COMPSCI 260 - Problem Set 5, Problem 2
Due: Fri 8 Nov 2019, 5pm
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Statement of collaboration and resources used (put None if you worked
entirely without collaboration or resources; otherwise cite carefully): None

My solutions and comments for this problem are below.
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a) See code
b) **For distance metric D_1:**
    D_1 is not ultrametric.
    - The triplet that does not satisfy the criterion is (1,2), (1,3), and (2,3).
    - 0.3, 0.7, and 0.6 do not satisfy this because 0.6 does not equal 0.7 even though 0.3 is less than 0.6.
    D_1 is additive.
    - See unrooted phylogenetic tree attached
    For distance metric D_2:
    D_2 is ultrametric.
    - See rooted phylogenetic tree attached
    D_2 is additive.
    - See unrooted phylogenetic tree attached
c) This distance metric satisfies both the ultrametricity and the additivity criteria. (See phylogenetic tree attached)
d) The relationships of the four proteins from PS4 described by the reconstructed tree are si from the relationships inferred based on their previously determined pairwise alignments. Additionally, the two fungal species are a poor fit with the two animal species and the two bacterial species due the the large distance between them and the animal and bacterial species on the phylogenetic tree.