The Space of Discrete Coalescent Trees

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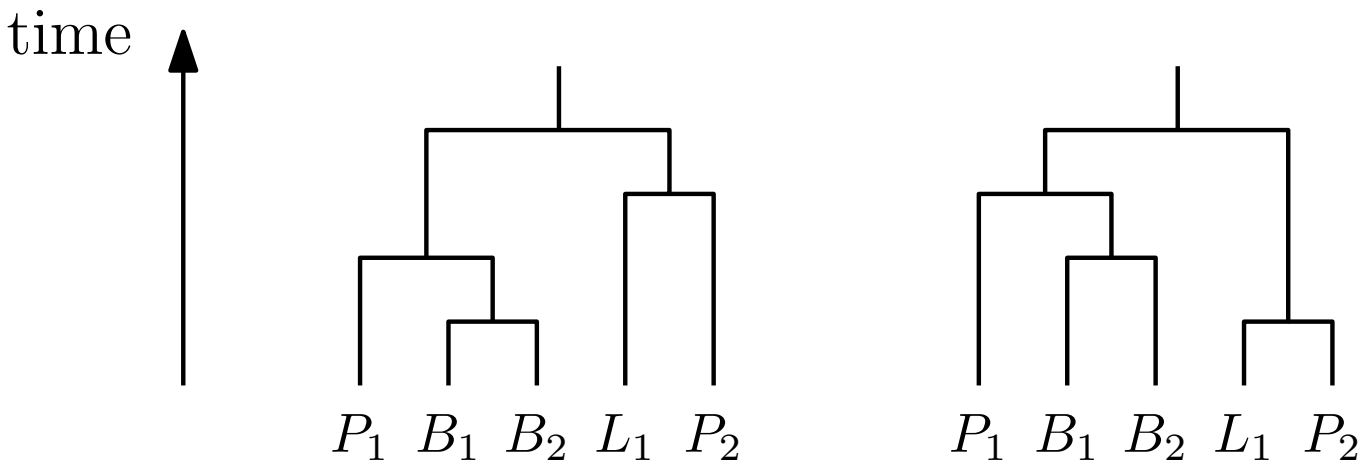
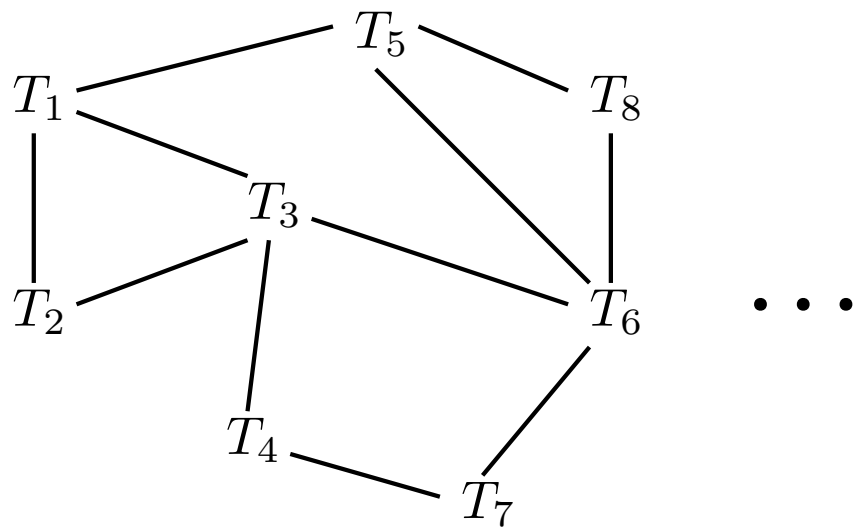
Time-trees



- B: Brain
- P: Pancreas
- L: Lungs

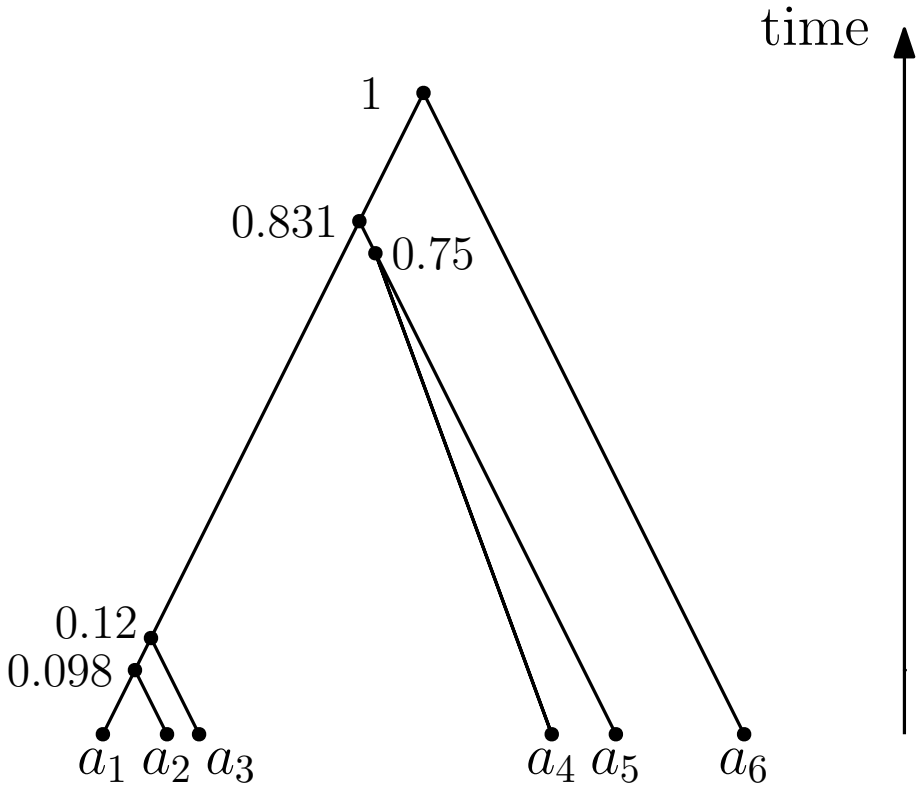
Tree Spaces



- Similarity measure for proposing trees
- Summarising trees
- ...

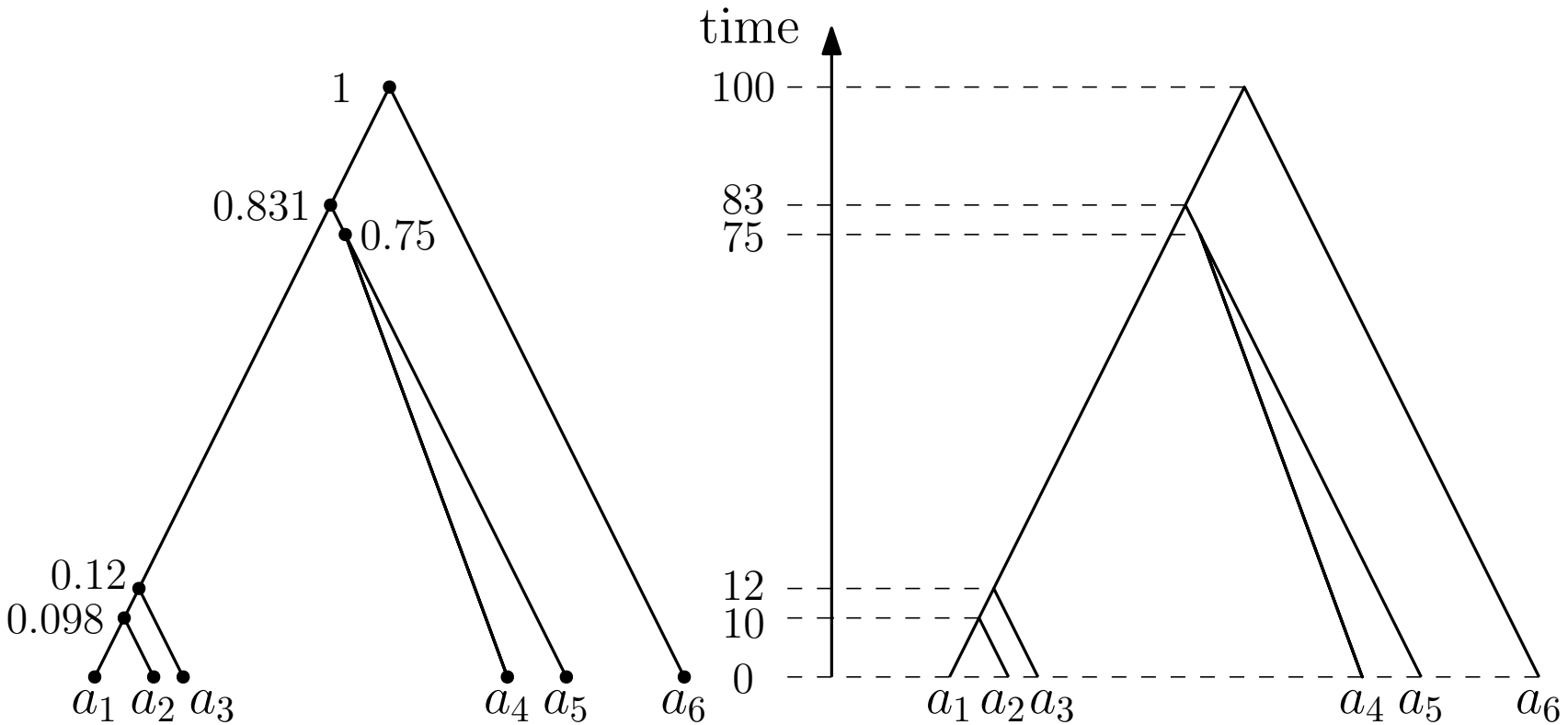
$\Rightarrow$ Tree re-arrangement operations (NNI, SPR, TBR)

Discretising Time Trees



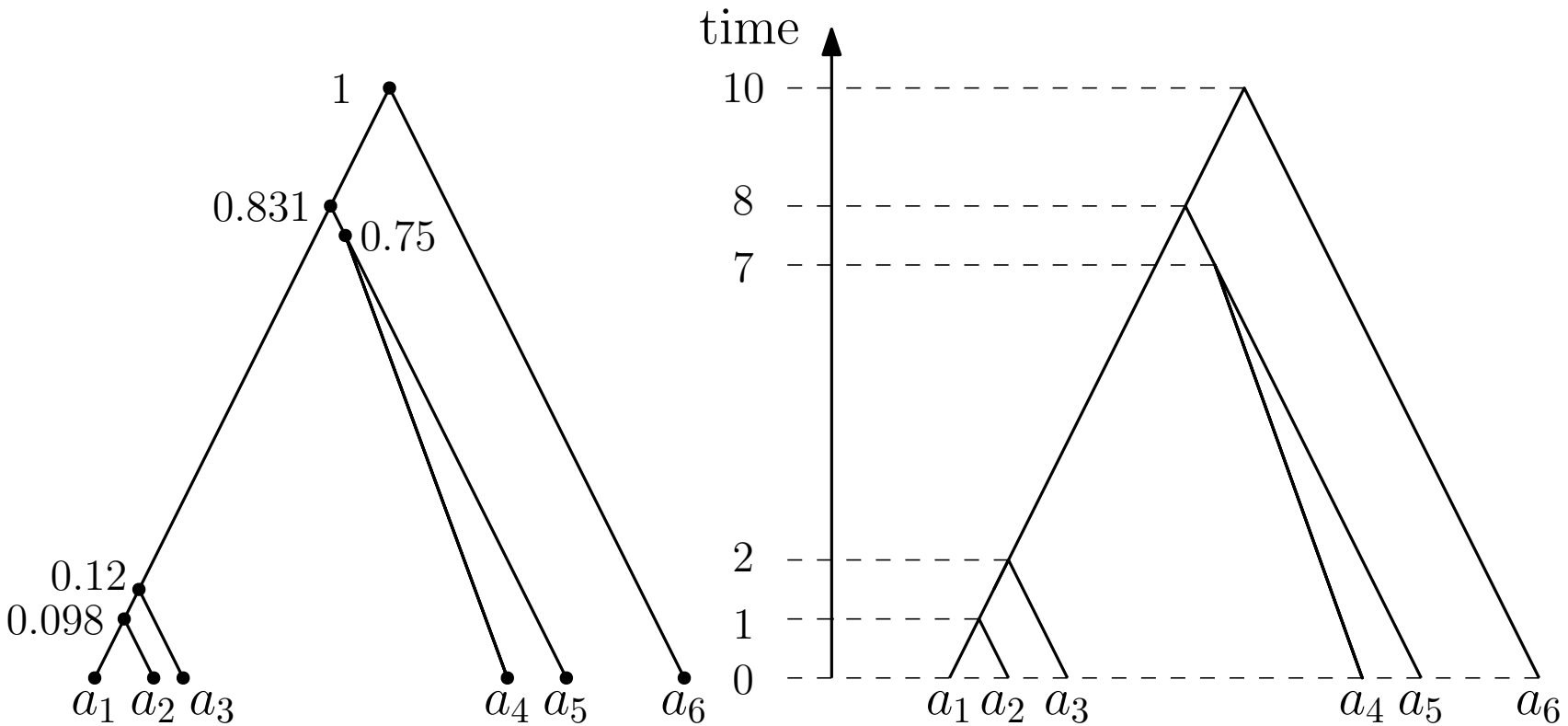
Discretising Time Trees

Discrete Coalescent Trees



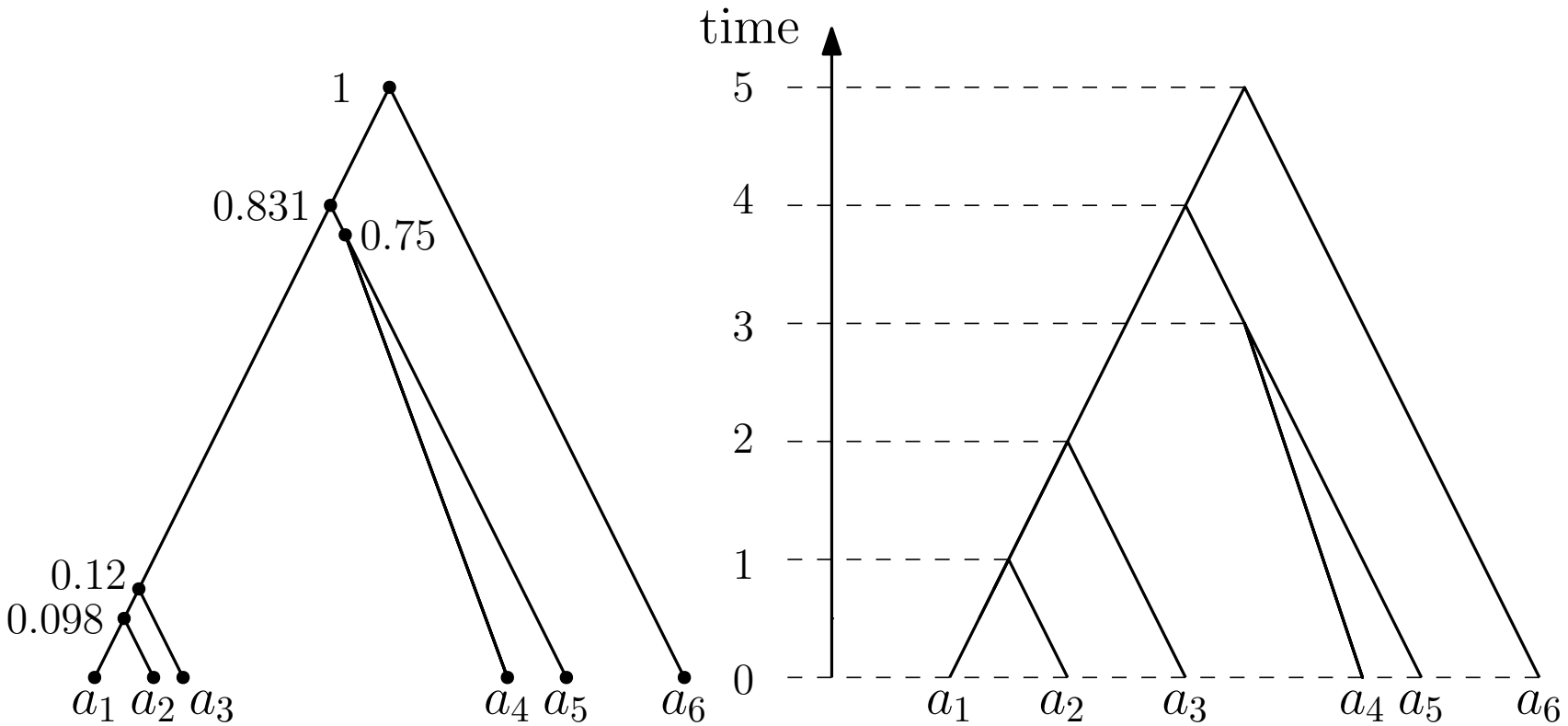
Discretising Time Trees

Discrete Coalescent Trees

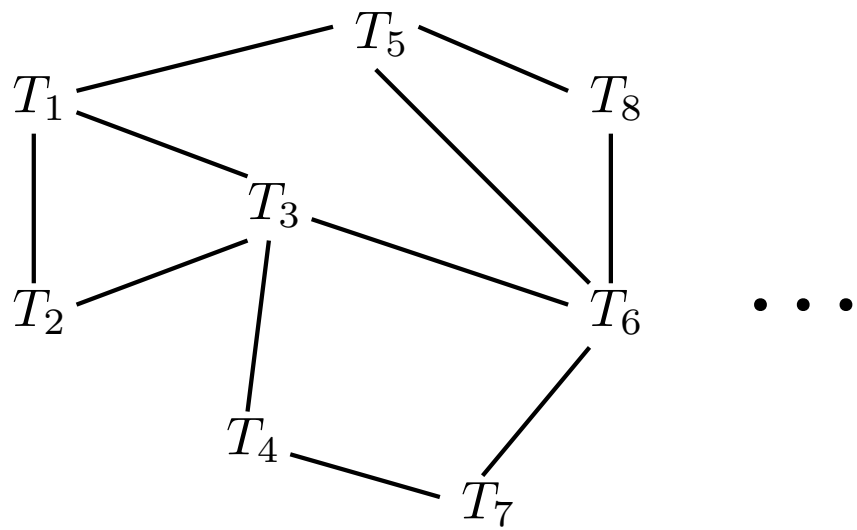


Discretising Time Trees

Ranked trees



DCT

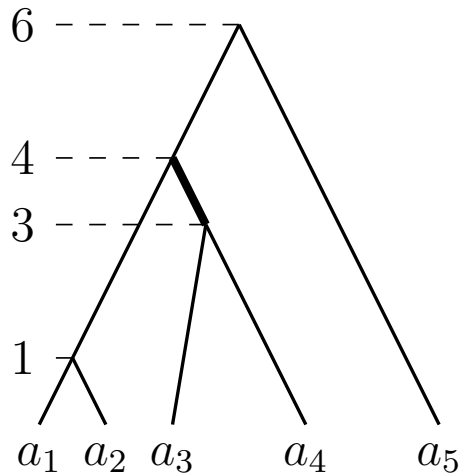


Three tree re-arrangement operations:

- NNI moves
- rank moves
- length moves

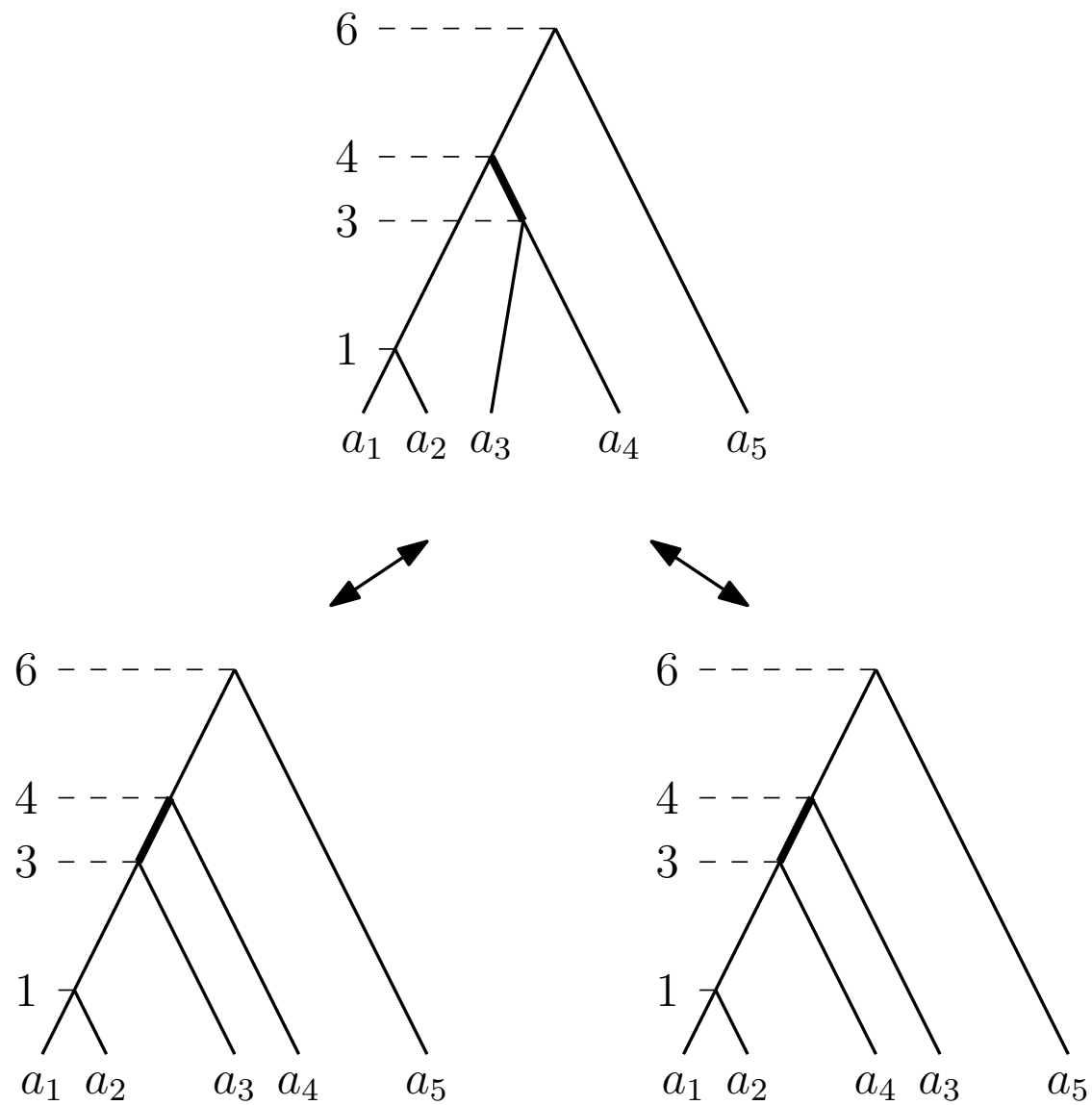
DCT

NNI Move



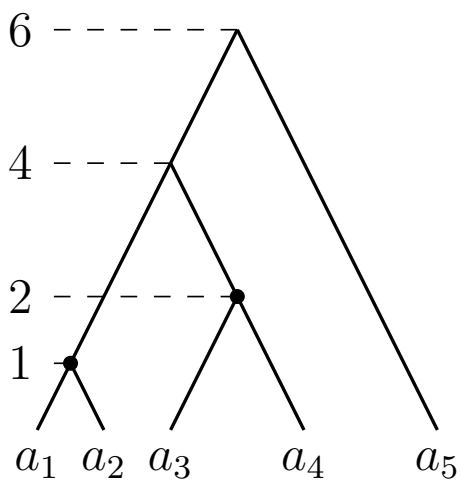
DCT

NNI Move



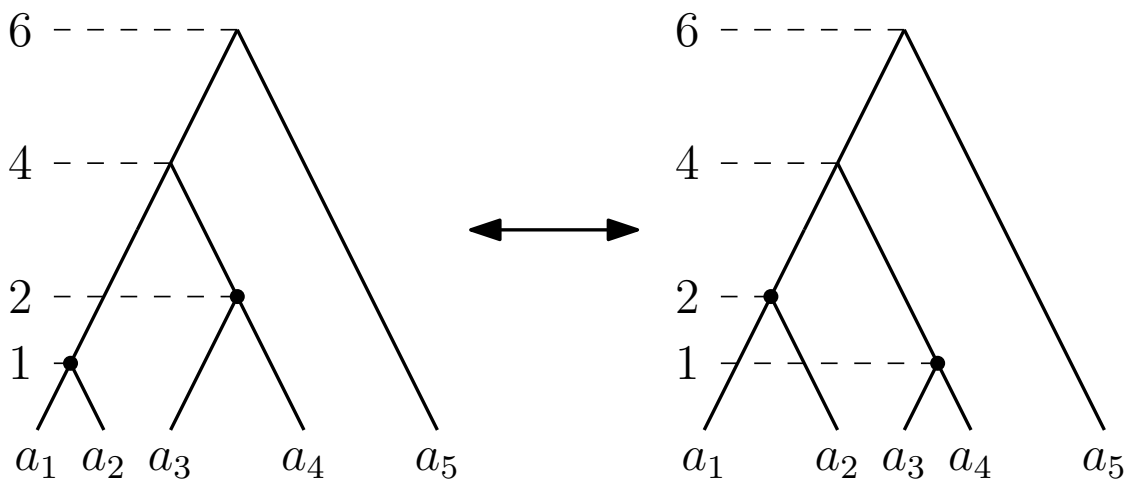
DCT

Rank Move



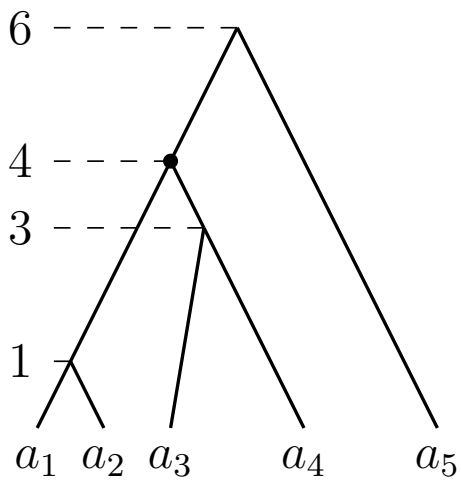
DCT

Rank Move



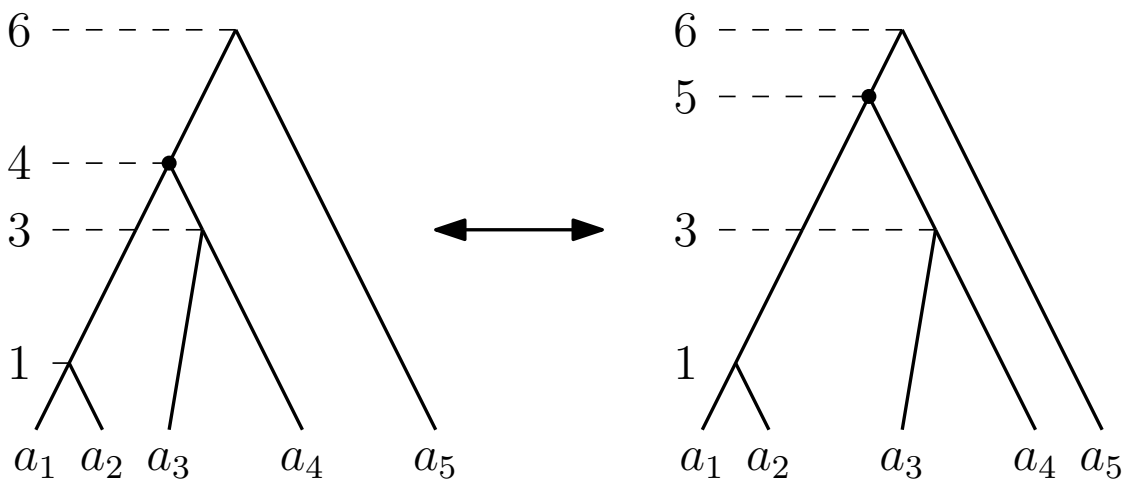
DCT

Length Move

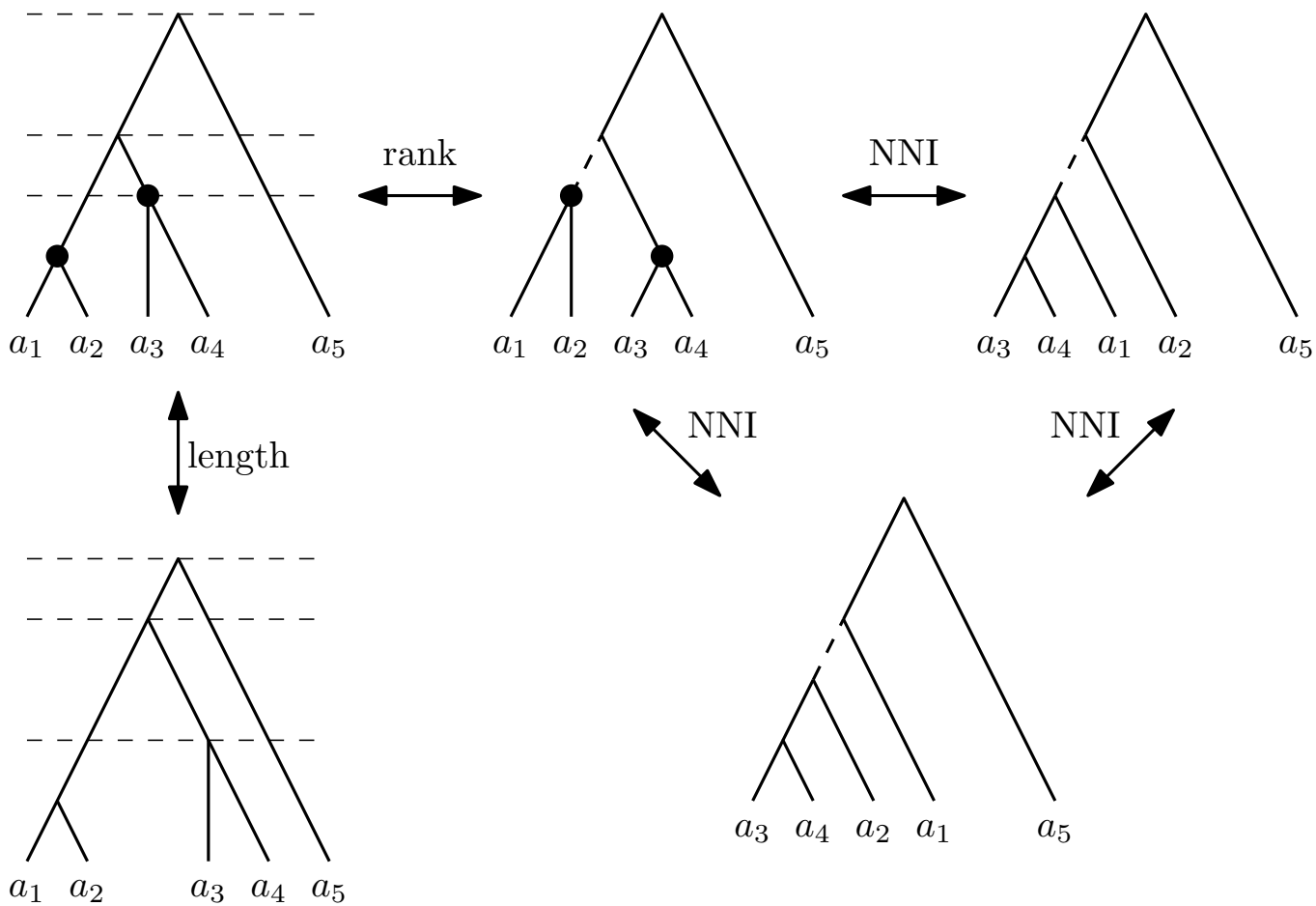


DCT

Length Move



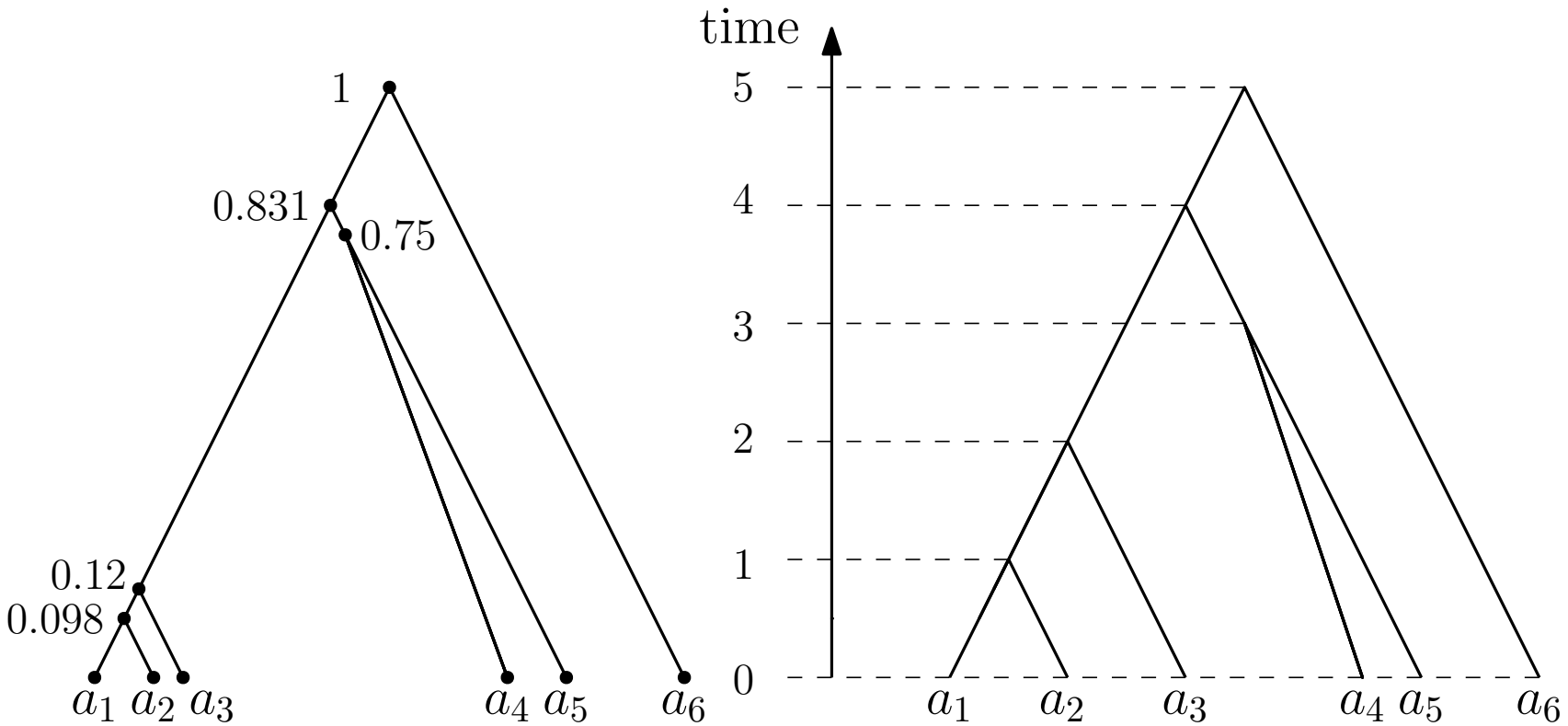
DCT_m



Parameters: n = number of leaves, m = max root time

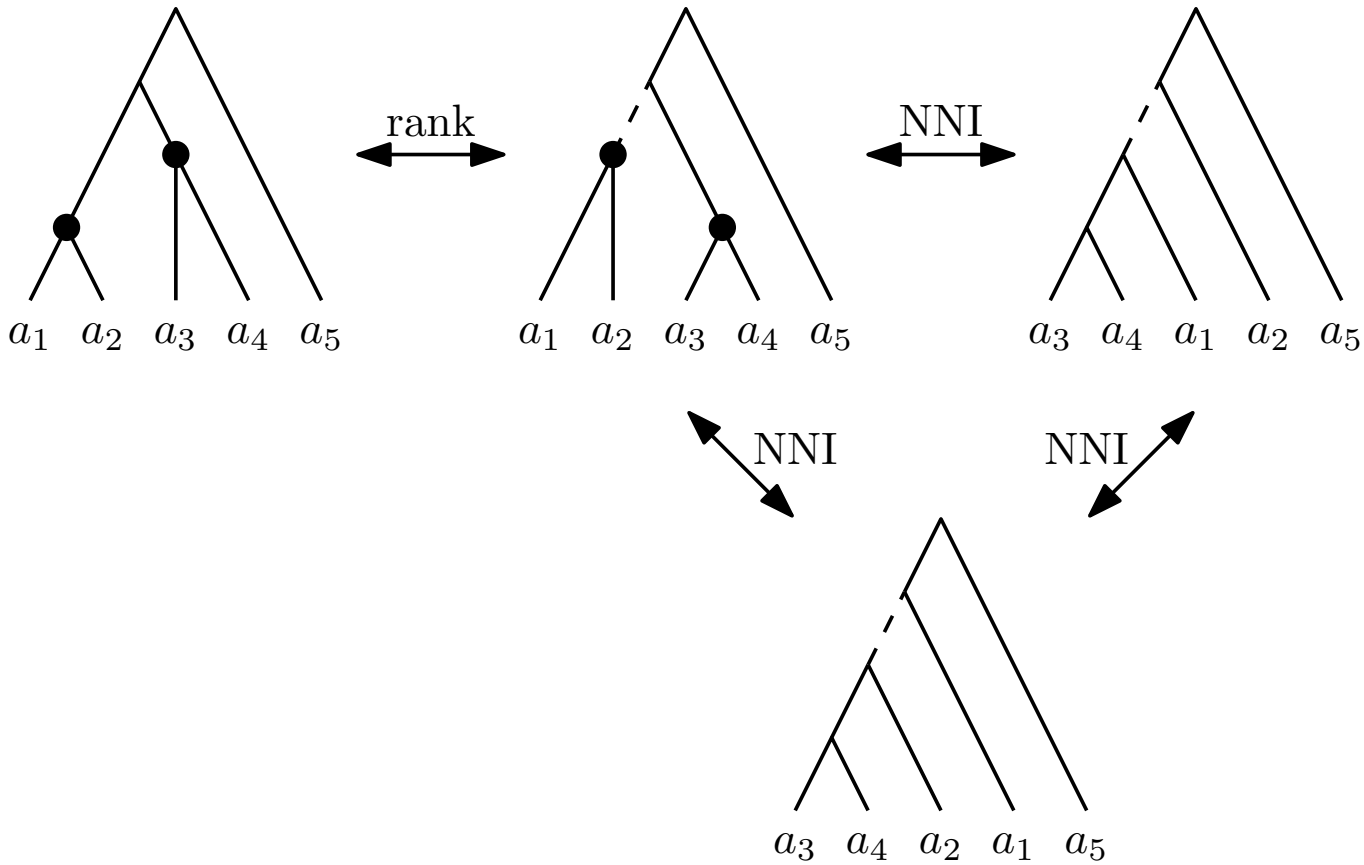
DCT_m

Special case: $m = n - 1$



DCT_{n-1}

RNNI



Computing shortest paths

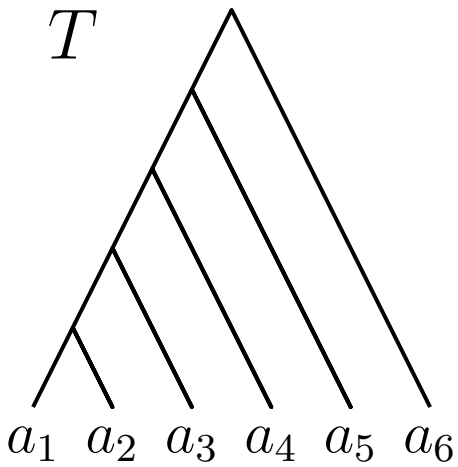
RNNI

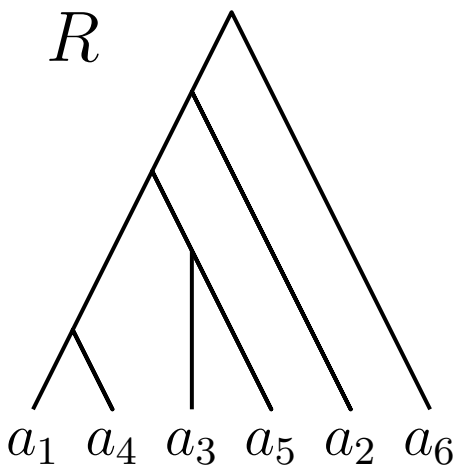
Theorem

The algorithm FindPath *computes shortest paths in* RNNI *in time* $\mathcal{O}(n^2)$.

FindPath

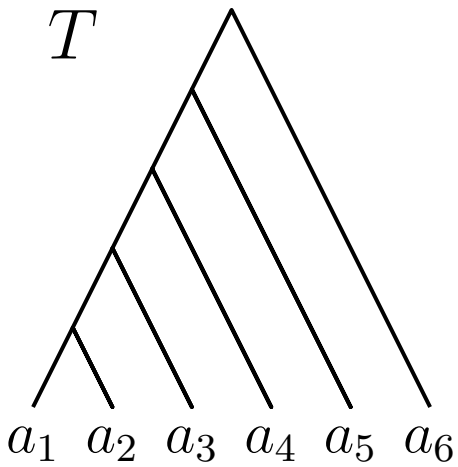
RNNI

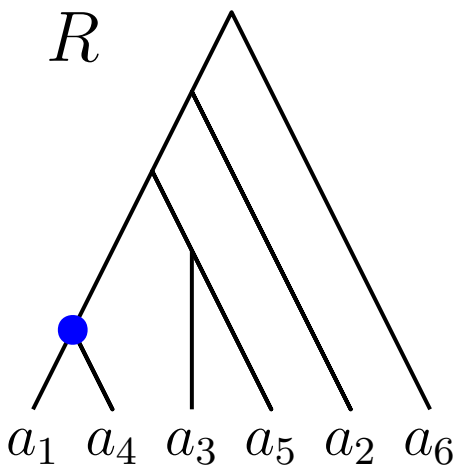




FindPath

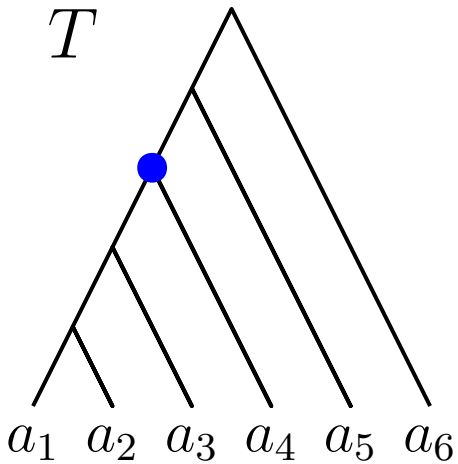
RNNI

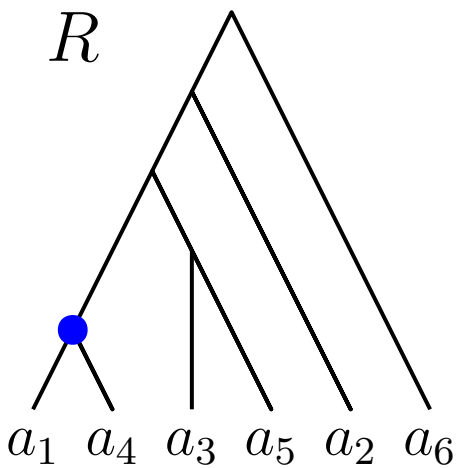




FindPath

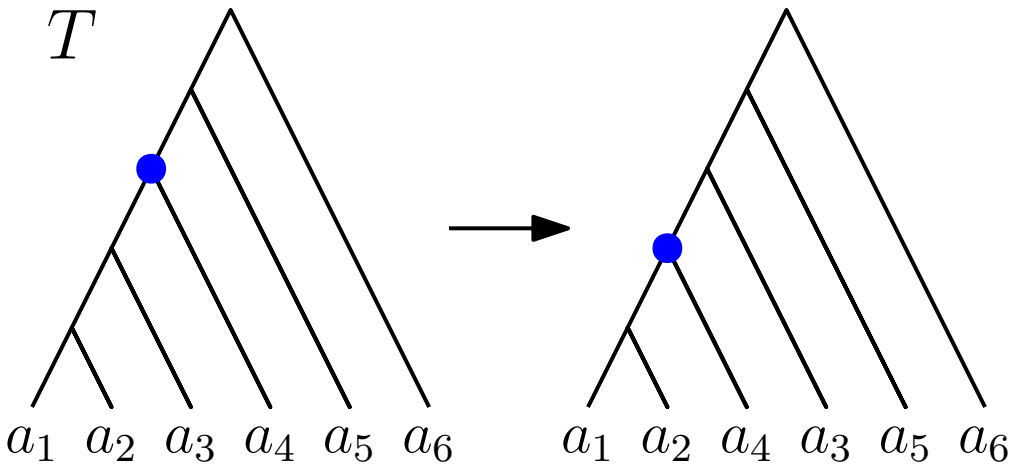
RNNI

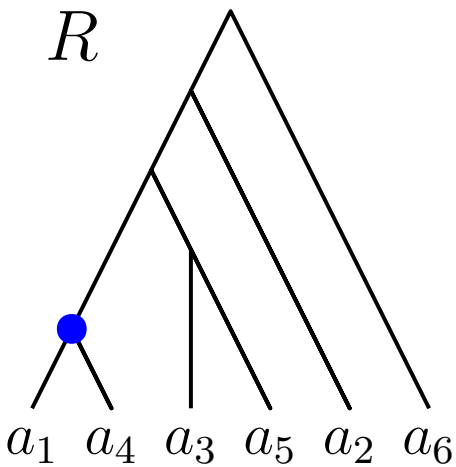




FindPath

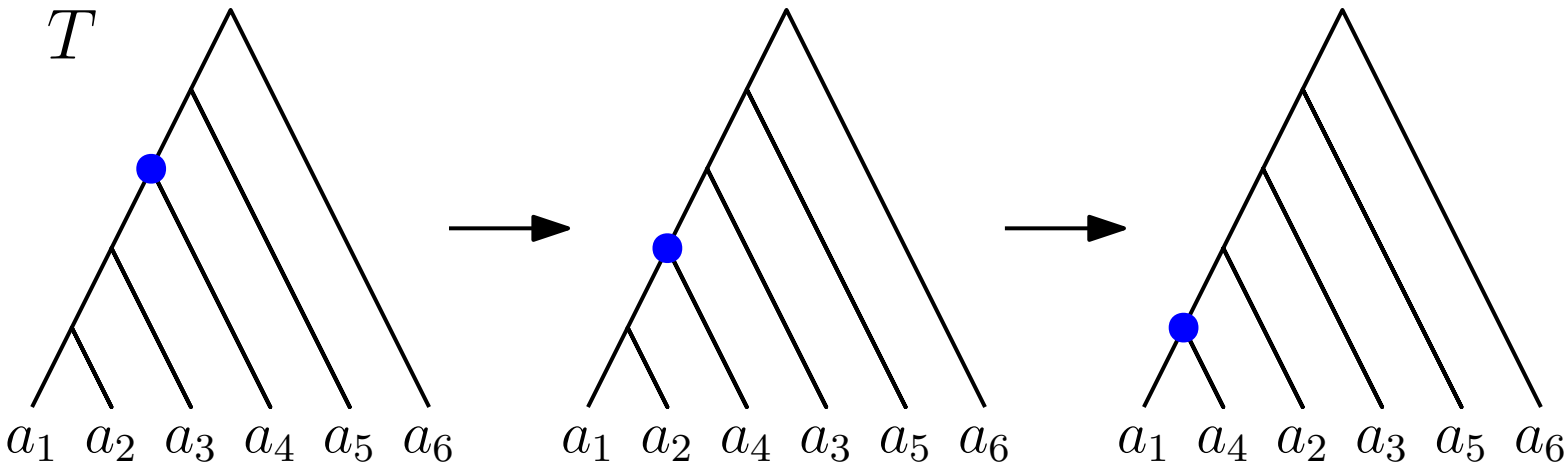
RNNI

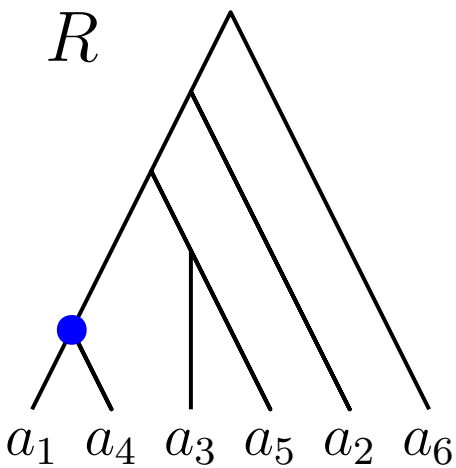




FindPath

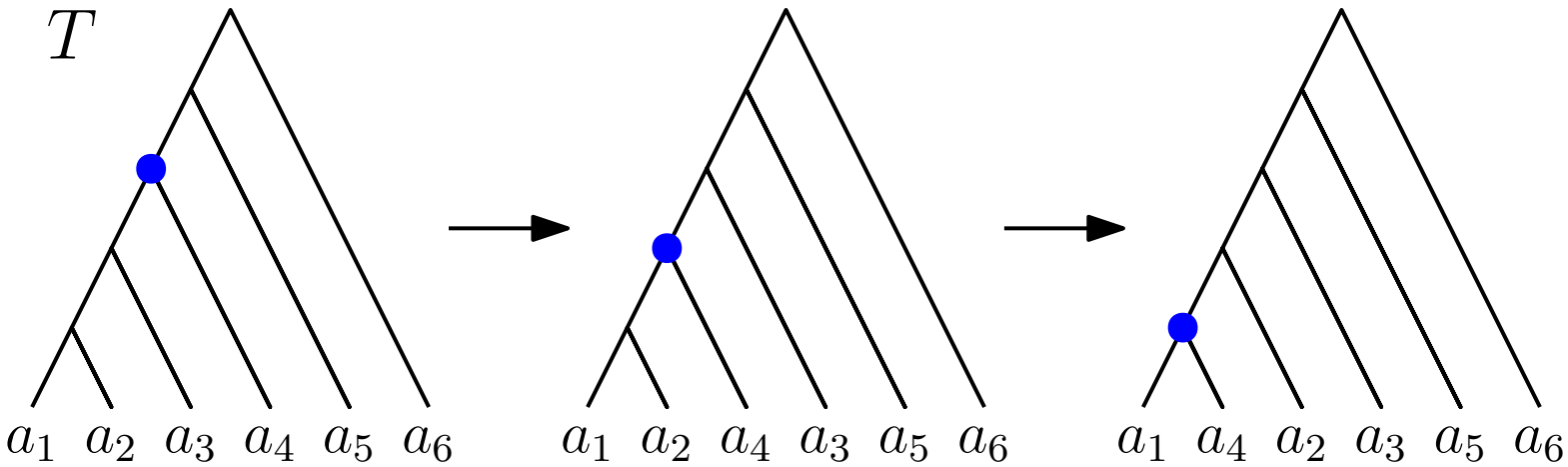
RNNI

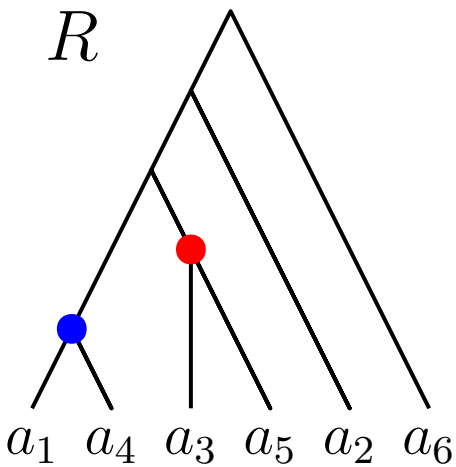




FindPath

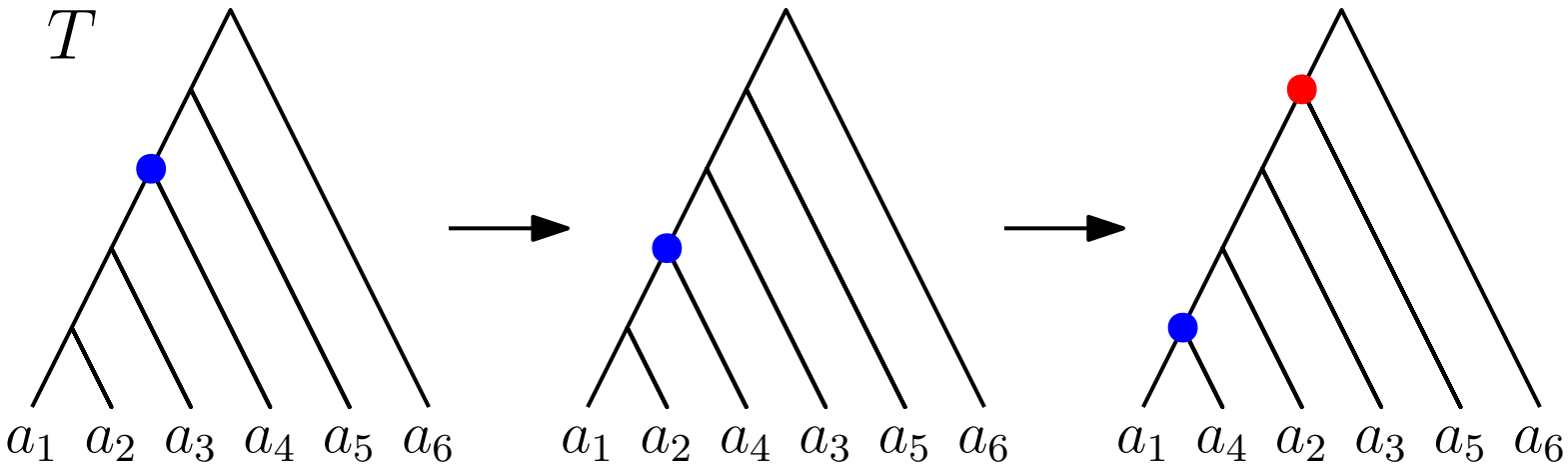
RNNI

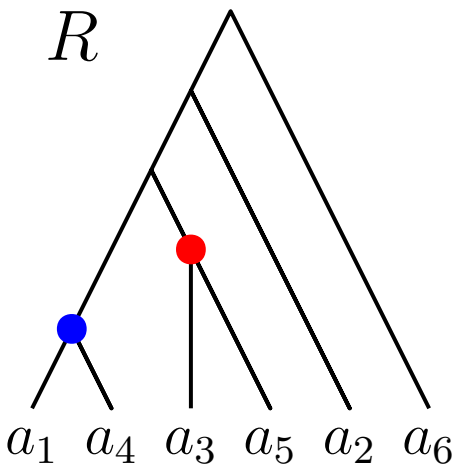




FindPath

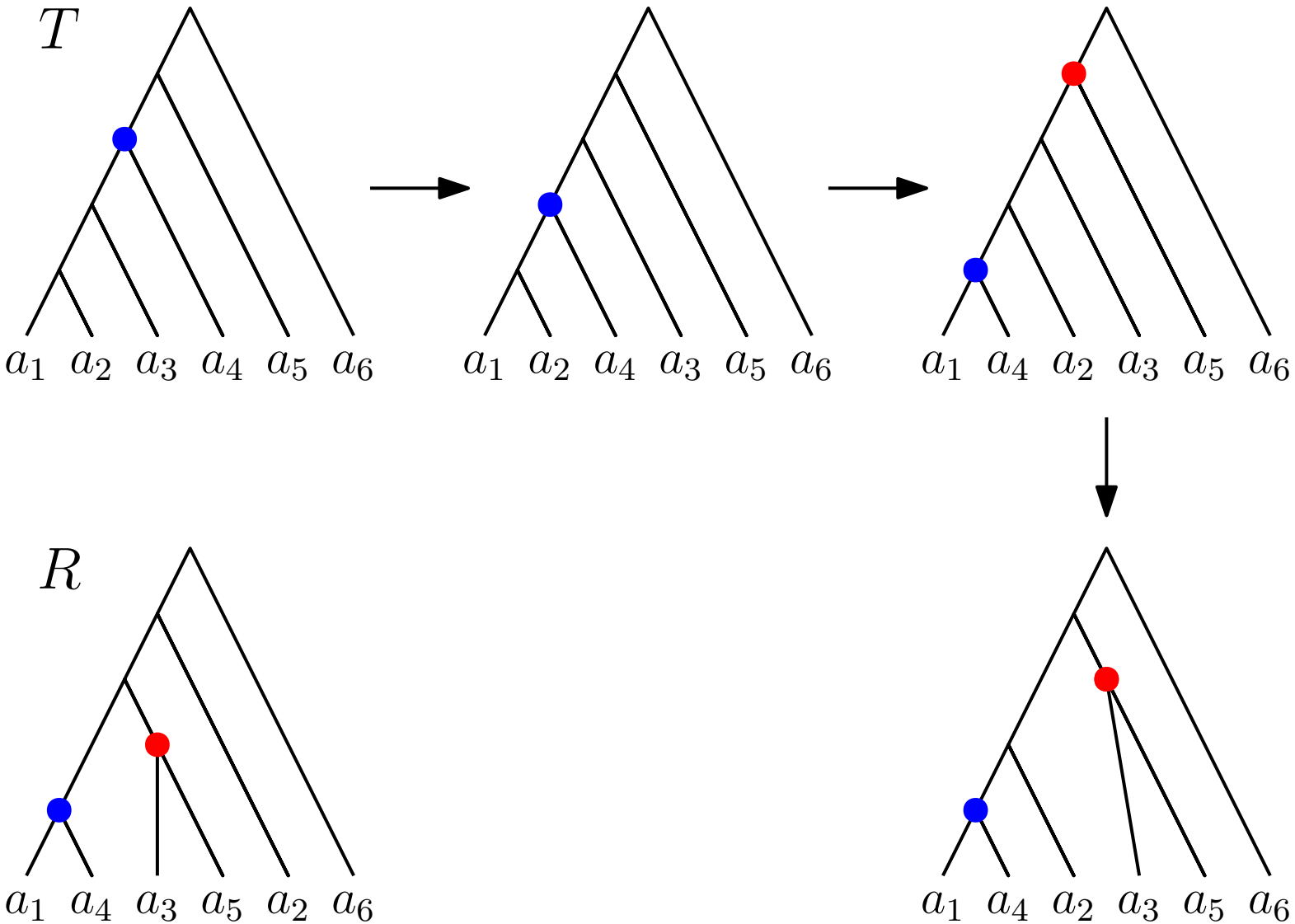
RNNI





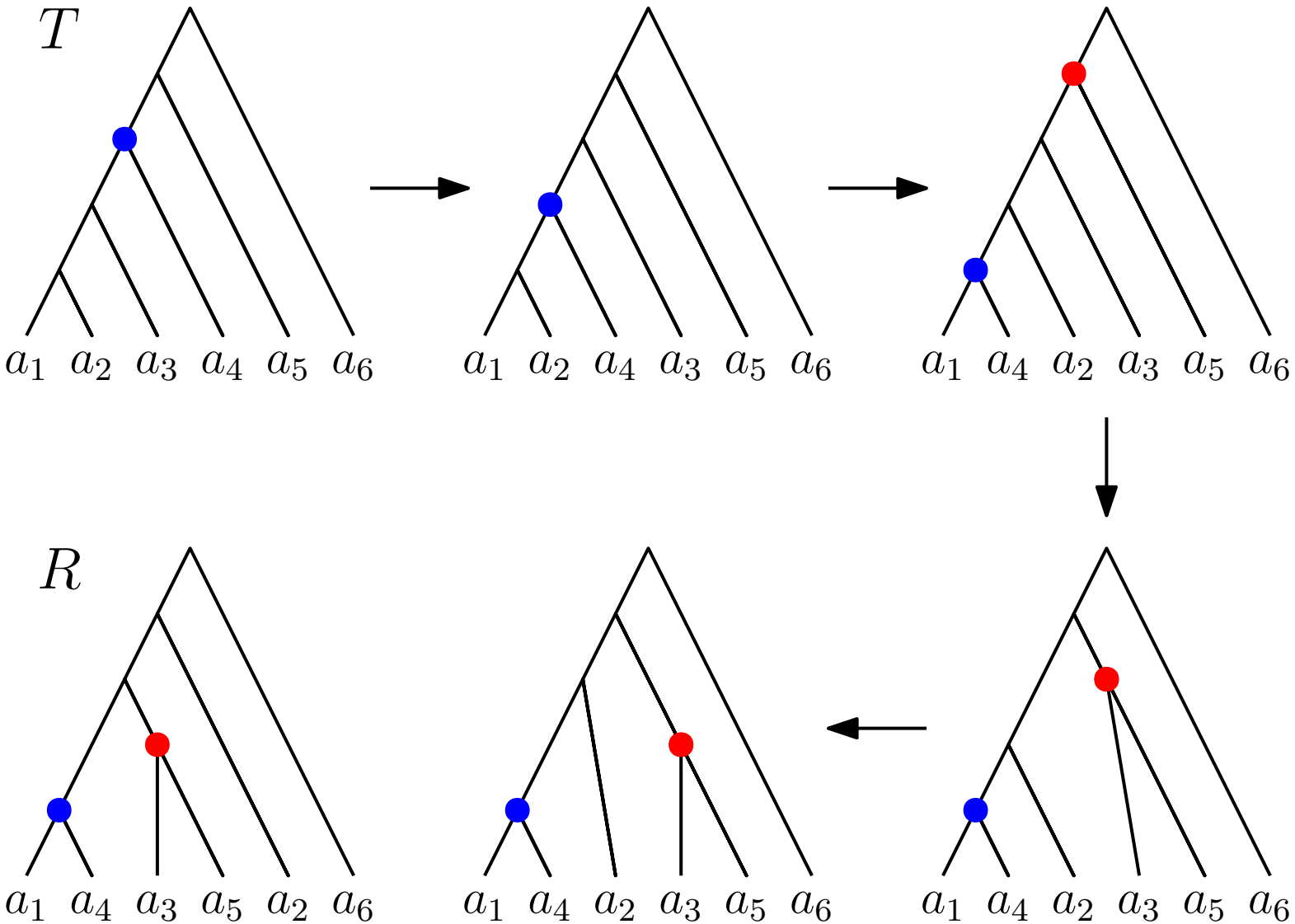
FindPath

RNNI



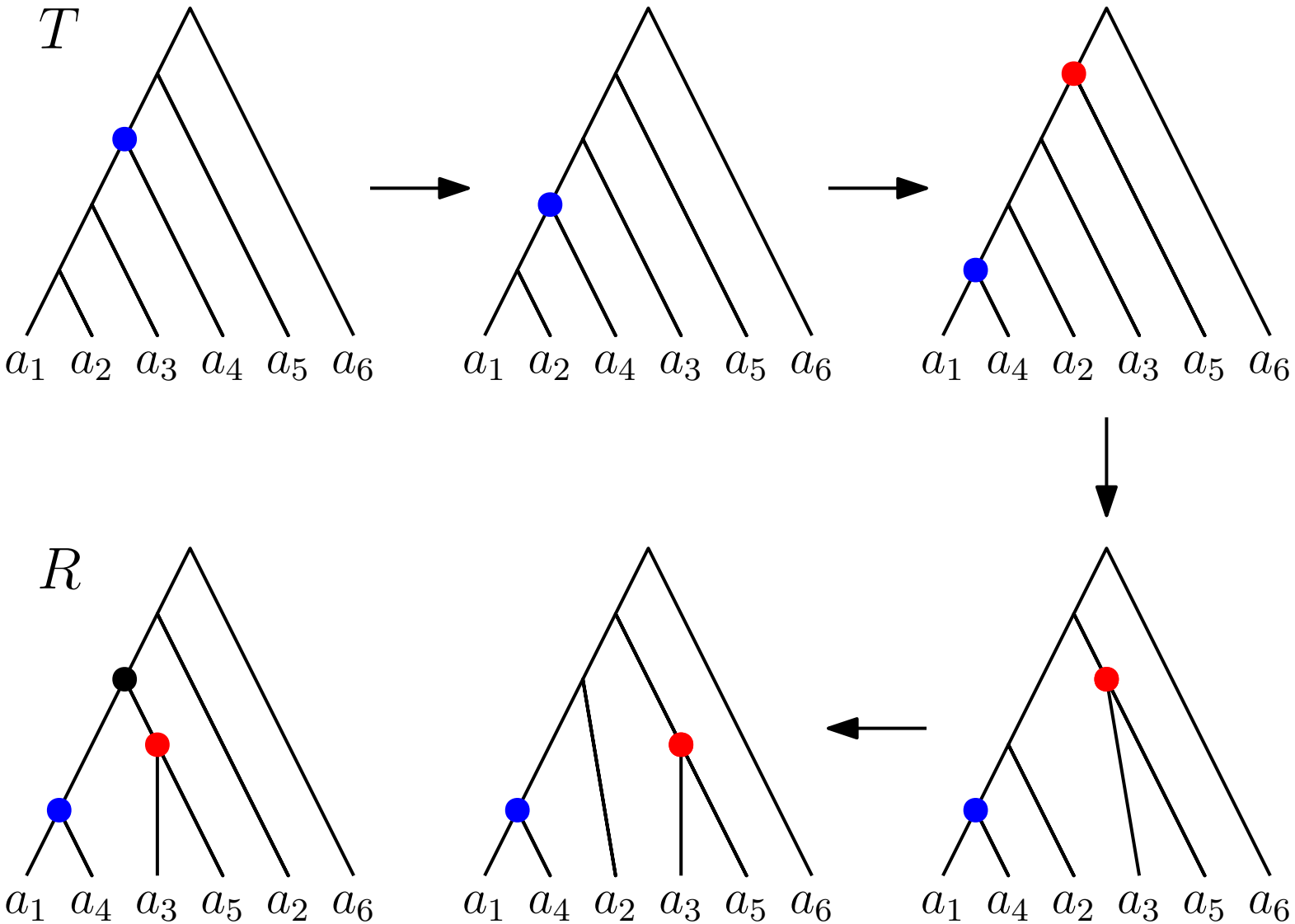
FindPath

RNNI



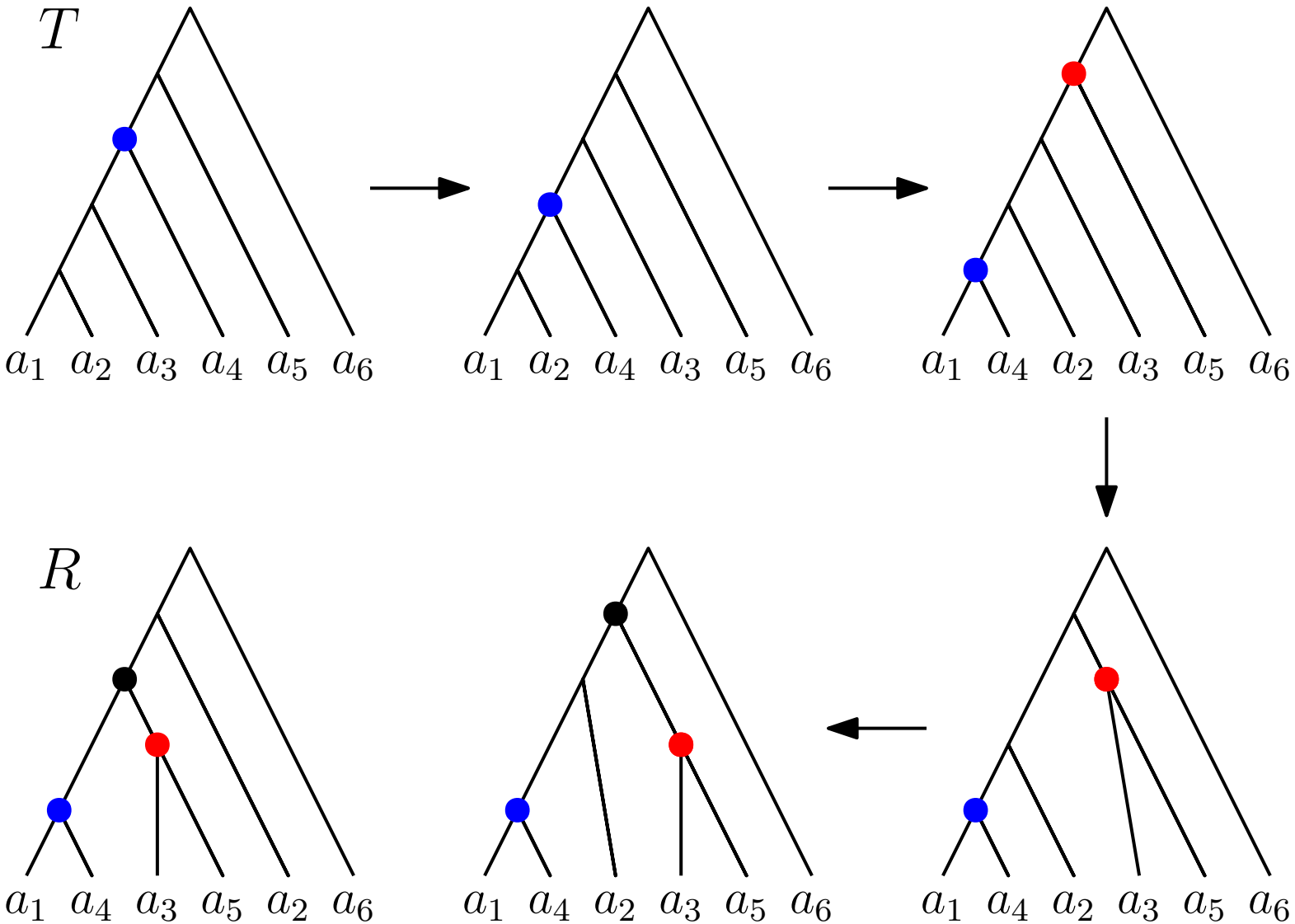
FindPath

RNNI



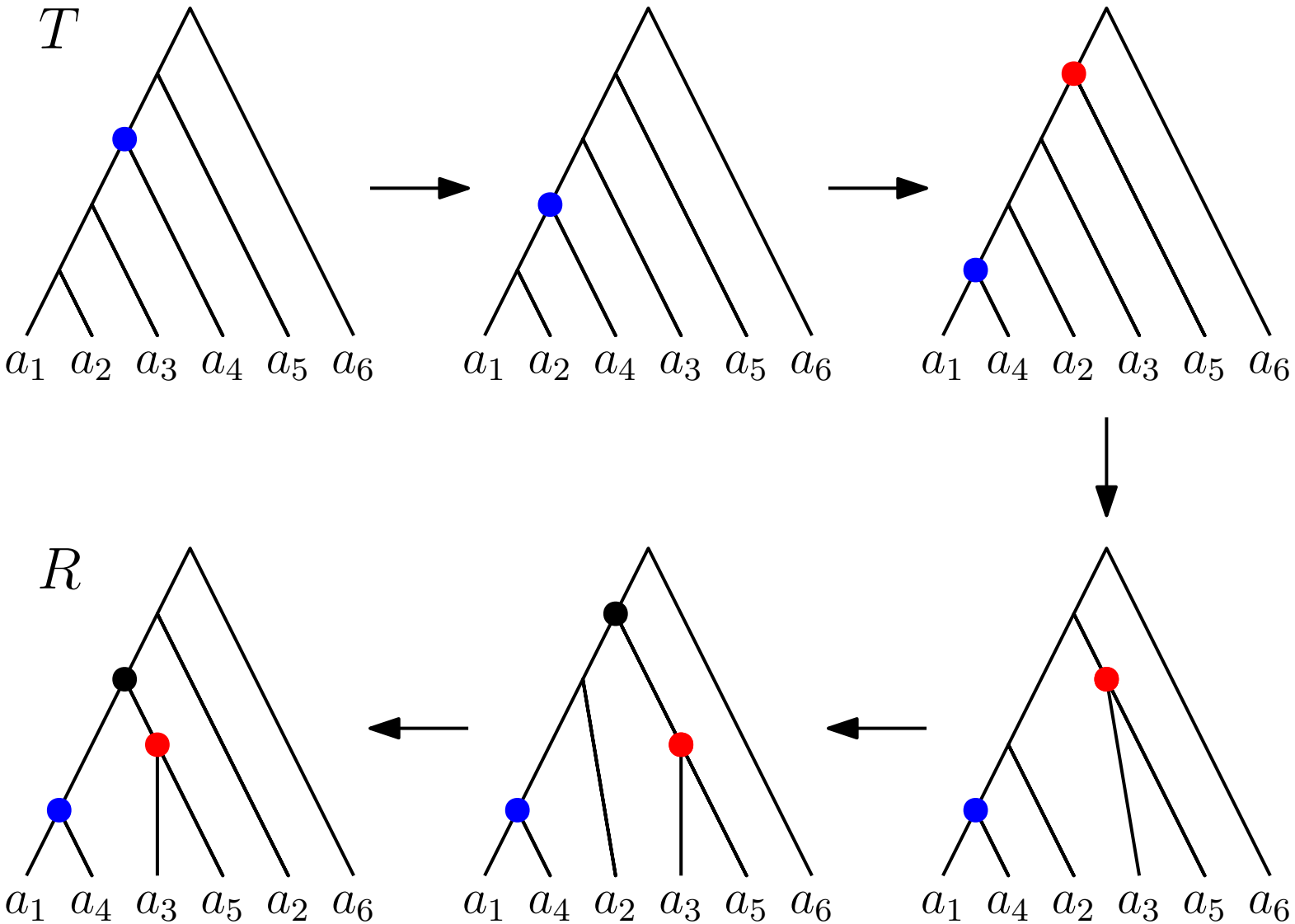
FindPath

RNNI

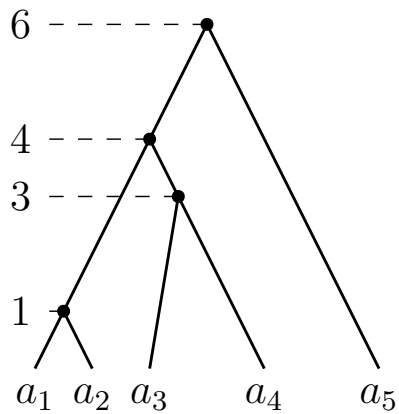


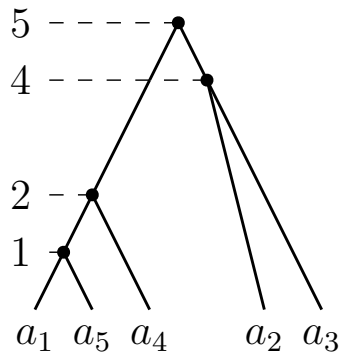
FindPath

RNNI



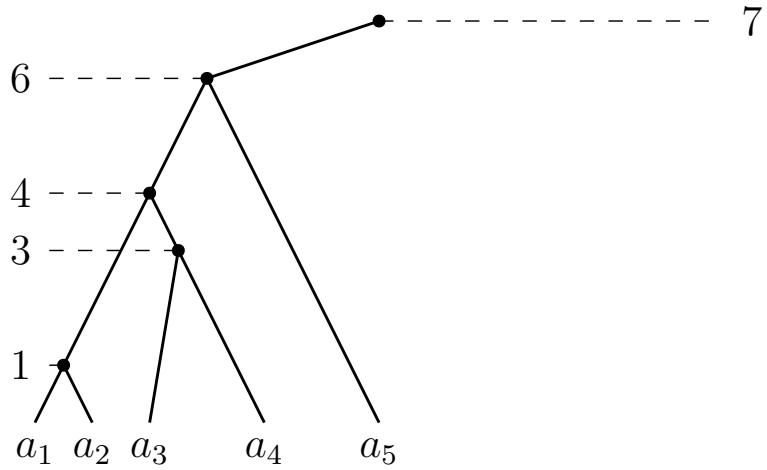
FindPath in DCT_m

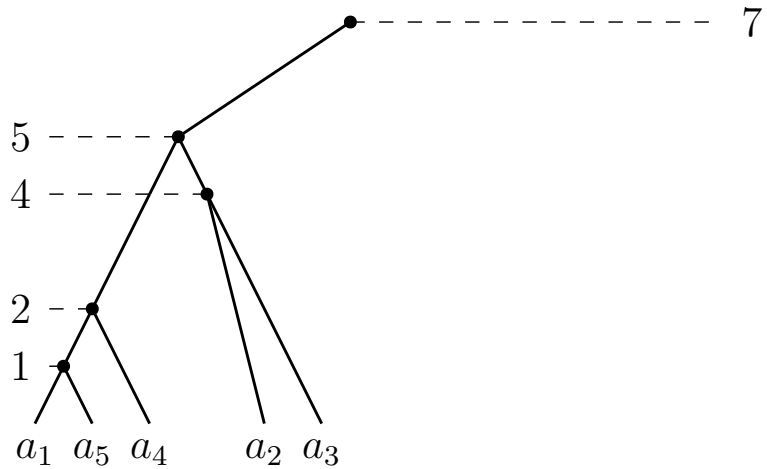




$\Rightarrow m = 6$

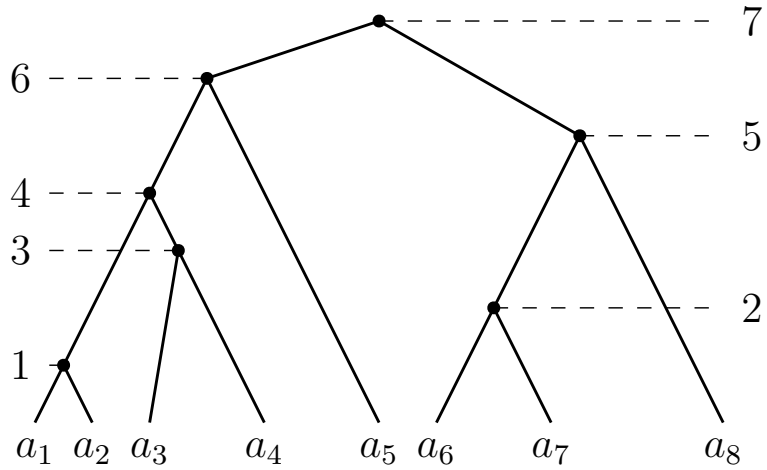
FindPath in DCT_m

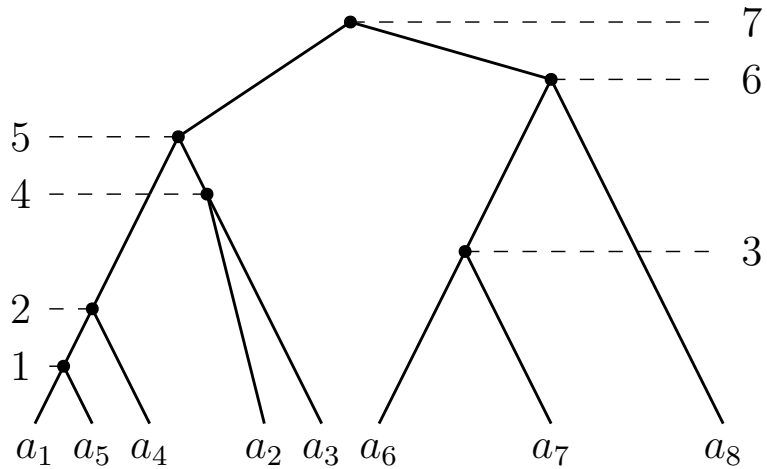




$\Rightarrow m = 6$

FindPath in DCT_m

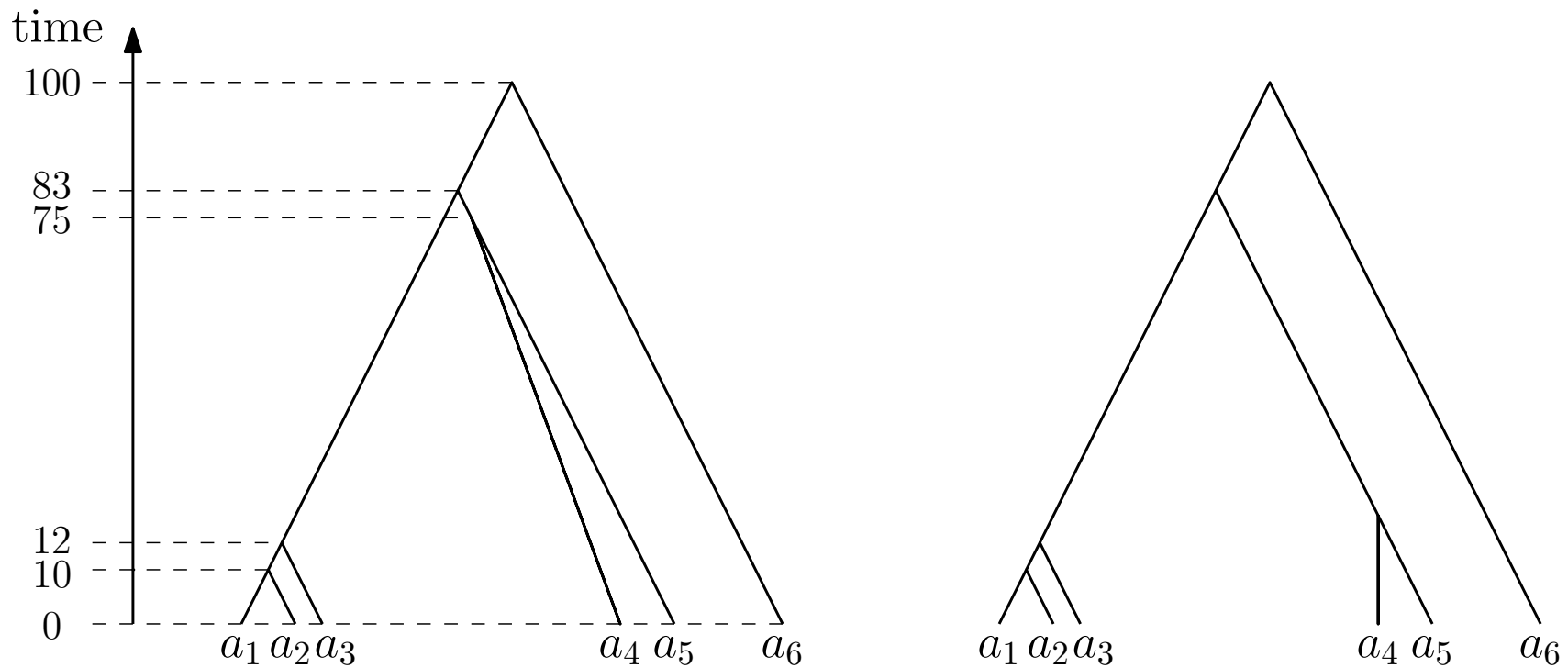




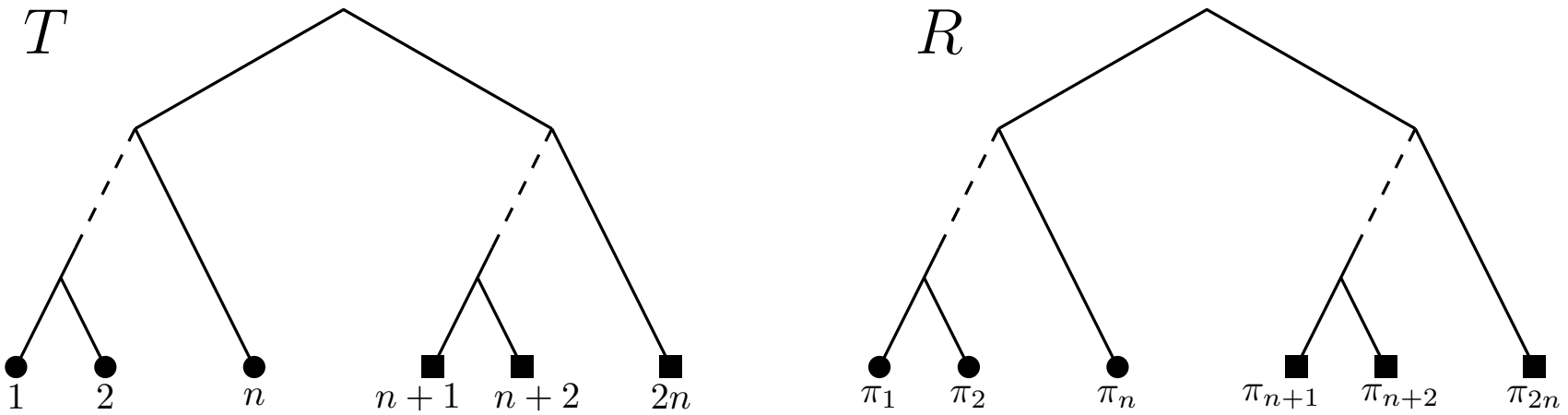
$\Rightarrow m = 6$

FindPath

A note on scalability



Cluster Property

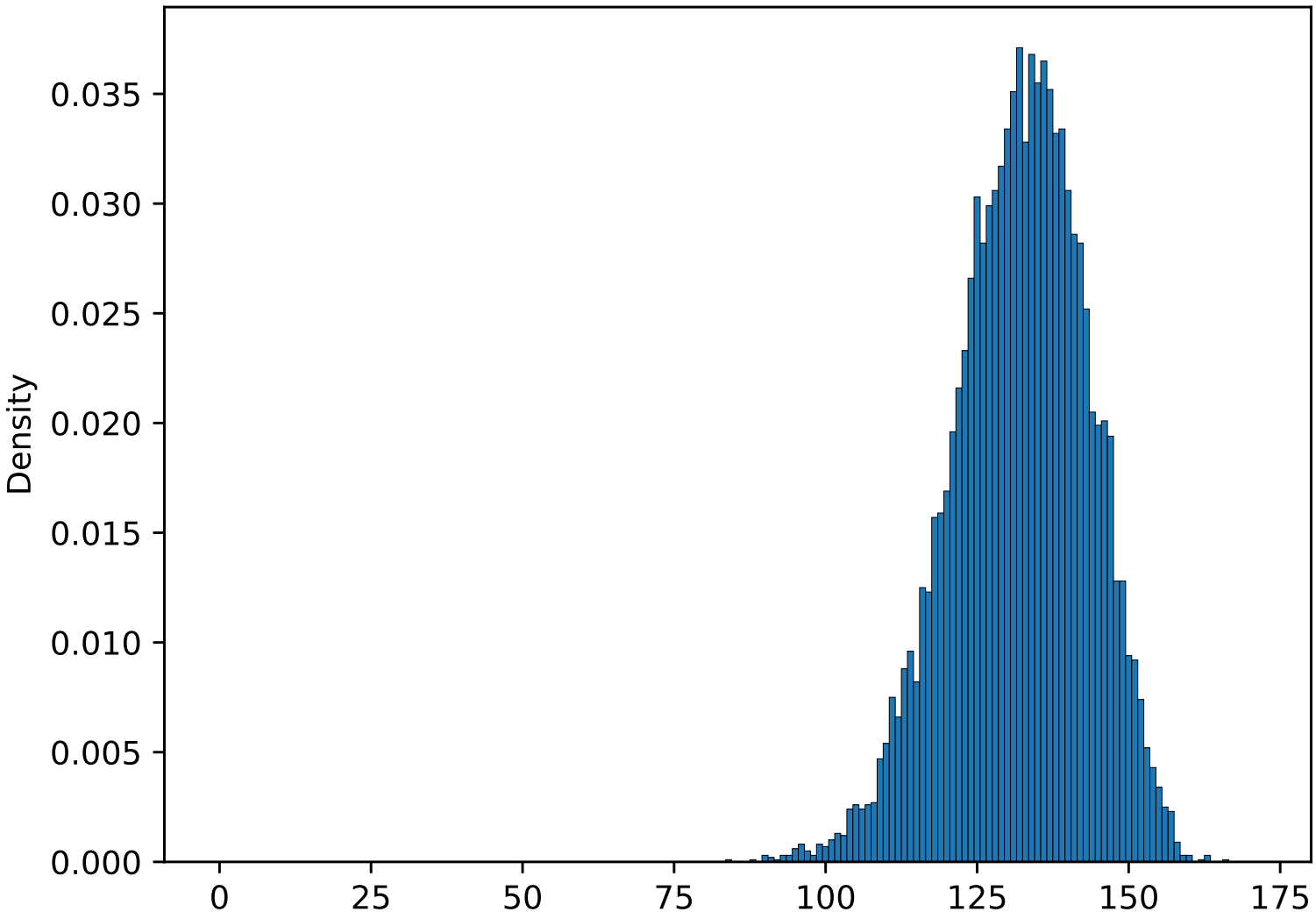


Theorem

DCT_m *has the cluster property.*

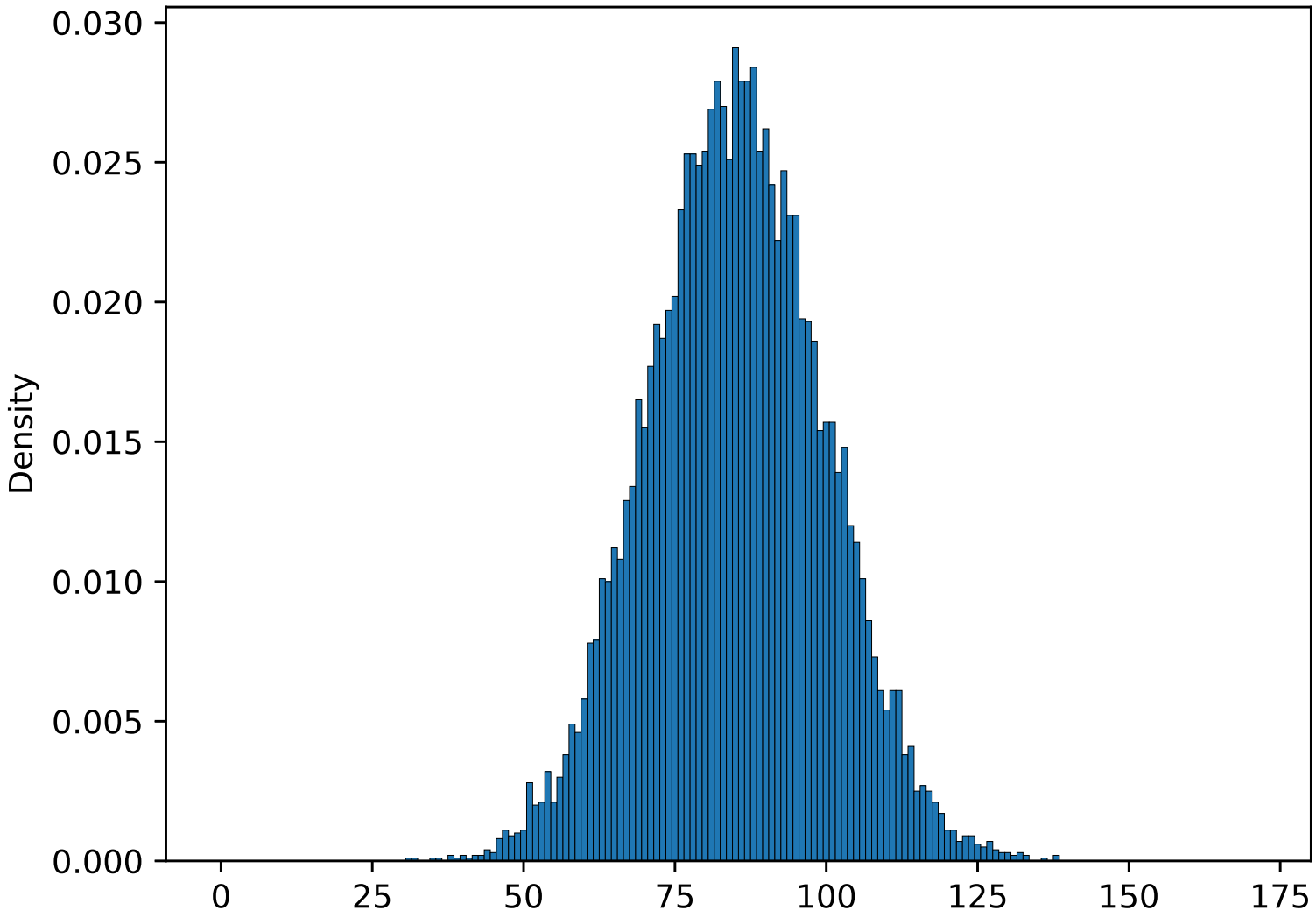
Distributions of distances

Coalescent



Distributions of distances

Birth-Death



Thank you

- Alex Gavryushkin (University of Otago)
- David Bryant (University of Otago)
- Mareike Fischer (University Greifswald)
- BioDS Lab: