

BIOL / MATH 2350
Homework assignment 6

In class we talked about the diploid selection model:

$$p(t+1) = p^2(t) \frac{W_{AA}}{\bar{W}} + p(t)q(t) \frac{W_{Aa}}{\bar{W}}$$

$$q(t+1) = q^2(t) \frac{W_{aa}}{\bar{W}} + p(t)q(t) \frac{W_{Aa}}{\bar{W}}$$

where

$$\bar{W} = p^2(t)W_{AA} + 2p(t)q(t)W_{Aa} + q^2(t)W_{aa}$$

Consider the four scenarios that follow. Numerically, use the recursions equations to calculate $p(t)$ and $q(t)$ for 6 generations for scenarios (a) and (c), and for 10 generations for scenarios (b) and (d). Use initial conditions of $p(0) = 0.5$ and $q(0) = 0.5$ for all cases.

(a) Heterozygotes have an advantage in natural selection:

$$W_{AA} = 0.5 \quad W_{Aa} = 1.5 \quad W_{aa} = 0.5$$

(b) Allele A is dominant and has an advantage in natural selection:

$$W_{AA} = 1.5 \quad W_{Aa} = 1.5 \quad W_{aa} = 0.5$$

(c) Allele A is dominant and has a disadvantage in natural selection:

$$W_{AA} = 0.5 \quad W_{Aa} = 0.5 \quad W_{aa} = 1.5$$

(d) Allele a is lethal:

$$W_{AA} = 1.5 \quad W_{Aa} = 1.5 \quad W_{aa} = 0$$

Describe the dynamics verbally, and what they predict about evolution under these scenarios.