S4 Model: Mitosis

In this scenario, we add mitosis to the life-cycle. Mitosis mimics the continual turnover of mitochondria that occurs within a cell. (Mitochondria form interconnected networks that continually undergo fission/fusion.) We examine how the model behaves when mitosis is inserted before selection and when it is inserted after selection. To model mitosis, we sample \( n \) mitochondria with replacement from a cell that contains \( i \) mutant (out of \( n \)) mitochondria. We denote the probability of sampling \( \hat{i} \) mutant mitochondria with replacement from a cell with \( i \) mutant mitochondria as \( X(\hat{i} ; n, i / n) \). When mitosis occurs before selection, the post-mitosis population is determined by

\[
P(M^{\text{mit}} = (\hat{i}, U_1 B_2)) = \sum_{i=0}^{n} X(\hat{i} ; n, i / n) P(M^{\text{mit}} = (i, U_1 B_2)).
\]

When mitosis occurs after selection, the post-mitosis population is given by

\[
P(M^{\text{mit}} = (\hat{i}, U_1 B_2)) = \sum_{i=0}^{n} X(\hat{i} ; n, i / n) P(M^{\text{mit}} = (i, U_1 B_2)).
\]