Problem 3.2.5

$P(X_3 = 0 \mid X_0 = 0, T > 3)$

$= P(X_3 = 0 \mid X_0 = 0, X_3 \in \{0, 1\})$

$= P(X_3 = 0 \mid X_0 = 0) / P(X_3 \in \{0, 1\} \mid X_0 = 0)$

$= (P^3)_{11} / ((P^3)_{11} + (P^3)_{12})$.

We find that:

$$P^3 = \begin{pmatrix} \frac{457}{1000} & \frac{230}{1000} & \frac{313}{1000} \\ \frac{345}{1000} & \frac{227}{1000} & \frac{428}{1000} \\ 0 & 0 & 1 \end{pmatrix}$$

Hence

$p = 457 / (457 + 230) = 0.6652$.