1. Five children A, B, C, D and E play catch. If A has the ball, then he/she is equally likely to throw the ball to B, D or E. If B has the ball, then he/she is equally likely to throw the ball to A, C or E. If either C or E gets the ball, they keep throwing it at each other. If D gets the balls, he/she runs away with it. Find the transition matrix, and classify the states.

2. Let \((X_n)_{n \geq 0}\) be a Markov chain with state space \(S = \{a, b, c\}\), with transition matrix

\[
P = \begin{bmatrix}
0 & 1/3 & 2/3 \\
1/4 & 3/4 & 0 \\
2/5 & 0 & 3/5
\end{bmatrix},
\]

and the initial distribution \(\pi = (\frac{2}{5}, \frac{1}{5}, \frac{2}{5})\). Compute the probability \(P(X_1 = b, X_2 = b, X_4 = a)\).