

Population/disease models in moderate size communities could be modeled using:

$$T = \mathbb{R}_+ \text{ or } T = \mathbb{Z}_{\geq 0} \left(\begin{array}{l} \text{observe at regular} \\ \text{discrete intervals} \\ \text{and/or generations} \end{array} \right)$$
$$S = \mathbb{Z}_{\geq 0}^d \text{ (d subpopulations)}$$

This has discrete, countable state space and the time domain can be either continuous or discrete depending on model.

Brownian motion of a particle:

$$S = \mathbb{R}^3$$
$$T = \mathbb{R}_{\geq 0}$$

Continuous time and continuous state space.