

Answer for Programming Project 22.1

The dimensioning and initialization of the alleles for the three founders need only be done once. To do 1000 gene drop simulations, animals 4 through 10 will have to receive randomly selected alleles 1000 time. The statements to do this are shown in red below.

```
RANDOMIZE
DEF FN_RND_INDEX = INT(2*RND+1) ! either returns 1 or 2,
                                ! which is equivalent to heads and tails
DIM animal1$(2)                ! dimension two alleles for
DIM animal2$(2)                ! each of the animals
DIM animal3$(2)
DIM animal4$(2)
DIM animal5$(2)
DIM animal6$(2)
DIM animal7$(2)
DIM animal8$(2)
DIM animal9$(2)
DIM animal10$(2)

LET animal1$(1) = "a"          ! give animals 1, 2 and 3 unique alleles
LET animal1$(2) = "b"          ! as these are the three founders
LET animal2$(1) = "c"
LET animal2$(2) = "d"
LET animal3$(1) = "e"
LET animal3$(2) = "f"

LET animal4$(1) = animal2$(FN_RND_INDEX) ! select individual 4 alleles
LET animal4$(2) = animal1$(FN_RND_INDEX) ! from mother 2 and father 1

LET animal5$(1) = animal2$(FN_RND_INDEX) ! select individual 5 alleles
LET animal5$(2) = animal1$(FN_RND_INDEX) ! from mother 2 and father 1

LET animal6$(1) = animal3$(FN_RND_INDEX) ! and so forth...
LET animal6$(2) = animal1$(FN_RND_INDEX)

LET animal7$(1) = animal4$(FN_RND_INDEX)
LET animal7$(2) = animal6$(FN_RND_INDEX)

LET animal8$(1) = animal4$(FN_RND_INDEX)
LET animal8$(2) = animal6$(FN_RND_INDEX)

LET animal9$(1) = animal5$(FN_RND_INDEX)
LET animal9$(2) = animal6$(FN_RND_INDEX)

LET animal10$(1) = animal7$(FN_RND_INDEX)
LET animal10$(2) = animal6$(FN_RND_INDEX)

PRINT animal10$(1)&animal10$(2)      ! print the genotype of animal 10

END
```

Thus, these statements must be inside a FOR-NEXT loop. The issue is whether the two alleles of individual 10 are the same. This is tested with the statement:

```
IF animal10$(1)= animal10$(2)THEN statement
```

The **statement** should count cases of autozygosity. Thus, a variable `auto_cnt` should be initialized before the loop and should be incremented by 1 each time the boolean expression in the IF-THEN statement is true. After the 1000 executions of the loop, the inbreeding coefficient is the number of times autozygosity occurred divided by 1000. A program to do these additional things is given below:

```
RANDOMIZE
DEF FN_RND_INDEX = INT(2*RND+1) ! either returns 1 or 2,
                                ! which is equivalent to heads and tails
DIM animal1$(2)                ! dimension two alleles for
DIM animal2$(2)                ! each of the animals
DIM animal3$(2)
DIM animal4$(2)
DIM animal5$(2)
DIM animal6$(2)
DIM animal7$(2)
DIM animal8$(2)
DIM animal9$(2)
DIM animal10$(2)

LET animal1$(1) = "a"          ! give animals 1, 2 and 3 unique alleles
LET animal1$(2) = "b"          ! as these are the three founders
LET animal2$(1) = "c"
LET animal2$(2) = "d"
LET animal3$(1) = "e"
LET animal3$(2) = "f"

LET auto_cnt = 0

FOR I = 1 TO 1000

    LET animal4$(1) = animal2$(FN_RND_INDEX) ! select individual 4
    LET animal4$(2) = animal1$(FN_RND_INDEX) ! from mother 2 and
    LET animal4$(2) = animal1$(FN_RND_INDEX) ! father 1

    LET animal5$(1) = animal2$(FN_RND_INDEX) ! select individual 5
    LET animal5$(2) = animal1$(FN_RND_INDEX) ! from mother 2 and
    LET animal5$(2) = animal1$(FN_RND_INDEX) ! father 1

    LET animal6$(1) = animal3$(FN_RND_INDEX) ! and so forth...
    LET animal6$(2) = animal1$(FN_RND_INDEX)

    LET animal7$(1) = animal4$(FN_RND_INDEX)
    LET animal7$(2) = animal6$(FN_RND_INDEX)

    LET animal8$(1) = animal4$(FN_RND_INDEX)
    LET animal8$(2) = animal6$(FN_RND_INDEX)

    LET animal9$(1) = animal5$(FN_RND_INDEX)
    LET animal9$(2) = animal6$(FN_RND_INDEX)
```

```
LET animal10$(1) = animal7$(FN_RND_INDEX)
LET animal10$(2) = animal6$(FN_RND_INDEX)

IF animal10$(1)=animal10$(2) THEN auto_cnt = auto_cnt + 1

NEXT I

PRINT "Inbreeding coef. ="; auto_cnt/1000

END
```