$A = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$

$\{\{1, 1\}, \{1, 0\}\}$

$\{\{\lambda 1, \lambda 2\}, \{v1, v2\}\} = \text{Eigensystem}[A]$

$\left\{\left\{\frac{1}{2}\left(1+\sqrt{5}\right), \frac{1}{2}\left(1-\sqrt{5}\right)\right\}, \left\{\left\{\frac{1}{2}\left(1+\sqrt{5}\right), 1\right\}, \left\{\frac{1}{2}\left(1-\sqrt{5}\right), 1\right\}\right\}\right\}$

$\text{Solve}\left[1 == c1 * v1[[1]] + c2 * v2[[1]] \,\&\&\, 1 == c1 * v1[[2]] + c2 * v2[[2]], \{c1, c2\}\right]$

$\left\{\left\{c1 \to \frac{1}{10}\left(5+\sqrt{5}\right), c2 \to \frac{1}{10}\left(5-\sqrt{5}\right)\right\}\right\}$

$c1 = \frac{1}{10}\left(5+\sqrt{5}\right)$

$c2 = \frac{1}{10}\left(5-\sqrt{5}\right)$

$\frac{1}{10}\left(5+\sqrt{5}\right)$

$\frac{1}{10}\left(5-\sqrt{5}\right)$

$w[n\_] = c1 * \lambda1\wedge n + c2 * \lambda2\wedge n$

$\frac{1}{5} \times 2^{-1-n}\left(1-\sqrt{5}\right)^{n}\left(5-\sqrt{5}\right) + \frac{1}{5} \times 2^{-1-n}\left(1+\sqrt{5}\right)^{n}\left(5+\sqrt{5}\right)$

$N@w[100]$

5.73148×10^{20}