

Show all work for full credit, and use correct notation. Simplify answers completely.

A 4-state model has states: Healthy (0), Sick (1), Dead (2), and Terminally Ill (3).

The transition intensities are:

$$\mu_x^{01} = 0.0001e^{-0.06x} \quad \mu_x^{02} = \mu_x^{12} = 6\mu_x^{01} \quad \mu_x^{03} = \mu_x^{13} = 0.05\mu_x^{01} \quad \mu_x^{10} = 0.1\mu_x^{01}$$

$$\mu_x^{32} = 1.2\mu_x^{02}$$

1. Determine  ${}_{10}p_{30}^{31}$ .

2. Determine an expression for  $\mu_{30+t}^{0\tau}$ .

3. Determine  ${}_{10}\overline{p}_{30}^{\overline{00}}$ .

4. Given  ${}_{10}p_{30}^{00} = 0.943363$  and  ${}_{10}p_{30}^{01} = 0.007833$ , determine  ${}_{10}\dot{p}_{30}^{00}$ .

5. Use Euler's Forward Equation with a step size of 0.125 to approximate the value of  ${}_{10.125}p_{30}^{00}$ .