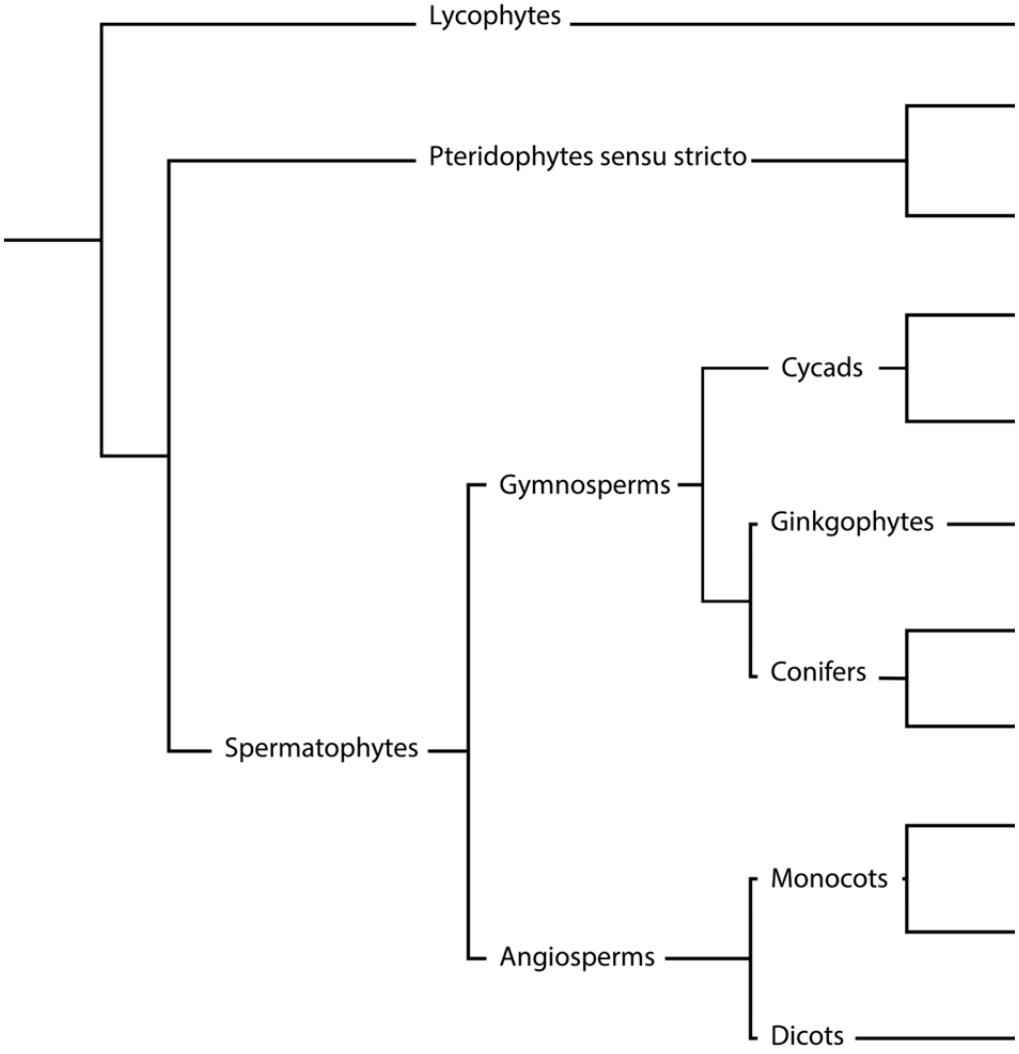
BIOL 325 – Plant Systematics
Dr. Hardy

Some Practice problems for Exam 3 material

Revised (problem # 44 added)

(keep in mind that 1/3 of the final exam will be on material from the first two exams).

1. Place the families from the third unit of lecture onto the cladogram below in their appropriate places.



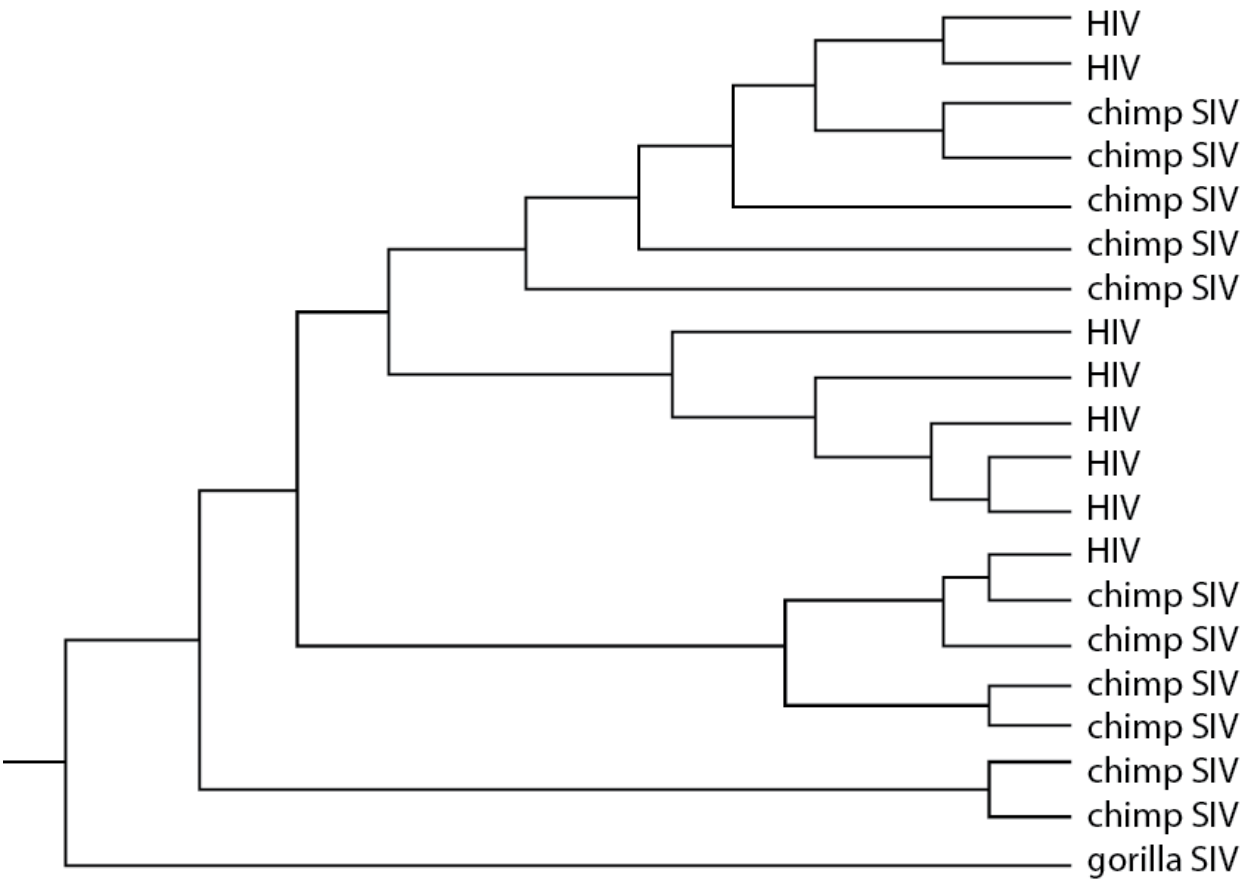
2. Which families of the third unit have leaves with only a single vein?

3. Which families of the third unit have compound leaves?

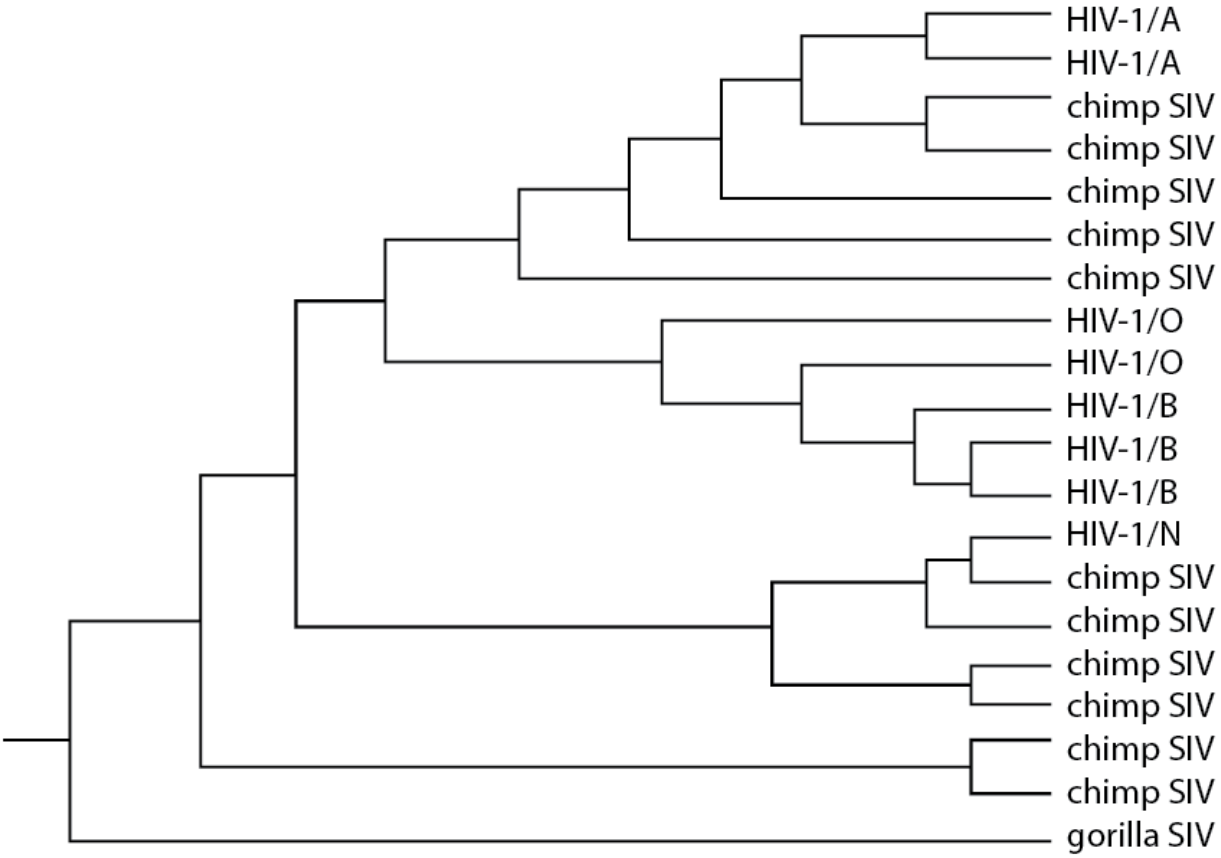
4. Which families of the third unit have trimerous flowers?

5. Which families of the third unit have umbel inflorescences and 4 or 5-merous flowers?

6. On the hypothetical tree below, HIV stands for Human Immunodeficiency virus and SIV for Simian Immunodeficiency Virus. Now use parsimony (Fitch optimization) on the tree below to tell me how many times HIV has originated from chimp SIV. Use hashmarks to represent the SIV to HIV transitions (Hint: ignore the 1/O, etc. designations).

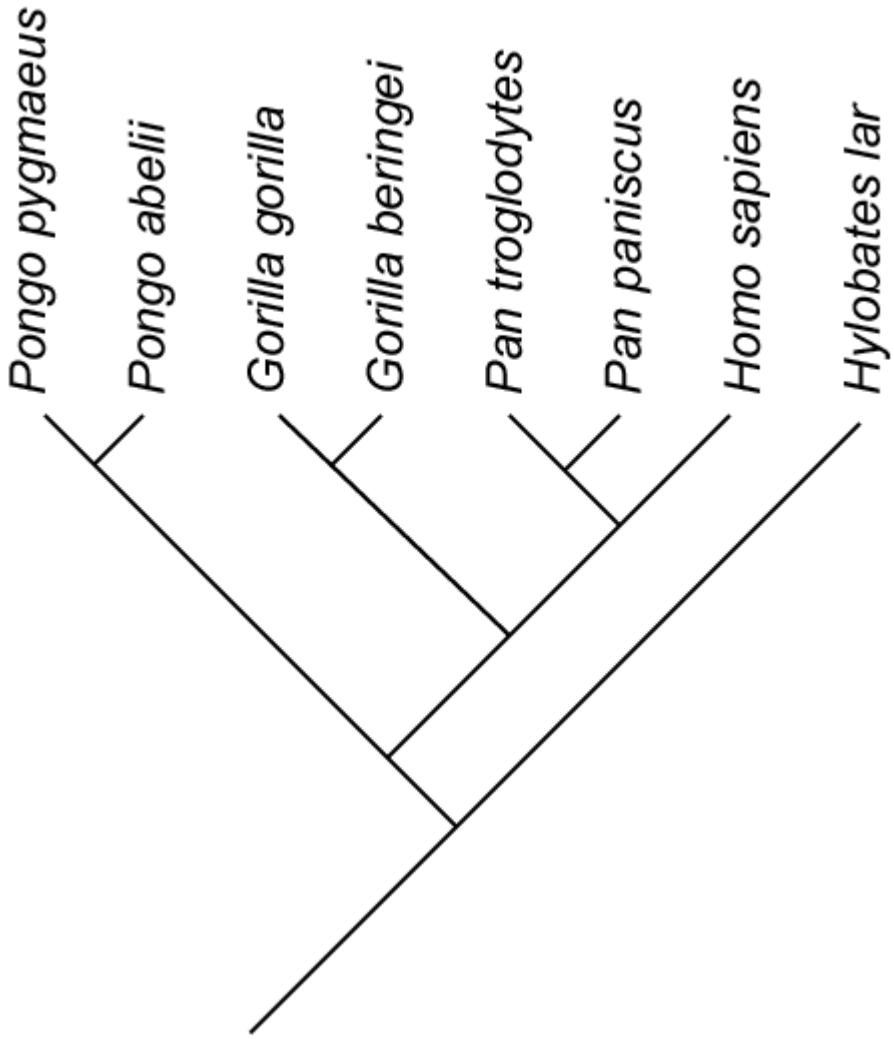


7. I've now added some detail to the hypothetical HIV tree below to represent different strains of HIV. Use parsimony on the tree below to tell me which of the HIV strain groups (A, O, B, and/or N) is/are monophyletic and which are not. Then tell me which of the HIV-1 strains has originated from an existing HIV strain.



8. Using the biogeographic data matrix and cladogram depicted below, apply Fitch parsimony to determine where humans originated.

	Current Distribution
Hylobates lar (lar gibbon)	Asia
Homo sapiens (human)	Cosmopolitan (America, Asia, Africa, Europe)
Gorilla gorilla (Western gorilla)	Africa
Gorilla beringei (eastern gorilla)	Africa
Pan paniscus (pygmy chimp)	Africa
Pan troglodytes (common chimp)	Africa
Pongo abelii (Sumatran orangutan)	Asia
Pongo pygmaeus (Bornean orangutan)	Asia



9. The Great Ape family (Hominidae) includes Humans, Chimps, Gorillas and Orangutans. Use Fitch parsimony on the data and tree above to infer where the Great Ape family (i.e. the most recent common ancestor to the all members of the family) originated.

A. Africa B. America C. Asia D. Europe

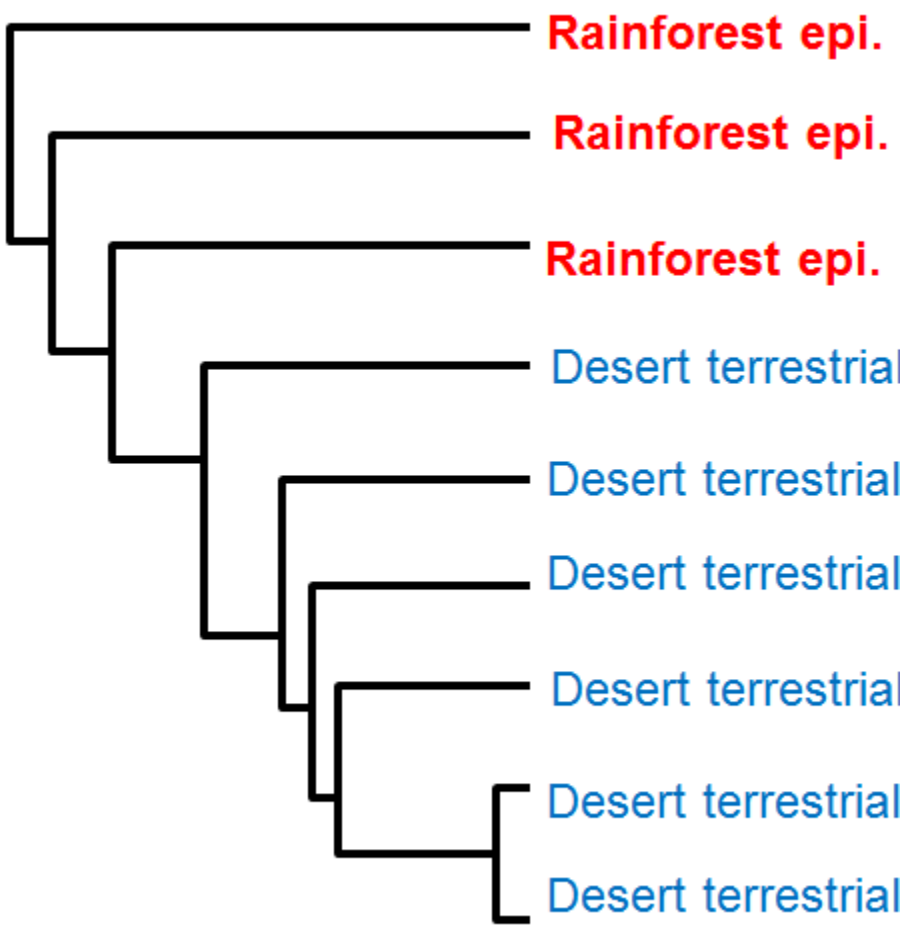
10. The hypothetical tree below indicates what? Use parsimony to infer an answer.

A. This clade arose first as desert terrestrials and later evolved once into rainforest epiphytes.

B. This clade arose first as rainforest epiphytes and then later evolved once into desert terrestrials.

C. This clade arose first as rainforest epiphytes and then later evolved twice into desert terrestrials.

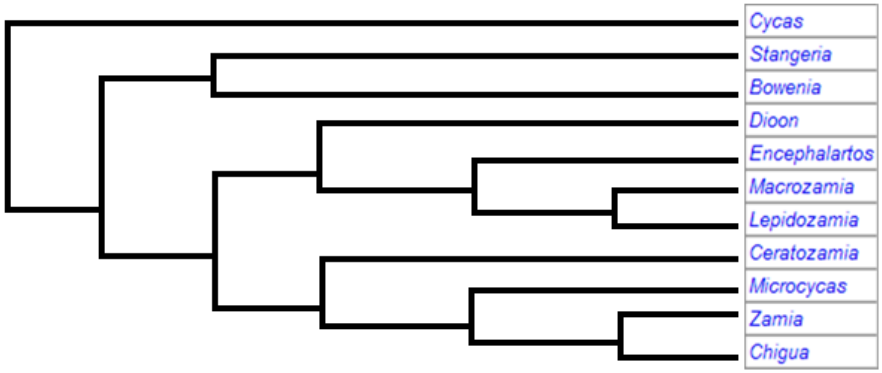
D. This clade arose first as desert terrestrials and later evolved twice into rainforest epiphytes.



11. Is the classification of the cycad order (Cycadales) below consistent with the phylogeny inferred by Stevenson (1992) below? Hint: to be consistent, all taxa from the classification would have to be monotypic or monophyletic.

Order	Suborder	Family	Subfamily	Tribe	Subtribe	Genus
Cycadales	Cycadineae	Cycadaceae				*Cycas*
	Zamiineae	Stangeriaceae	Stangerioideae			*Stangeria*
			Bowenioideae			*Bowenia*
		Zamiaceae	Encephalartoideae	Diooeae		*Dioon*
				Encephalarteae	Encephalartinae	*Encephalartos*
					Macrozamiinae	*Macrozamia*
						Lepidozamia
			Zamioideae	Ceratozamieae		*Ceratozamia*
				Zamieae	Microcycadinae	*Microcycas*
					Zamiinae	*Zamia*
						Chigua

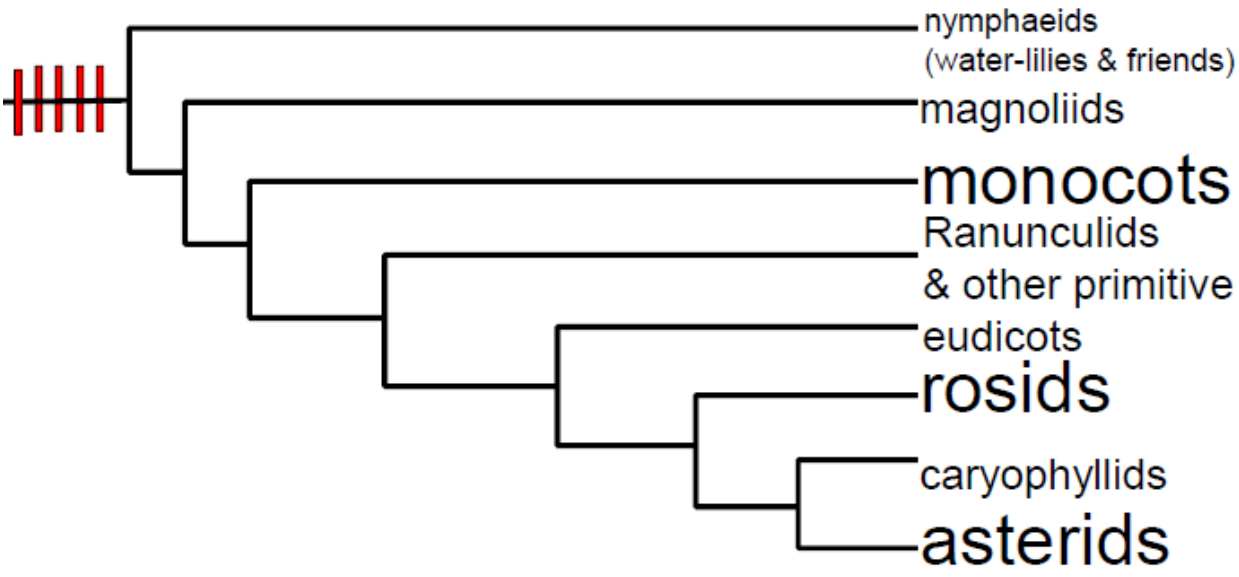
Most parsimonious cladogram from Stevenson (1992).



12. Consider the following cladogram and the hypothetical classification scheme that included 4 classes as follows:

Nymphaeopsida: all nymphaeids
Lauropsida: all magnoliids and all monocots
Rosopsida: includes all rosids, most caryophyllids and all primitive eudicots
Asteropsida: includes all asterids and some caryophyllids

How many monophyletic classes are recognized in this scheme?
a. one
b. two
c. three
d. four
e. five



13. In the above classification scheme, how many of those 4 classes is not monophyletic? Base your answer on the same cladogram above.
a. one
b. two
c. three
d. four
e. five

14. In the above tree, how many clades are actually graphically depicted?
a. one
b. three
c. five
d. seven
e. nine

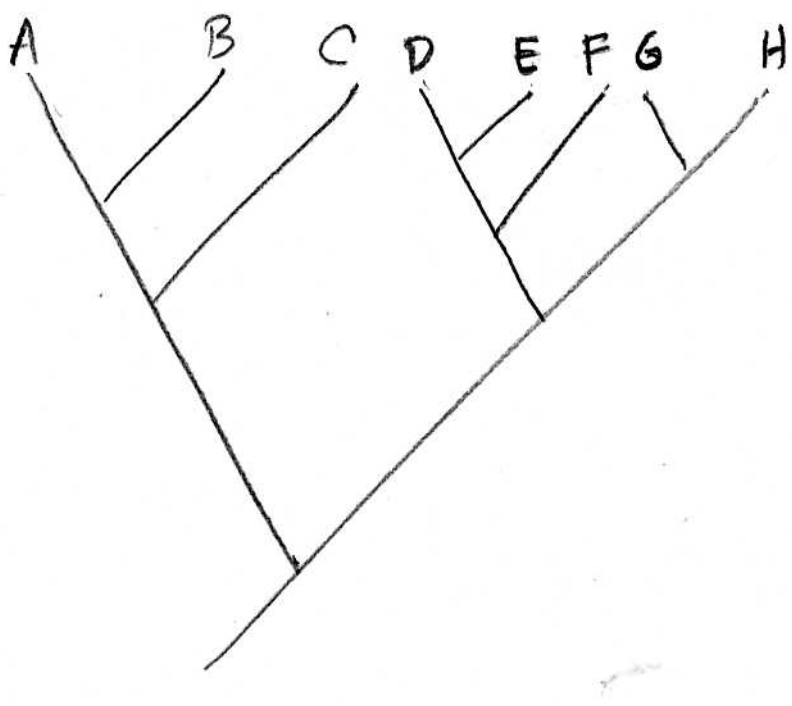
15. In the above tree, how many sister group relationships (same thing as sister group pairs) are actually graphically depicted?

a. zero
b. one
c. three
d. five
e. seven

16. In the tree above, what would be an appropriate name for the most inclusive clade that is depicted?

a. vascular plants
b. seed plants
c. gymnosperms
d. angiosperms
e. eudicots

17. In the cladogram below, how many speciation events are represented?



a. one

b. three

c. five

d. seven

e. nine

18. Using the following data matrix of ingroup species A-H, and the tree for question 17, how many times have lineages evolved from low to high altitude habitats in the cladogram shown? Use Fitch Optimization as described in class to resolve this. Remember to pick the best answer.

	Elevation	Leaf surface	Fruit
A	High	Tomentose	Capsule
B	High	Tomentose	Capsule
C	High	Tomentose	Berry
D	Low	Glabrous	Berry
E	High	Tomentose	
F	Low	Glabrous	
G	Low	Glabrous	
H	High	Tomentose	

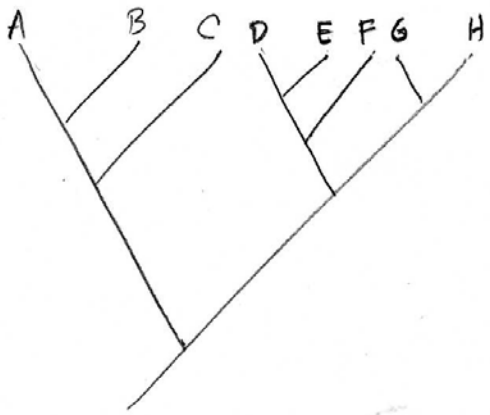
a. zero
b. once
c. 2-3 times
d. 3-4 times
e. none of the above (or we do not have enough information)

19. <u>Using</u> <u>tree from 17, matrix from 18:</u> Assume that you add an outgroup taxon to the analysis, which grows in a high elevation habitat, how many times have lineages evolved from high to low altitude habitats in the cladogram shown? Use Fitch Optimization as described in class to resolve this. Remember to pick the best answer.

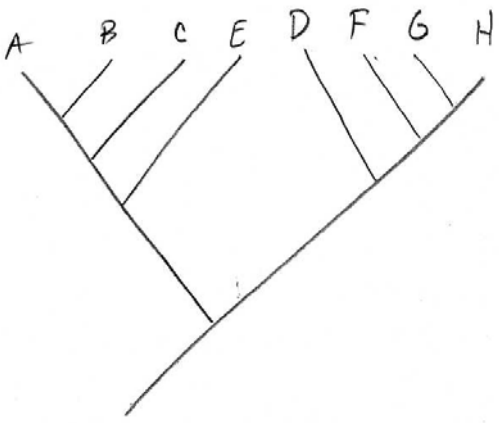
a. zero
b. once
c. 2-3 times
d. 3-4 times
e. none of the above (or we do not have enough information)

20. **<u>Trees below and matrix from 18</u>:** It is often seen that high altitude plants are covered with a thick covering of long, white, wooly looking trichomes. These plant surfaces are said to be tomentose. Some botanists have speculated that this is an adaptation to insulate plants at night against the cold temperatures of high elevations. Assuming an outgroup species that is low elevation and glabrous, which of the following cladograms provides more support for viewing tomentose pubescence as an adaptation to high elevation habitats? Use Fitch Optimization as discussed in class.

a.



b.



21. The term Bounty Hunting derives from...
a. The HMS Bounty's hunt for breadfruit.
b. The HMS Bounty's hunt for mutineers.
c. The HMS Pandora's hunt for breadfruit.
d. The HMS Pandora's hunt for mutineers.
e. The HMS Bounty's hunt for the bountiful natural products of Tahiti.

22. Which of the following is the scientific name for the wild species from which breadfruit was originally derived?
a. Moraceae
b. Euphorbiaceae
c. *Artocarpus mariannensis*
d. *Artocarpus altilis*
e. *Artocarpus camansi*

23. Based on Zerega's AFLP data, Hawaiian cultivars of breadfruit consist entirely of alleles (markers) from which wild species (other than the breadfruit species, of course)?
a. Moraceae
b. Euphorbiaceae
c. *Artocarpus mariannensis*
d. *Artocarpus altilis*
e. *Artocarpus camansi*

24. Based on Zerega's AFLP data, where does one find breadfruit cultivars with more dugdug alleles (markers) than in other areas?
a. Hawaii
b. NE Polynesia
c. French Polynesia
d. Micronesia
e. New Zealand

25. The ancestral, pre-historical Polynesians are called the _____ by archeologists.
a. Hawaiians
b. Polynesians
c. Lapita
d. Amazonians
e. Pilipino

26. The ancestral, pre-historical Polynesians selected for what in breadfruit?
a. more seed, less pulp
b. more seed and pulp
c. less seed, less pulp
d. less seed, more pulp
e. fruitless cultivars

27. Where was the Bounty to collect breadfruit?
a. Papua New Guinea
b. Fiji
c. Hawaii
d. West Indies
e. Tahiti

28. Where was the Bounty to deliver breadfruit?
a. Papua New Guinea
b. Fiji
c. Hawaii
d. West Indies
e. Tahiti

29. Which of the following lies in the Atlantic Ocean?
a. Papua New Guinea
b. Fiji
c. Hawaii
d. West Indies
e. Tahiti

31. What is the name for the technique to isolate and amplify a single gene for subsequent DNA sequencing?
a. Isozyme analysis
b. AFLP
c. PCR
d. Allozyme analysis
e. histological technique

32. The name for the use of DNA sequence data to study evolution and taxonomy is called...
a. Morphological cladistics
b. Morphological systematics
c. Molecular systematics
d. AFLP analysis
e. PCR

33. Zerega's data support which hypothesis about the origin of breadfruit more strongly?
a. It was derived initially from breadnut, then some cultivars had limited hybridization with dugdug.
b. It was derived initially from dugdug, then some cultivars had limited hybridization with breadnut.
c. It was derived initially from hybridization between breadnut and dugdug, then some cultivars lost dugdug alleles.
d. It was derived initially from hybridization between breadnut and dugdug, then some cultivars lost breadnut alleles.
e. It was derived solely through hybridization between breadnut and dugdug.

34. Which of the following authors would be more likely to advocate the theory that HIV in humans came from chimps through the development of the Oral Polio Vaccine?
a. Hennig
b. Andrew Warwick
c. Hilary Koprowski
d. Edward Hooper
e. Michael Worobey

35. Which of the following authors would be more likely to refute the theory that HIV in humans came from chimps through the development of the Oral Polio Vaccine?
a. Cronquist
b. Andrew Warwick
c. Hilary Koprowski
d. Edward Hooper
e. Michael Worobey

36. Which of the two HIV strains is more virulent in humans?
a. HIV-1
b. HIV-2
c. SIV

37. The more virulent strain of HIV originated from chimps in ...
a. eastern tropical Africa
b. central tropical Africa
c. western tropical Africa
d. northern Africa
e. southern Africa

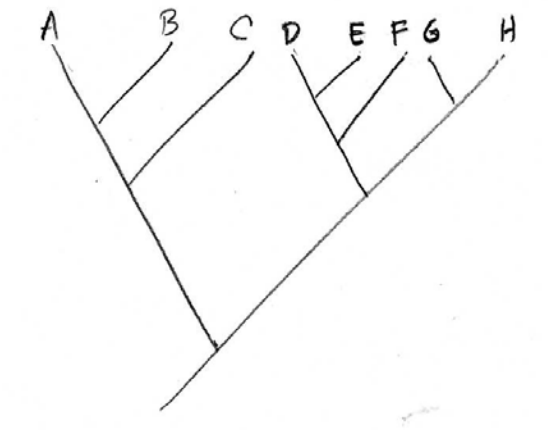
38. The following screenshot is from a website started by whom?
a. Tom Curtis
b. Andrew Warwick
c. Hilary Koprowski
d. Edward Hooper
e. Michael Worobey

39. Name all of the species that were closely associated with the Mutiny on the Bounty the day it happened?

a. *Homo erectus, Artocarpus altilis*, *Artocarpus camansi*
b. *Artocarpus altilis*, *Artocarpus camansi, Homo sapiens*
c. *Artocarpus camansi, Homo sapiens*
d. Artocarpus altilis, *Pan troglodytes, Homo sapiens*
e. *Artocarpus altilis*, *Homo sapiens*

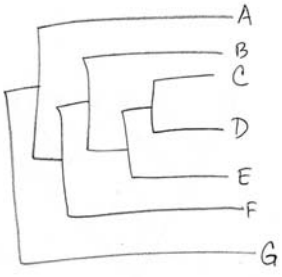
40. With limited funding and land, Lancaster County wishes to set aside one contiguous hectare of land for a conservation park. Which of the preserve designs maximizes both the number of species and phylogenetic breadth? Use the cladogram below.

a. Preserve 1: contains 10 species from A, 10 from B, and 10 from C
b. Preserve 2: contains 10 species from C, 10 from B
c. Preserve 3: contains 10 species from A, 10 from B, and 10 from D
d. Preserves 1 and 3 are equally maximal in this respect
e. Preserves 2 and 3 are equally maximal in this respect



41. With limited funding and land, Lancaster County wishes to set aside one contiguous hectare of land for a conservation park. Which of the preserve designs maximizes both the number of species and phylogenetic breadth? Use the cladogram below.

a. Preserve 1: contains 10 species from A, 10 from B, and 10 from C
b. Preserve 2: contains 10 species from C, 10 from B
c. Preserve 3: contains 10 species from A, 10 from B, and 10 from D
d. Preserves 1 and 3 are equally maximal in this respect
e. Preserves 2 and 3 are equally maximal in this respect



42. Using the cladogram in 41 above, which species are more closely related?

a. A and G
b. A and B
c. G and F
d. F and B
e. D and G

43. "Most closely related" is the same as saying that the taxa in question.....

a. share a most recent common ancestor
b. share a common ancestor
c. are most similar
d. are most apomorphic
e. share a synapomorphy

44. Using the chronogram below, plot the number of cumulative species through time on the graph paper to the right. Use this plot to determine when (how many millions of years ago) there was a marked increase in the net diversification rate (the accumulation of species) in this clade.