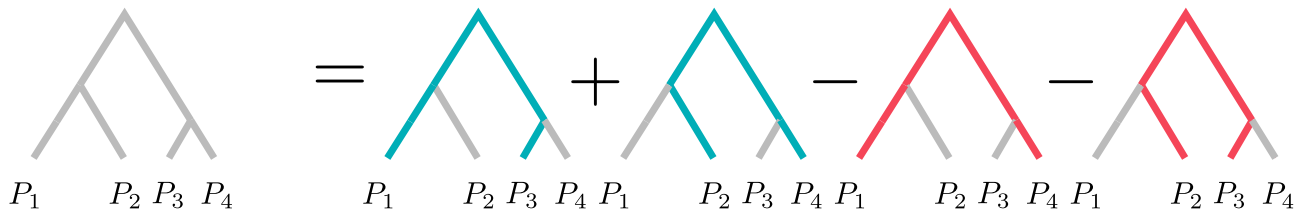


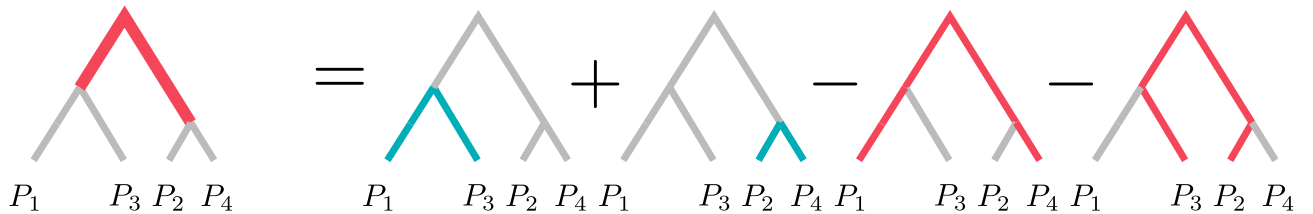
A. Equation

$$2 F_4(P_1, P_2; P_3, P_4) = \mathbb{E}T_{13} + \mathbb{E}T_{24} - \mathbb{E}T_{14} - \mathbb{E}T_{23}$$

B. Concordant genealogy



C. Discordant genealogy (BABA)



D. Discordant genealogy (ABBA)

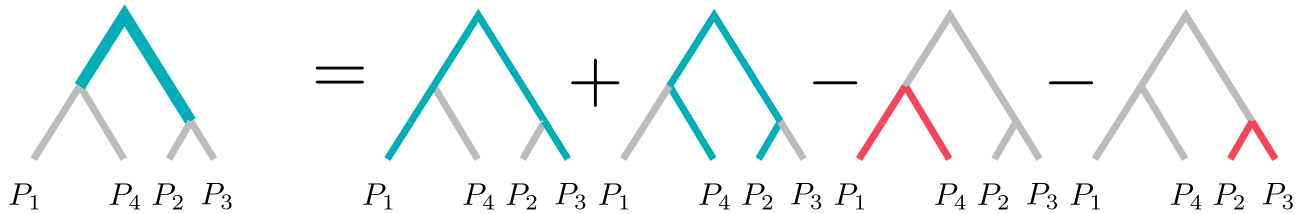


Figure S3 Schematic explanation how F_4 behaves conditioned on gene tree. Blue terms and branches correspond to positive contributions, whereas red branches and terms are subtracted. Labels represent individuals randomly sampled from that population. All branches cancel out in the concordant genealogy (Panel B), and that the two discordant genealogies contribute with weight +2 and -2, respectively. The mutation rate as constant of proportionality is omitted.