Solution to An Introduction to Population Genetics Theory

Author:
James F. Crow
Motoo Kimura

Solution by
Hanbin Lee

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Chapter 1

Models of Population Growth

Problem 1.0.1. *In a population with discrete generations and with fitness w, how many generations are required to double the population number?*

Proof. By the definition of fitness in discrete generations, w is given by $w = \frac{N_{i+1}}{N_i}$. This gives $N_i = w^i N_0$. Since $N_i = 2N_0$ by the given condition, $i = \log 2 / \log w$. □

Problem 1.0.2. *How long is required for the population to double with model 2?*

Proof. By the definition of fitness in continuous generations, w is given by $w = \frac{1}{N}\frac{dN}{dt}$. This gives $\frac{1}{N}dN = wdt$ followed by $\int_{N_0}^{N} \frac{1}{N}dN = \int_{t_0}^{t} wdt$. Therefore, $\log 2 = \log \frac{N}{N_0} = w(t - t_0)$. □