1. Complete these problems from the book:
   (a) p.75, Exercise 2.4.1
   (b) p.75, Exercise 2.4.2
2. Prove the following statement using Bolzano-Weierstrass theorem.

   Assume that $(x_n)_{n\in\mathbb{N}}$ is a *bounded* sequence in $\mathbb{R}$ and that there exists $x \in \mathbb{R}$ such that any *convergent* subsequence $(x_{n_i})_{i\in\mathbb{N}}$ converges to x. Then $\lim_{n\to\infty} x_n = x$.
3. Show that
   (a) the set $\mathbb{Z} = \{\dots, -1, 0, 1, \dots\}$ has no cluster points.
   (b) every point in $\mathbb{R}$ is a cluster point of $\mathbb{Q}$.
4. In the lecture we have shown

   $$\text{any Cauchy sequence } (x_n)_{n\in\mathbb{N}} \subset \mathbb{R} \text{ has a limit in } \mathbb{R}, \text{ i.e. there exists } x \in \mathbb{R} \text{ with } \lim_{n\to\infty} x_n = x. \tag{1}$$

   The same statement is false in $\mathbb{Q}$, the following is false:

   $$\text{any Cauchy sequence } (x_n)_{n\in\mathbb{N}} \subset \mathbb{Q} \text{ has a limit in } \mathbb{Q}, \text{ i.e. there exists } x \in \mathbb{Q} \text{ with } \lim_{n\to\infty} x_n = x. \tag{2}$$

   (a) Give a counterexample to (2).
   (b) Which part of the proof of (1) (from the lecture) fails when we attempt to prove (2)?

   (Reference for this problem: Theorem 2.4.5 on pg. 74)