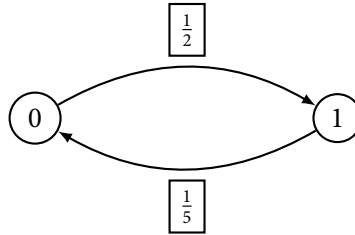**Solutions to Problem 1.**

a.

- **State space.** $\mathcal{M} = \{0,1\}$. State 0 represents being on the phone, state 1 represents answering email.
- **Transition rate diagram.**

- **Generator matrix.**

$$\mathbf{G} = \begin{bmatrix} -\frac{1}{2} & \frac{1}{2} \\ \frac{1}{5} & -\frac{1}{5} \end{bmatrix}$$

b.

$$\left. \begin{array}{r} -\dfrac{1}{2}\pi_0 + \dfrac{1}{5}\pi_1 = 0 \\[2mm] \dfrac{1}{2}\pi_0 - \dfrac{1}{5}\pi_1 = 0 \\[2mm] \pi_0 + \pi_1 = 1 \end{array} \right\} \qquad \Rightarrow \qquad \pi_0 = \frac{2}{7}, \pi_1 = \frac{5}{7}$$

In the long-run, the customer service representative spends 2/7 of their time on the phone, and 5/7 of their time answering email.