Systematics of Mysterious Metal Animals

Working day and night, Dr. Ksepka and his team of intrepid students collected a sample of mysterious fossils from 50 million year old rocks. While it remains uncertain what these animals looked like in life, their metal skeletons were preserved in carbonized sediments that suggest they may have burrowed into wood. Now, it is of the utmost importance to reconstruct their evolutionary tree so we can start to unlock the secrets of these tiny extinct beasts.

Your task is to conduct your own phylogenetic analysis by applying the methods we discussed today. The outgroup has already been selected for you - use the carriage bolt (large, thick screw with letters stamped on top). For convenience we will identify the six ingroup screws as taxon A-F by order of length - the shortest ingroup screw (tiny gold screw) will be taxon A and the longest screw taxon F.

1. **Formulate characters:** Compare the screws and come up with a list of six characters for use in your analysis. List your characters in the first column of the table. An example is provided in the first row.
2. **Define character states:** List the primitive and derived character state for each character in the table. Remember, the state observed in the outgroup is considered the primitive state.
3. **Fill in the character-taxon matrix** by listing the state for each taxon for all of the characters in the table provided.
4. **Label each character state change on the default tree** provided in this handout by drawing a bar on the branch where it changes. Every character must change at least once, and some may change more than once depending on your choice of characters. Remember, characters can change back to the primitive state too. The first character is labeled for you.
5. **Determine the best tree.** The default tree will probably not be the best for your characters set. Explore different trees until you think you have the one that requires the least character changes.
6. **Draw your best tree and label each character change.**

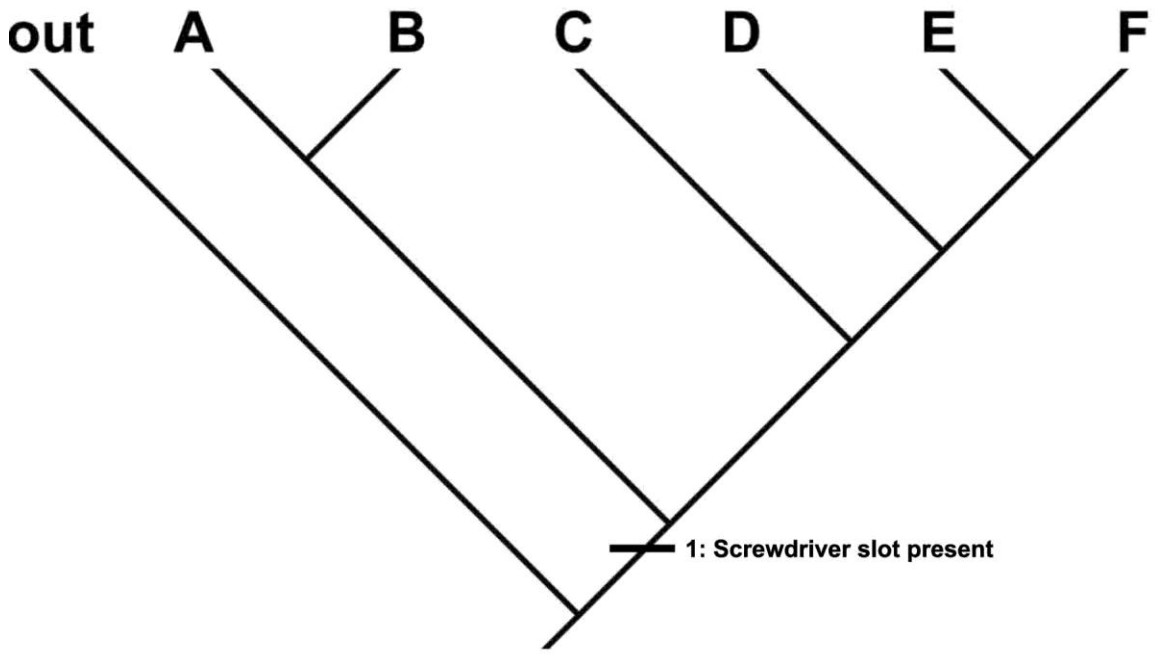
CHARACTER TABLE

Character	**Primitive State**	**Derived State**
1: Screwdriver slot	absent	present
2:		
3:		
4:		
5:		
6:		

CHARACTER-TAXON MATRIX

	Char1	Char2	Char3	Char4	Char5	Char6
Outgroup	absent					
Taxon A	present					
Taxon B	present					
Taxon C (hex top)	present					
Taxon D	present					
Taxon E	present					
Taxon F (longest)	present					

DEFAULT TREE:



Number of steps_____

DRAW YOUR BEST TREE HERE AND LABEL CHANGES:

Number of steps_____