A has been grouped in a family with species D and E. Is this advisable? Why or why not?
9. Determine if the following groups are monophyletic, paraphyletic, or polyphyletic. Species A, B, C. Species C, D, E. Species C and D. Species A and B. Species B, D, E.
**Part 3.** Use the data matrix to construct the most parsimonious cladogram for the eight species. Species 1 (Sp 1) is the outgroup taxon.

<table>
<thead>
<tr>
<th>Character</th>
<th>Sp 1</th>
<th>Sp 2</th>
<th>Sp 3</th>
<th>Sp 4</th>
<th>Sp 5</th>
<th>Sp 6</th>
<th>Sp 7</th>
<th>Sp 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle (0)/Square (1)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Central circle</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Side lobe</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Triangle spines</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Blue (0)/Yellow (1) color</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Central diamond</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

10. What is the synapomorphy of the clade defined by the most recent common ancestor of species 4 and 8 and all of its descendants?

11. List the apomorphies that distinguish species 4 from all other species.

12. What is the synapomorphy of the clade defined by the most recent common ancestor of species 6 and 7 and all of its descendants?

13. List the plesiomorphic characters found in the clade defined by the most recent common ancestor of species 3 and 4.

14. What traits would you predict in the common ancestor of species 4 and 6?

15. What character evolved independently in different clades (convergent evolution)?

16. Is the group of taxa sharing the character “triangle spines” monophyletic, paraphyletic, or polyphyletic?