B2.9.1–2.9.2, B6.5

1 2

ab cd

cov(u1, u2) = E[α­aα­c] + E[α­aα­d] + E[α­bα­c] + E[α­bα­d]

E[α­aα­c] = P(a=c)var(α­) + [1-P(a=c)(0)] = var[α­](P(a=c) + P(a=d) + P(b=c) + P(b=d)

var[α­] = σA2/2

P(a=c) = K12 = kinship

So cov(u1, u2) = 2K12σA2

2K12 = A12 = “additive relationship”

How do you calculate kinship from pedigree information.

1. Order individuals such that progeny follow the parents:

1

2

3

4

.

.

.

n

sorted such that no individual is a parent of any individual higher in the list

Calculating kinship is a recursive algorithm, sometimes called the (Tabular Method)

)

for j < i

[i.e., “i" is lower down in the list, and cannot be an ancestor of j]

Average kinship between parents of i with j = kinship between two individuals

Kii = 1/2(P(a=a)) + 1/2P(a=b)

= ½(1 + Fi)

Inbreeding coefficient sampling without replacement

Kinship = sampling with replacement = coefficient of coancestry

= ½(1 + Kmother,father) Fi = Kmother of I, father of i

Aij = 2Kij = Kmom of i,j + Kdad of i, j

Aii = 2Kij = Kmom of i,j + Kdad of i, j

½ (2Kmomi, j + 2 Kdad I, j)

Aii = 1 + Fi

= 1 + 1/2 Amom i,dad i

1. 2

3(12) 4(12)

5(13)

A11 = A22 = 1 founders are outbred

A12 = 0 founders are unrelated

A13 = ½(A11 + A12) = ½

= A14= A23= A24 = Aparent, offspring

Afull-sib = A34 = ½ (A31 + A32) = 1/2(1/2 + ½) = ½

A33 = 1 + (Fi) = 1

A35= ½(A33+A31) = ½(1 + ½) = ¾

A55 = 1 + F5 = 1 + ½(A13) = 1 + ¼ = 5/4

y = XB + Zu + e

Zg Zge [ ug

Uge] = Zgug + Zgeuge