1. Use Euler’s Circuit Theorem to prove Euler’s Path Theorem.

2. Suppose $P$ and $Q$ are posets, let $P \times Q = \{(x, y) \mid x \in P$ and $y \in Q\}$, and define $(x, y) \leq (x', y') \iff x \leq x'$ and $y \leq y'$.

   (a) Use the definition of poset, to show that $(P \times Q, \leq)$ is a poset.
       Recall that the definition of equality in $P \times Q$ is
       \[(x, y) = (x', y') \iff x = x'$ and $y = y'\]

   (b) Give an example of two totally ordered sets $P$ and $Q$ such that
       $(P \times Q, \leq)$ is not a totally ordered set.

3. (a) How many total orderings are there on an $n$ element set?
       Justify your answer.

   (b) How many isomorphism classes are there of totally ordered sets
       with $n$ elements? Justify your answer.