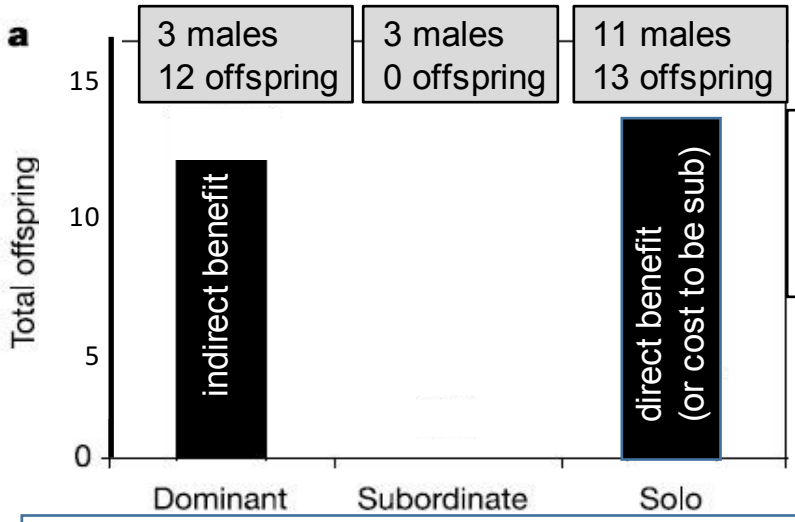
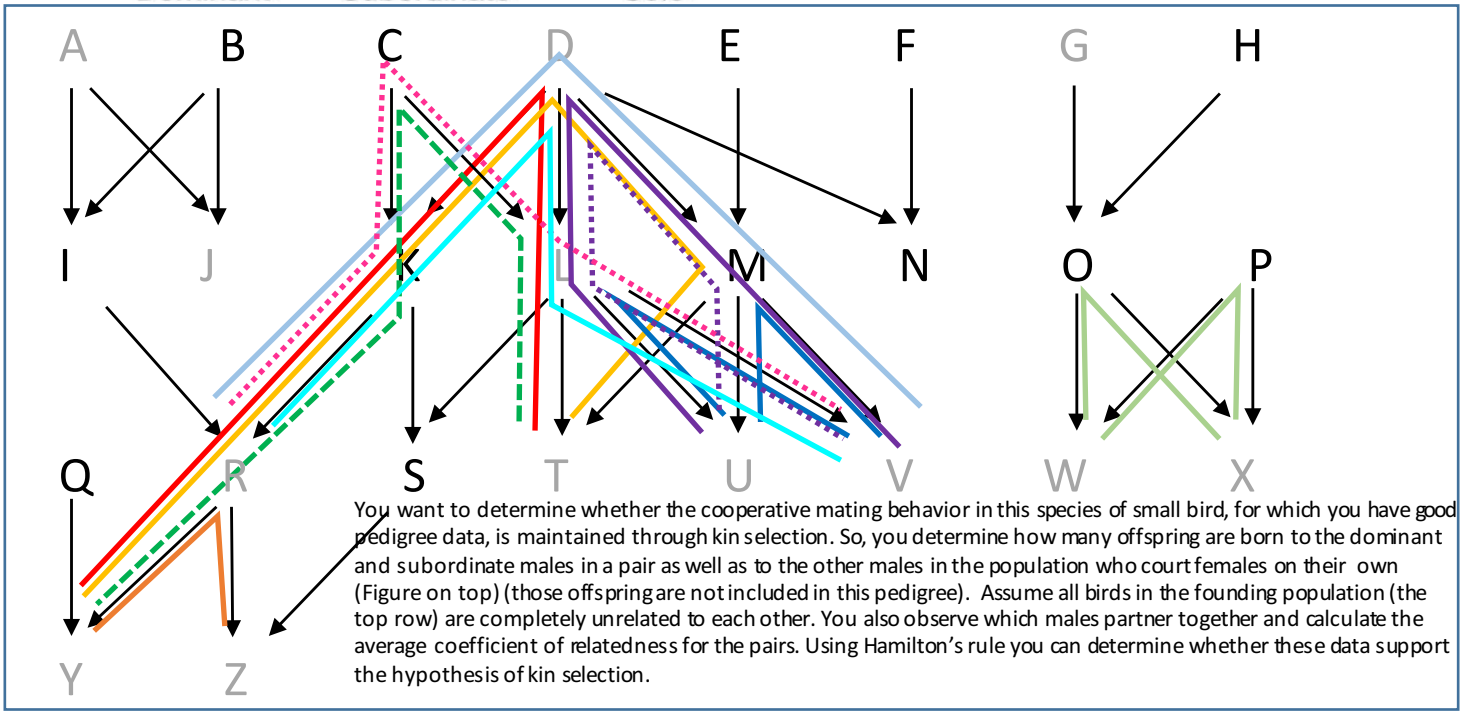


NAME _____

avg. dir. benefit to solo = 1.18 (cost when given up)
avg. benefit to dom. = 4-1.18 = 2.82

net benefit = RB-C



You want to determine whether the cooperative mating behavior in this species of small bird, for which you have good pedigree data, is maintained through kin selection. So, you determine how many offspring are born to the dominant and subordinate males in a pair as well as to the other males in the population who court females on their own (Figure on top) (those offspring are not included in this pedigree). Assume all birds in the founding population (the top row) are completely unrelated to each other. You also observe which males partner together and calculate the average coefficient of relatedness for the pairs. Using Hamilton's rule you can determine whether these data support the hypothesis of kin selection.

Do your data support the hypothesis if you observe Y&Z, T&Y and U&V cooperating?

R_{yz} = ½^2 = 1/4 ; R_{ty} = ½^5 + ½^5 + ½^5 = 3/32 ; R_{uv} = ½^2 + ½^2 + ½^4 + ½^4 = 5/8

R_{total} = ¼ + 3/32 + 5/8 = 31/32 = 0.97 ; R_{avg} = 0.97/3 = 0.323

Relatedness X Benefit = Cost; 0.323 X 2.82 – 1.18 = -0.268 so costs are greater then benefit ; no support.

Do your data support the hypothesis if you observe U&Z, T&Y and R&V cooperating?

Ruz = (same as T&Y) = 3/32 ; R_{ty} = ½^5 + ½^5 + ½^5 = 3/32 ; R_{rv} = ½^4 + ½^4 + ½^4 = 3/16

R_{total} = 3/32 + 3/32 + 3/16 = 12/32 = 0.37 ; R_{avg} = 0.37/3 = 0.123

Relatedness X Benefit = Cost; 0.123 X 2.82 – 1.18 = -0.83 so costs are greater then benefit ; no support

Do your data support the hypothesis if you observe U&V, T&V, and W&X cooperating?

R_{uv} = ½^2 + ½^2 + ½^4 + ½^4 = 5/8 ; R_{tv} = (same as UV) = 5/8 ; R_{xw} = ½^2 + ½^2 = ½

R_{total} = 5/8 + 5/8 + ½ = 14/8 = 1.75 ; R_{avg} = 0.583

Relatedness X Benefit = Cost; 0.583 X 2.82 – 1.18 = 0.46; so yes, data support kin selection hypothesis

To help you, I have drawn paths connecting some of these coalitions (I did not draw them for T&V because it was getting very cluttered (I also realize I left of lines through C for RV and YT) but they are related in the same way that U&V are.) You should be able to do the math to figure this out, not just guess. I will post the key later.
of course you would need a bigger dataset