Randomness in Biology [2014 Aug Term]

Homework 7: Assigned Nov 3. Due Nov 10.

1. A diffusing particle is described by the FP equation

$$\frac{\partial \mathcal{D}(y,t)}{\partial t} = D \frac{\partial^2 \mathcal{D}(y,t)}{\partial y^2}$$

Assuming particles start at y = 0, this equation has the solution

$$\mathcal{D}(y,t) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{y^2}{2\sigma^2}}, \text{ with } \sigma^2 = 2Dt.$$

We have shown in class that, for a symmetric process like diffusion, we have the identity

$$p^*(t) = \int_0^t f_{R,0}(\tau) d\tau = 2\wp(y(t) > R),$$

where p^* is the probability of being in the limbo state after hitting y = R.

- a. Find $f_{R,0}(t)$.
- b. Find the mean first passage time.