1. Prove or disprove that the set $S_1 = \{(a, b) : a \in \mathbb{N}, b \in \mathbb{N}\}$ is countable.

2. Prove or disprove that the set $S_2 = \mathcal{P}(\mathbb{N})$ is countable.

   Recall that the power set of a set A, denoted $\mathcal{P}(A)$, is the set of all subsets of A. That is $\mathcal{P}(A) = \{X : X \subseteq A\}$.