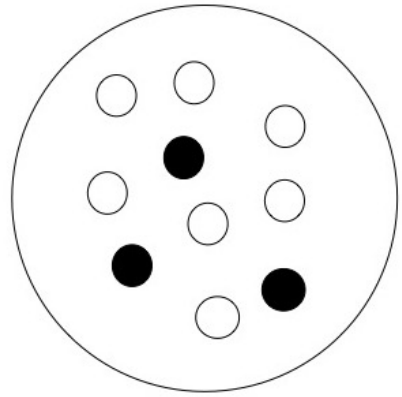
Bean bag genetics

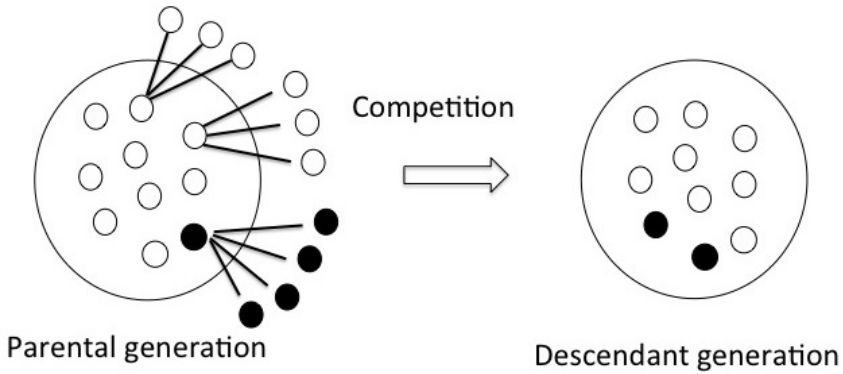
- Evolution is the change in allele frequency in a population.
- We can see alleles as beans in a bag of beans.



Make some bean bag genetics with random genetic drift, selection, and mutation.

Model assumptions

- Parental population of size $n = 8$ with equal initial frequency of A and B (choose a bean type for each allele).
- Offspring production: for each individual, role the dice and assign the number of offspring as given by the dice.
- New parental generation: put all offspring in a bag and randomly sample 8 offspring to form the next generation of adults.
- Repeat the cycle until one allele has been fixed and report the frequencies as a function of time on the sheets.



Evolutionary regimes

- Only random drift. For each adult A and B individual, the number of its offspring are given by rolling the dice and using the realized number. Mean fecundity is

$$\frac{1}{6}(1+2+3+4+5+6) = 3.5$$

- Drift and mutation. Number of A and B offspring are given by the realized dice number. Then, mutation can occur from A to B, but not the reverse. The probability of a mutation is assumed to be $1/2$. Hence, take an A offspring, roll the dice, and if the so-obtained number > 3, replace the A offspring by a B offspring.

Evolutionary regimes

Drift and selection. The number of offspring of a B individual is obtained by rolling the dice and using the realized number. The number of offspring of a B individual is obtained by rolling the dice and shifting the realized number as "1" $\rightarrow$ "2", "2" $\rightarrow$ "3"', "3" $\rightarrow$ "4", "4" $\rightarrow$ "5"etc... The selection coefficient on A for this situation is given by

$$s = \underbrace{\frac{1}{6}(2+3+4+5+6+7)}_{w_{\mathrm{A}}} - \underbrace{\frac{1}{6}(1+2+3+4+5+6)}_{w_{\mathrm{B}}} = 1$$