Let A_n be the set $[0, \frac{1}{2^n})$, then A_{n+1} will be $[0, \frac{1}{2^{n+1}})$.

Because $\frac{1}{2^n} > \frac{1}{2^{n+1}}$, it is proved that $A_{n+1} \subset A_n$.

Since $\forall n, \frac{1}{2^n} > 0$, so A_n is not empty and 0 is always an element.

So set $C = \bigcap_{n=1}^{\infty} A_n = \emptyset$ at least includes 0, which means $c \neq \emptyset$.

Hence, it's proved true.