1 Notation

$\mathcal{T}$ Phylogeny with migration history

d Number of distinct demes

Λ Migration matrix $\Lambda = [\Lambda_{ij}]_{i,j=1}^{d}$ such that $\Lambda = \lambda_{i \to j}$ is the migration rate from deme i into deme j backwards in time. Note that self-migrations are forbidden, i.e. $\lambda_{ii} = 0 \; \forall i = 1, 2, \ldots, d$.

θ Effective population vector such that θ_i is the effective population in deme i

g Mean generation length for individuals in the overall population ($g > 0$)

2 Structured Coalescent Likelihood

(Based on Ewing et al. (2004))

$$L_{n,d}(\mathcal{T}) = \prod_{i=1}^{d} \prod_{\substack{j=1 \\ j \neq i}}^{d} \frac{1}{\theta_i^{c_i}} \lambda_{ij}^{m_{ij}} \prod_{r=2}^{2n+M-1} \exp\left\{ -\left(\frac{k_{ir}(k_{ir}-1)}{2\theta_i} + k_{ir}\lambda_{ij} \right) (t_{r-1} - t_r) \right\} \quad (1)$$

3 MCMC

Fix a structured coalescent phylogeny and the evolutionary parameters (migration matrix, effective populations). Construct a MCMC algorithm inspired by Ewing et al. (2004) with the following three types of proposal move

1. Migration Birth/Death Move
2. Migration Pair Birth/Death Move
3. Coalescent Node Split/Merge Move

which obtain irreducibility over the space of migration histories on a fixed phylogeny with fixed evolutionary parameters.

3.1 Migration Birth/Death Move

The migration birth/death move aims to add or remove a single migration node from the migration history, reassigning demes as necessary to maintain a consistent