Q1. [10 ] In Mathland, the weather is described either as *sunny* or *rainy* (nothing in between). On a sunny day there is an equal chance it will rain on the following day or be sunny. On a rainy day, however there is a 70% chance it will rain on the following day (versus a 30% chance it will be sunny).

Is Mathland, on the average, a rainy place or a sunny place?

SOLN.1 Model the weather as an ergodic Markov chain, with a regular transition matrix, $A$:

$$
A = \begin{bmatrix}
0.7 & 0.3 \\
0.5 & 0.5
\end{bmatrix}.
$$

The solution is given by the stationary distribution $\pi = (r, s)$, such that $\pi A = \pi$ (why?). That is,

$$
0.7r + 0.5s = r \\
0.3r + 0.5s = s
$$

and $r = 0.625$. 