1. Let $X$ be a topological space and $Y \subseteq X$ be a subset. What is the smallest topology on $Y$ that makes the canonical embedding $i : Y \rightarrow X$ continuous?

2. For each $i \in I$ let $X_i$ be a topological space. What is the smallest topology on $\prod_{i \in I} X_i$ that makes all the projection maps $\pi_j : \prod_{i \in I} X_i \rightarrow X_j (j \in I)$ continuous?

3. Take $I = \mathbb{N}$ and $X_i = \mathbb{N}$ with the discrete topology. Is the topology on $\prod_{i \in \mathbb{N}} \mathbb{N}$ induced from a metric?

Note that $\prod_{i \in \mathbb{N}} \mathbb{N}$ can be regarded as functions from $\mathbb{N}$ into $\mathbb{N}$.

5. Show that the set of injective maps from $\mathbb{N}$ into $\mathbb{N}$ is a closed set.

6. Show that the set of surjective maps from $\mathbb{N}$ into $\mathbb{N}$ is not a closed set.

5. Show that $\text{Sym}(\mathbb{N})$ is a topological space with respect to the induced metric.