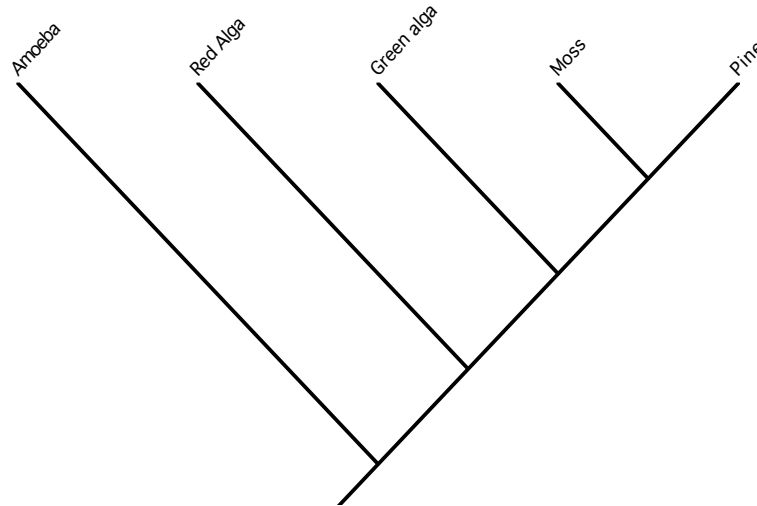


Basic Tree Thinking Assessment

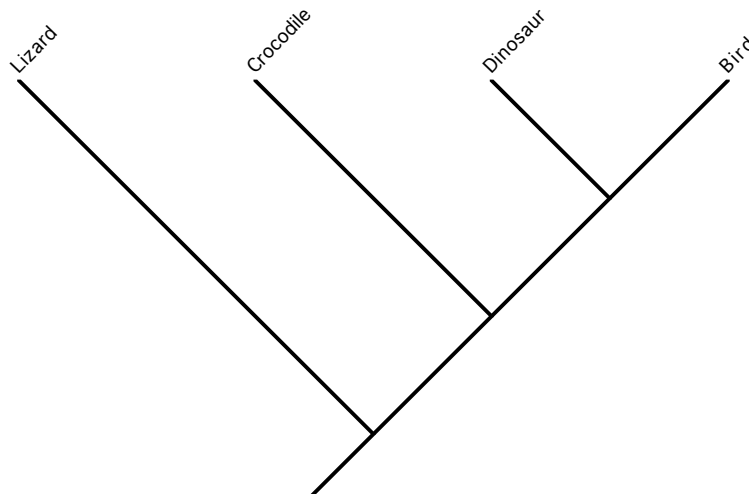
David A. Baum, Stacey DeWitt Smith, Samuel S. Donovan

This quiz includes a number of multiple-choice questions you can use to test yourself on your ability to accurately interpret evolutionary trees. Insofar as real biological examples have been used they are accurate based on current knowledge.



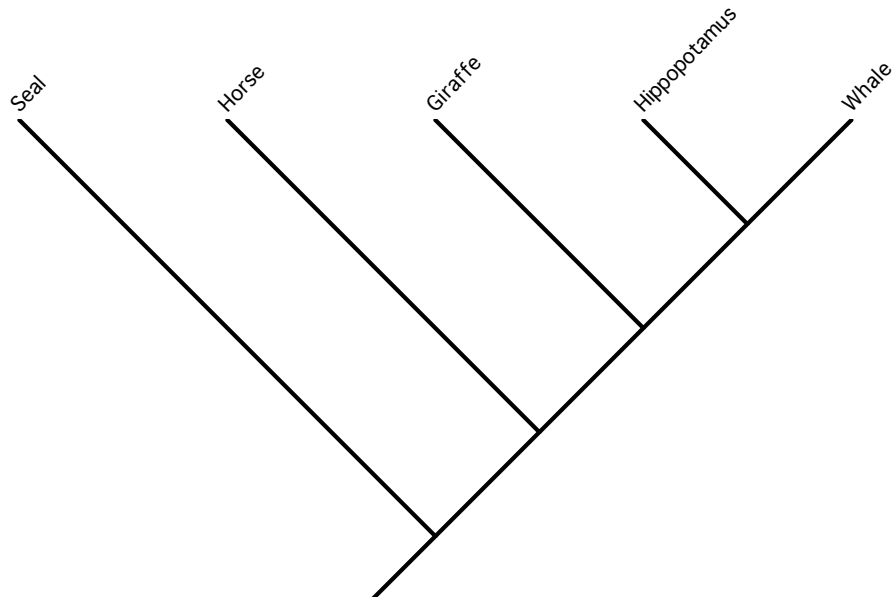
1) By reference to the tree above, which of the following is an accurate statement of relationships?

- a) A green alga is more closely related to an red alga than to a moss
- b) A green alga is more closely related to a moss than to a red alga
- c) A green alga is equally related to a red alga and a moss
- d) A green alga is related to a red alga, but is not related to a moss



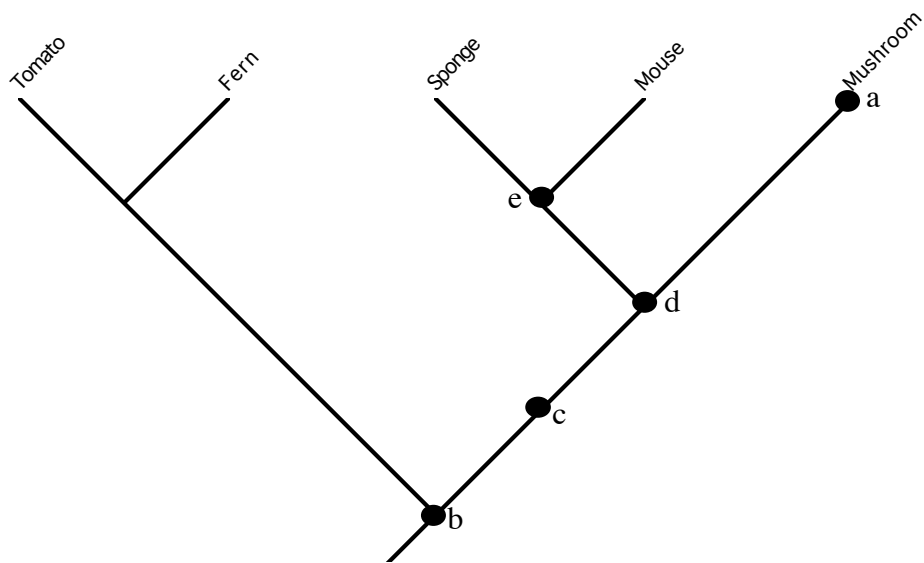
2) By reference to the tree above, which of the following is an accurate statement of relationships?

- a) A crocodile is more closely related to a lizard than to a bird
- b) A crocodile is more closely related to a bird than to a lizard
- c) A crocodile is equally related to a lizard and a bird
- d) A crocodile is related to a lizard, but is not related to a bird

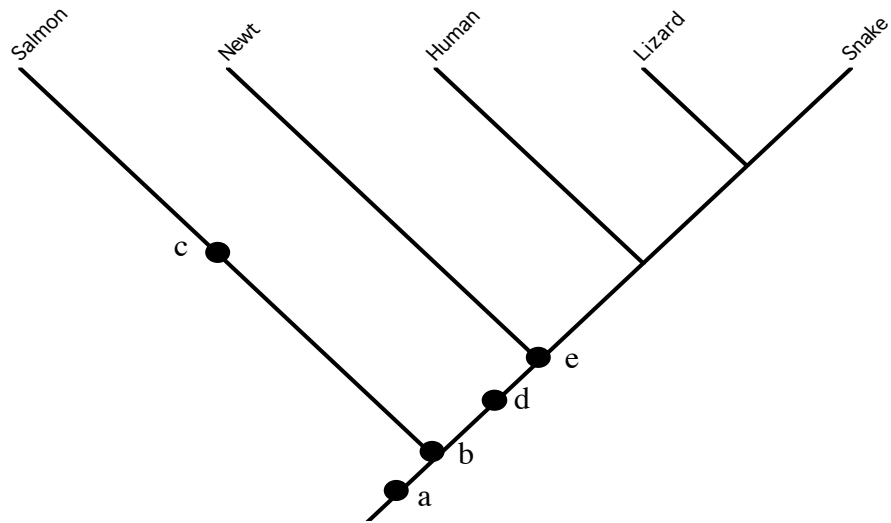


3) By reference to the tree above, which of the following is an accurate statement of relationships?

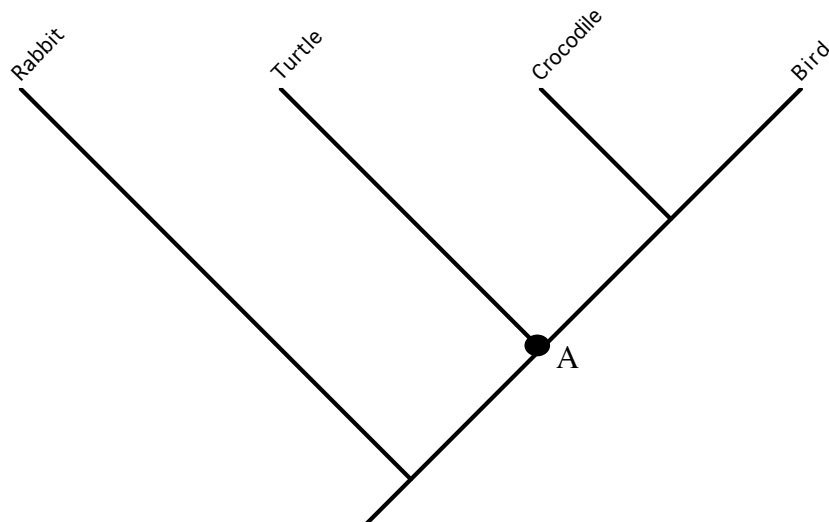
- a) A seal is more closely related to a horse than to a whale
- b) A seal is more closely related to a whale than to a horse
- c) A seal is equally related to a horse and a whale
- d) A seal is related to a whale, but is not related to a horse



4) Which of the five marks in the tree above corresponds to the most recent common ancestor of a mushroom and a sponge?

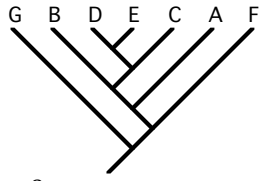


5) If you were to add a trout to the phylogeny shown above, where would its lineage attach to the rest of the tree?

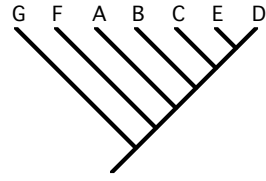


6) Given the tree above, what would you expect the common ancestor marked 'A' to look like?

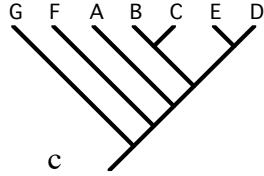
- Most like a rabbit because it is the only included ancestor of A
- Most like a turtle because it is the most direct descendant of A
- Most like a crocodile because a crocodile is known to be a "living fossil"
- An equal mix of rabbit, turtle, crocodile, and bird features, because it is an ancestor of all of them
- One cannot say without a model of how traits evolve along the branches of this tree



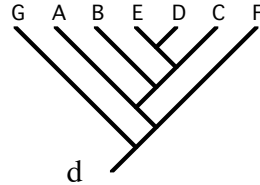
a



b

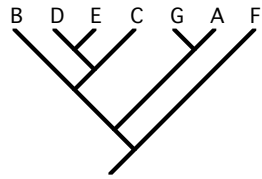


c

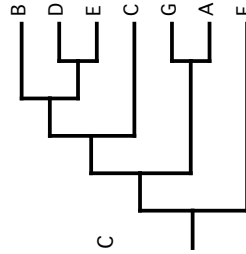


d

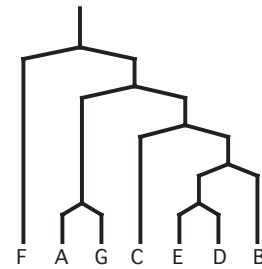
7) Which of the four trees above depicts a different pattern of relationships than the others?



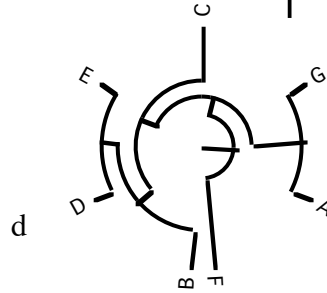
a



b

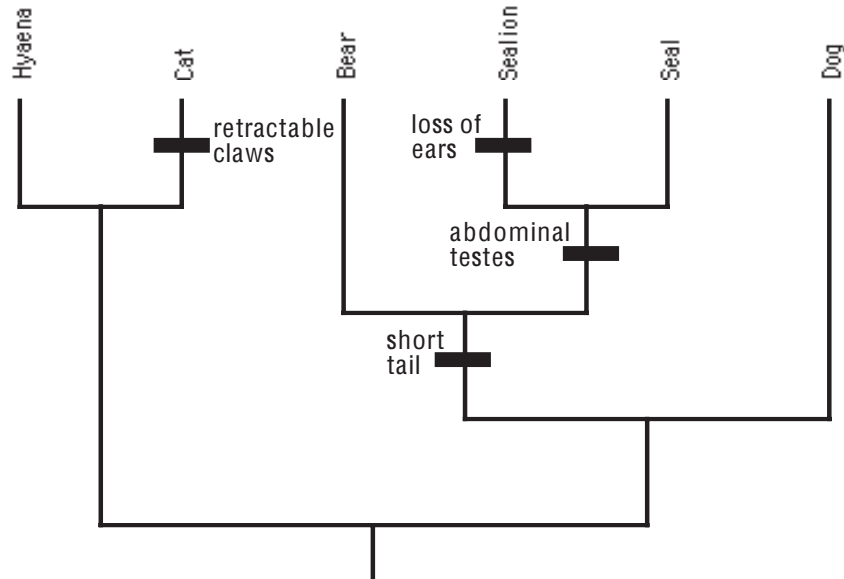


c



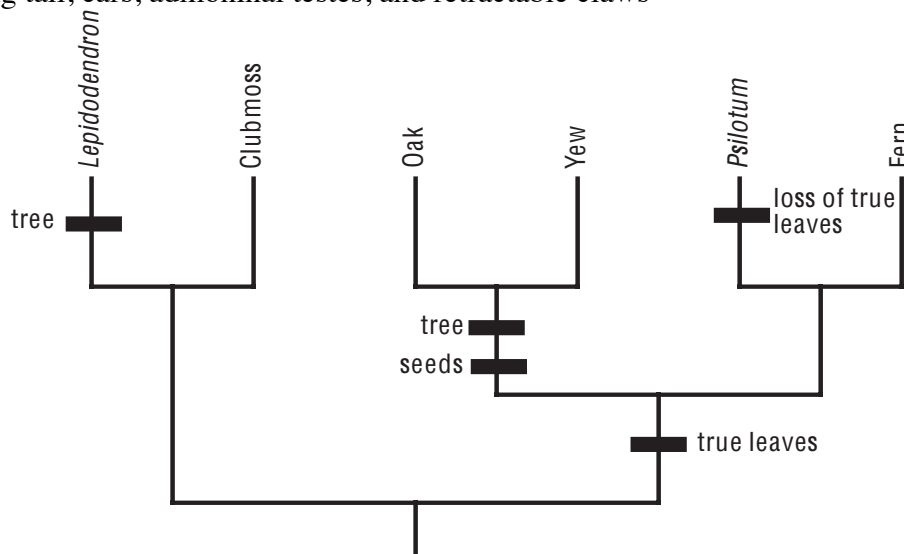
d

8) Which of the four trees above depicts a different pattern of relationships than the others?



9) In the above tree, assume that the ancestor had a long tail, ears, external testes, and fixed claws. Based on the tree and assuming that all evolutionary changes in these traits are shown, what traits does a seal have?

- long tail, ears, external testes, and fixed claws
- short tail, no ears, external testes, and fixed claws
- short tail, no ears, abdominal testes, and fixed claws
- short tail, ears, abdominal testes, and fixed claws
- long tail, ears, abdominal testes, and retractable claws



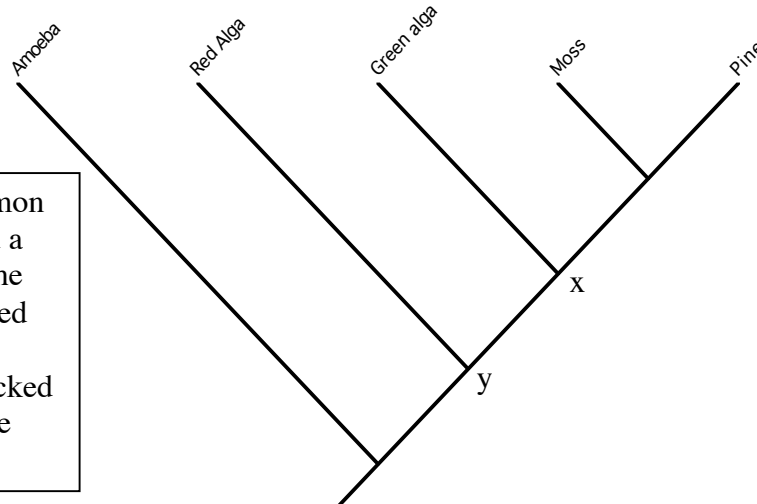
10) In the above tree, assume that the ancestor was a herb (not a tree) without leaves or seeds. Based on the tree and assuming that all evolutionary changes in these traits are shown, which of the tips has a tree habit and lacks true leaves?

- Lepidodendron*
- Clubmoss
- Oak
- Psilotum*
- Fern

Basic Tree Thinking Assessment

David A. Baum, Stacey DeWitt Smith, Samuel S. Donovan

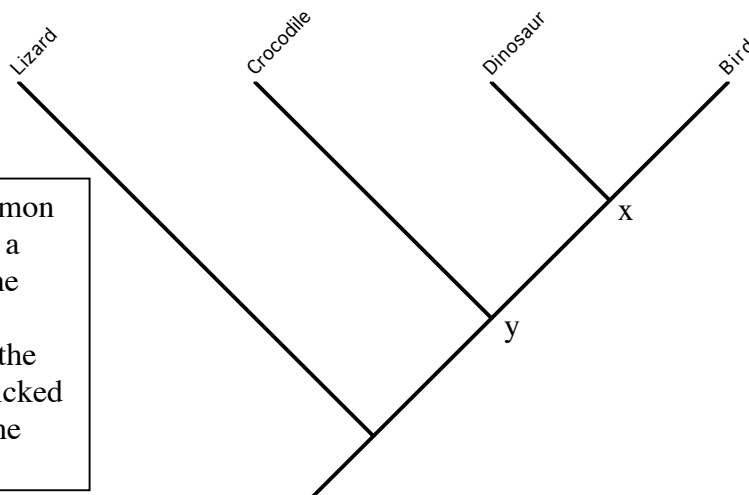
This quiz includes a number of multiple-choice questions you can use to test yourself on your ability to accurately interpret evolutionary trees. Insofar as real biological examples have been used they are accurate based on current knowledge.



'b' is correct. The last common ancestor of a green alga and a moss is at node x whereas the last common ancestor of a red alga and a moss is at the "deeper" node, y. If you picked 'c' you are reading along the tips.

1) By reference to the tree above, which of the following is an accurate statement of relationships?

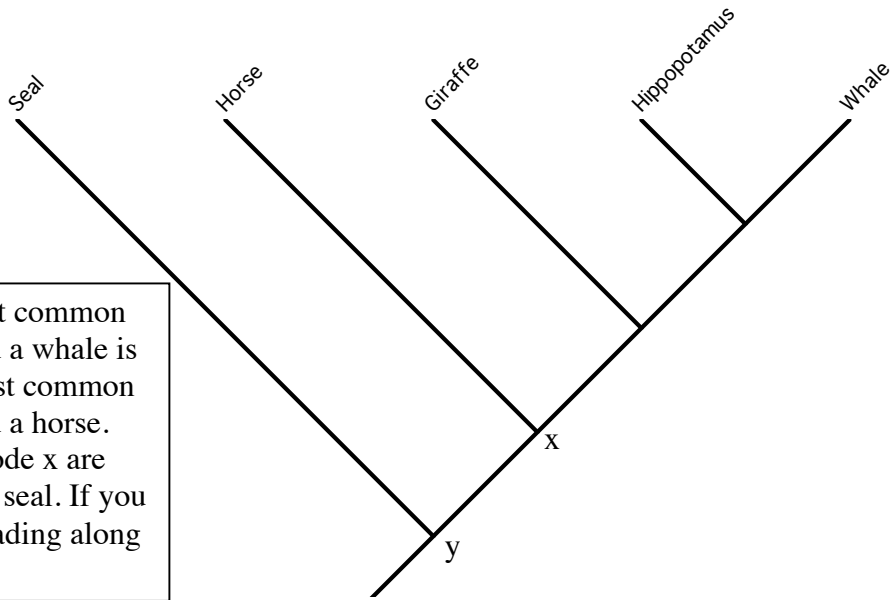
- a) A green alga is more closely related to an red alga than to a moss
- b) A green alga is more closely related to a moss than to a red alga
- c) A green alga is equally related to a red alga and a moss
- d) A green alga is related to a red alga, but is not related to a moss



'b' is correct. The last common ancestor of a crocodile and a bird is at node x whereas the last common ancestor of a crocodile and a lizard is at the "deeper" node, y. If you picked 'a' you are reading along the tips.

2) By reference to the tree above, which of the following is an accurate statement of relationships?

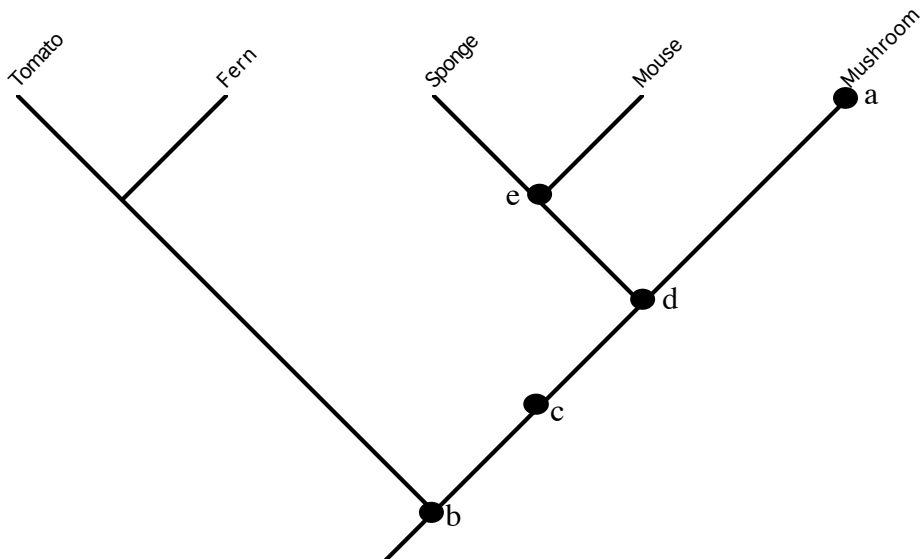
- a) A crocodile is more closely related to a lizard than to a bird
- b) A crocodile is more closely related to a bird than to a lizard
- c) A crocodile is equally related to a lizard and a bird
- d) A crocodile is related to a lizard, but is not related to a bird



'c' is correct. The last common ancestor of a seal and a whale is at node y, as is the last common ancestor of a seal and a horse. All descendants of node x are equally related to the seal. If you picked 'a' you are reading along the tips.

3) By reference to the tree above, which of the following is an accurate statement of relationships?

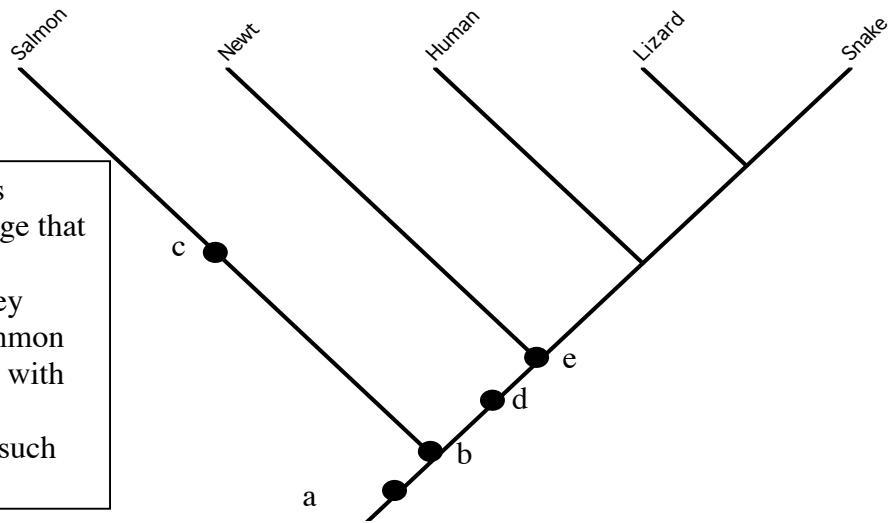
- a) A seal is more closely related to a horse than to a whale
- b) A seal is more closely related to a whale than to a horse
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- d) A seal is related to a whale, but is not related to a horse



4) Which of the five marks in the tree above corresponds to the most recent common ancestor of a mushroom and a sponge?

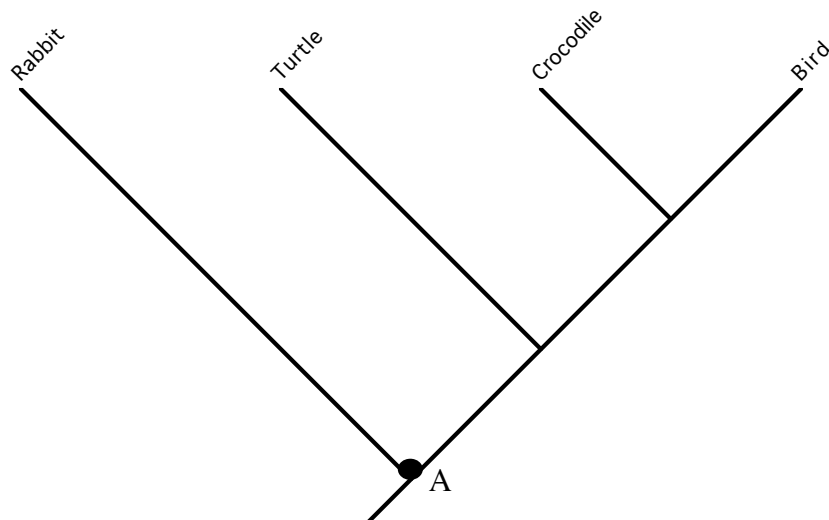
'd' is the correct answer. 'a' is a living species and is not an ancestor. 'e' is an ancestor of a sponge but not of a mushroom. 'b' and 'c' are common ancestors of a sponge and a mushroom, but they are more ancient common ancestors than 'd'.

'c' is the correct answer. This depends on only the knowledge that a salmon and a trout are very closely related. Therefore they must share a more recent common ancestor with each other than with any other included species. Position 'c' is the only place such an ancestor could be.



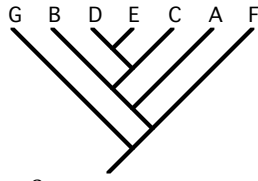
5) If you were to add a trout to the phylogeny shown above, where would its lineage attach to the rest of the tree?

'e' is the correct answer. 'a' is wrong: all included species are descendants of A. 'b' is wrong: a turtle is no more a direct descendant of A than are crocodiles or birds. 'c' is wrong: while the claim might suggest that the common ancestor of a bird and a crocodile was more like a crocodile, it says little about A. 'd' is wrong: an "equal" mix is hard to imagine.

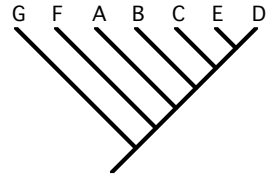


6) Given the tree above, what would you expect the common ancestor marked 'A' to look like?

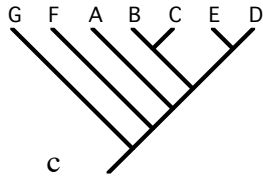
- a) Most like a rabbit because it is the only included ancestor of A
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- c) Most like a crocodile because a crocodile is known to be a "living fossil"
- d) An equal mix of rabbit, turtle, crocodile, and bird features, because it is an ancestor of all of them
- e) One cannot say without a model of how traits evolve along the branches of this tree



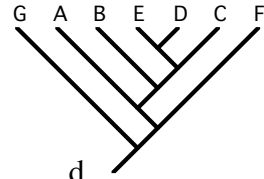
a



b



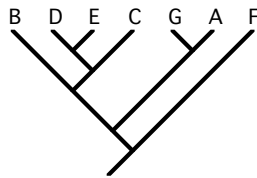
c



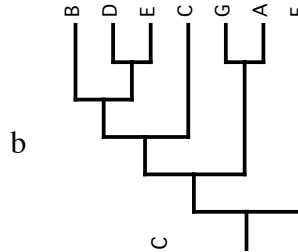
d

7) Which of the four trees above depicts a different pattern of relationships than the others?

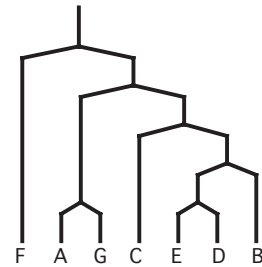
'c' is the correct answer. In all the other trees C is more closely related to E and D than to B. In 'c,' C is more closely related to B than to E or D.



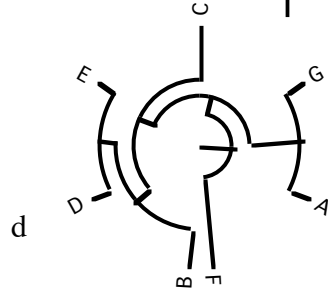
a



b



c

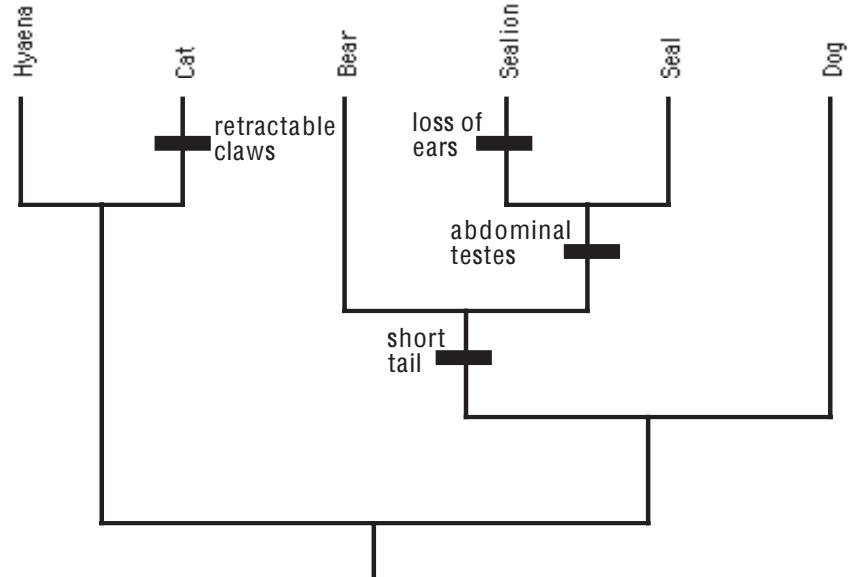


d

8) Which of the four trees above depicts a different pattern of relationships than the others?

'a' is the correct answer. In all the other trees C is more closely related to E and D than is B. In 'a,' B is more closely related to E and D than is C.

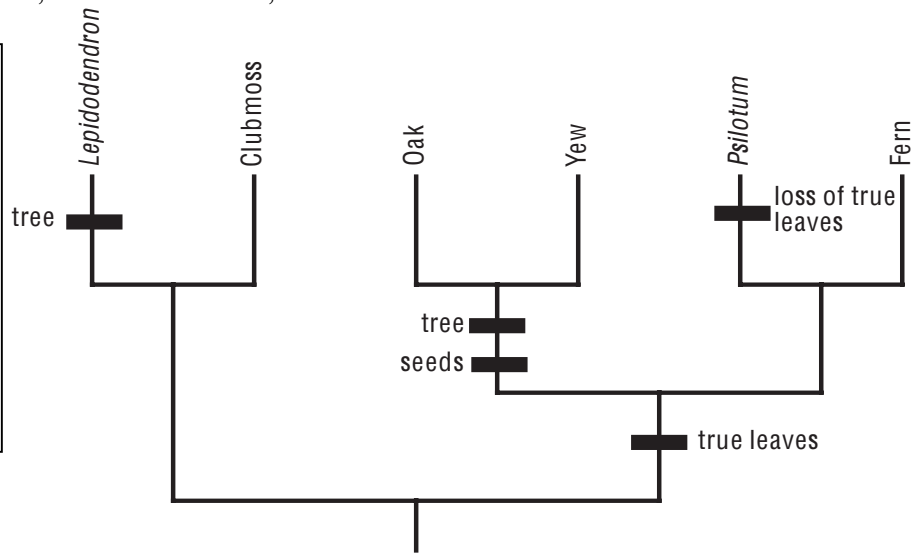
'd' is the correct answer. Tracing up from the ancestor one sees that the only changes are in tail length and testes position. For the other traits it seals have the ancestral condition.



9) In the above tree, assume that the ancestor had a long tail, ears, external testes, and fixed claws. Based on the tree and assuming that all evolutionary changes in these traits are shown, what traits does a seal have?

- a) long tail, ears, external testes, and fixed claws
- b) short tail, no ears, external testes, and fixed claws
- c) short tail, no ears, abdominal testes, and fixed claws
- d) short tail, ears, abdominal testes, and fixed claws
- e) long tail, ears, abdominal testes, and retractable claws

'a' is the correct answer. Clubmosses are not trees. Oak (and yew) are trees but they have leaves. *Psilotum* lacks leaves, but it is not a tree. A fern has leaves and is not a tree.



10) In the above tree, assume that the ancestor was a herb (not a tree) without leaves or seeds. Based on the tree and assuming that all evolutionary changes in these traits are shown, which of the tips has a tree habit and lacks true leaves?

- a) *Lepidodendron*
- b) Clubmoss
- c) Oak
- d) *Psilotum*
- e) Fern