Exercise 10. (Q2.5): Two sequences (a_n) and (b_n), where $(a_n b_n)$ and (a_n) converge but (b_n) does not.

Let $a_n = \frac{1}{n^3}$ and $b_n = n$ for all $n \in \mathbb{N}$, then $a_n b_n = \frac{1}{n^2}$ for all $n \in \mathbb{N}$. Thus $(a_n b_n)$ and (a_n) converge, but (b_n) doesn't.