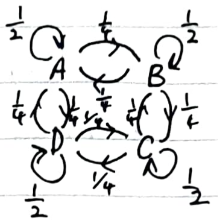

$$
\begin{array}{c c}
 & \begin{array}{cccc} A & B & C & D \end{array} \\
\begin{array}{c} A \\ B \\ C \\ D \end{array} &
\begin{pmatrix}
\frac{1}{2} & \frac{1}{4} & 0 & \frac{1}{4} \\
\frac{1}{4} & \frac{1}{2} & \frac{1}{4} & 0 \\
0 & \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\
\frac{1}{4} & 0 & \frac{1}{4} & \frac{1}{2}
\end{pmatrix}
\end{array}
$$

$$
M^2 = \begin{pmatrix}
\frac{3}{8} & \frac{1}{4} & \frac{1}{8} & \frac{1}{4} \\
\frac{1}{4} & \frac{3}{8} & \frac{1}{4} & \frac{1}{8} \\
\frac{1}{8} & \frac{1}{4} & \frac{3}{8} & \frac{1}{4} \\
\frac{1}{4} & \frac{1}{8} & \frac{1}{4} & \frac{3}{8}
\end{pmatrix}
$$

$$
M^3 = \begin{pmatrix}
\frac{5}{16} & \frac{1}{4} & \frac{3}{16} & \frac{1}{4} \\
\frac{1}{4} & \frac{5}{16} & \frac{1}{4} & \frac{3}{16} \\
\frac{3}{16} & \frac{1}{4} & \frac{5}{16} & \frac{1}{4} \\
\frac{1}{4} & \frac{3}{16} & \frac{1}{4} & \frac{5}{16}
\end{pmatrix}, \quad
M^4 = \begin{pmatrix}
\frac{9}{32} & \frac{1}{4} & \frac{7}{32} & \frac{1}{4} \\
\frac{1}{4} & \frac{9}{32} & \frac{1}{4} & \frac{7}{32} \\
\frac{7}{32} & \frac{1}{4} & \frac{9}{32} & \frac{1}{4} \\
\frac{1}{4} & \frac{7}{32} & \frac{1}{4} & \frac{9}{32}
\end{pmatrix}
$$

$$
M^n = \begin{pmatrix}
\frac{2^{n-1}+1}{2^{n+1}} & \frac{1}{4} & \frac{2^{n-1}-1}{2^{n+1}} & \frac{1}{4} \\
\frac{1}{4} & \frac{2^{n-1}+1}{2^{n+1}} & \frac{1}{4} & \frac{2^{n-1}-1}{2^{n+1}} \\
\frac{2^{n-1}-1}{2^{n+1}} & \frac{1}{4} & \frac{2^{n-1}+1}{2^{n+1}} & \frac{1}{4} \\
\frac{1}{4} & \frac{2^{n-1}-1}{2^{n+1}} & \frac{1}{4} & \frac{2^{n-1}+1}{2^{n+1}}
\end{pmatrix}
$$

can prove by induction...

4. $$M^n \cdot \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2^{n-1}+1}{2^{n+1}} \\ \frac{1}{4} \\ \frac{2^{n-1}-1}{2^{n+1}} \\ \frac{1}{4} \end{pmatrix} = \begin{pmatrix} P(A) \\ P(B) \\ P(C) \\ P(D) \end{pmatrix}$$

$$n \to \infty \qquad \frac{2^{n-1} \pm 1}{2^{n+1}} = \frac{1}{4} \pm \frac{1}{2^{n+1}}$$

$$n \to \infty, \quad \frac{1}{2^{n+1}} \to 0$$

Probability each child holds parcel is $\frac{1}{4}$.