3.4 Find the upper and lower limits (the lim inf and lim sup) of the sequence \((s_n)\) defined by
\[
 s_1 = 0; \quad s_{2m} = \frac{s_{2m-1}}{2}; \quad s_{2m+1} = \frac{1}{2} + s_{2m}.
\]

*1. Theorem S.9 says: If \((s_n)\) is a real sequence, then \(\exists\) a subsequence \((s_{n_k})\) s.t. \(s_{n_k} \to \limsup s_n\). Similarly, there is a subsequence converging to \(\liminf s_n\).

The proof given in class addressed the cases where \(\liminf s_n, \limsup s_n \in \mathbb{R}\). Show that S.9 holds when \(\liminf s_n, \limsup s_n = \pm\infty\).