Homework 4: Life History Evolution

1. Mutation Accumulation

In class we simulated the evolution of antagonistic-plieotropic alleles that have fitness benefits and young ages and deleterious effects at older ages. A non-mutually exclusive explanation for the evolution of senescence is that deleterious mutations are under less selection at older ages and hence obtain higher frequencies.

A. Propose a model of mutation-selection balance in a non-age structured population. Consider a life cycle of Census->Mutation->Selection->Reproduction. Assume that the mutation is deleterious

$$W_{AA} = (1-2s), W_{Aa} = (1-2s), \text{ and } W_{aa} = 1$$

What is the equilibrium allele frequency of the mutation and how does it depend on s?

B. Propose a model of mutation-selection balance in an age-structured population. Suppose that in the absence of mutation increases death rate

$$d_{AA} = d_0(1-2s), d_{Aa} = d_0(1-s) \text{ and } d_{aa}(a) = d_0$$

C. Numerically calculate the equilibrium frequency of the deleterious mutation. Make a plot that shows how the equilibrium frequency of the allele changes with age and with s.