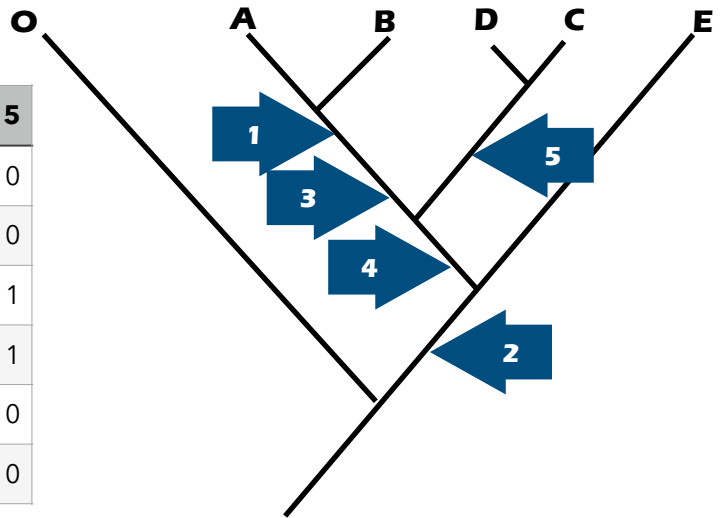


taxon/character	1	2	3	4	5
A	1	1	1	1	0
B	1	1	1	1	0
C	0	1	0	1	1
D	0	1	0	1	1
E	0	1	0	0	0
O	0	0	0	0	0



So, In the above example, although we cannot know the identity of the common ancestor that was shared by any two branches, we can infer the character states that would have existed for that organism, based on what we know about the character states of its descendants. The tree above shows the relationships among these taxa. The blue arrows represent when each character would have evolved, based on the character matrix and tree.

For example, A and B are sister taxa. They share a most recent common ancestor. This ancestor (let's call it AB), would have been plesiomorphic for all the plesiomorphic characters found in either A or B. In other words, if either of the descendants of AB possesses the plesiomorphic version of a character, they must have inherited that from the ancestor. So, for character 5, AB would have possessed a "0". For characters 1-4, both A and B possess the derived version. In that case, we can assume that they inherited the derived version from their common ancestor. So we would assume that AB possessed the derived state (1) for characters 1-4. **Therefore, we can assume that the character states for the hypothetical organism AB would have been 11110.**

The A-B branch is sister to the D-C branch. i.e. those two branches share a common ancestor, and all of those taxa share that common ancestor that we could call ABCD. Two of those descendants (C and D) possess the plesiomorphic version of characters 1 and 3. A and B possess the plesiomorphic version of character 5. Therefore, the ancestor ABCD must have been plesiomorphic for characters 1, 3, and 5. However, since all of the descendants of ABCD possess the derived version of characters 2 and 4, ABCD probably also had the derived version (as far as we know.) **Therefore, we can assume that the character states for the hypothetical organism ABCD would have been 01010.**

The ancestor that is shared by all of these taxa after the node shared with the outgroup would have been plesiomorphic for all of these characters except character 2. Taxon A, B, C, D, and E all possess the derived version of character 2. For all of the other characters, at least one of the descendant taxa has the plesiomorphic version. **Therefore, the character state for the hypothetical organism ABCDE would have been 01000.**