One- and two-locus inbreeding for recurrent selection and overlapping generations selection schemes

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Inbreeding coefficients at one and two loci are evaluated for
recurrent selection and overlapping generations selection schemes. These
mating schemes have found great use in plant and animal breeding. The
inbreeding coefficients are derived in terms of probability measures that
genes are identical by descent. The procedures demonstrated here can be
applied to any regular system of mating between individuals or groups of
individuals.

For individual mating systems, two digametic individual measures are
defined and employed in the derivation of a recurrence formula for the one-
locus inbreeding coefficients. Two further classes of individual measures,
trigametic and quadrigametic, are required for transition from one
generation to the previous one to allow the calculation of the inbreeding
coefficients for the two-locus case. This process is illustrated for the
case of recurrent selection. For recurrent selection populations with
various imposed assumptions, numerical values of the average inbreeding
coefficients at the end of the breeding cycles are listed to demonstrate
the effects of linkage and population size on the accrual of inbreeding and
hence of homozygosity.

For group mating systems, gametic set measures are needed in addition
to the average individual measures. Transition equations relating values
in successive generations of gametic set measures are established for the
calculation of the group inbreeding coefficients. As an illustration of
this process, the one- and two-locus inbreeding coefficients for

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populations with overlapping generations are evaluated. Both monoecious
and dioecious populations of diploids are considered and family size is not
restricted to being Poisson. Inbreeding effective numbers found by the
exact treatment here are compared to various previous approximate results.