1. [10 pts] Rishab is back with his Skittles sweet tooth! Say Rishab has a set of Skittles $A$. Let $R$ be a relation on $A$ that is both symmetric and antisymmetric.

   (a) Prove that if $a, b$ are distinct Skittles (elements) in $A$, then $(a, b) \notin R$.

   (b) Is $R$ reflexive? Prove your answer or give a counterexample.

2. [10 pts] Somil, Will, Grace, Marn Yee, Annie, and Waley, the owners of various fruit stands, decide to host a Farmer’s Market. There are currently $n$ potential customers, and $k$ distinct fruits for sale. Bharath, ever the most observant, notices that each of the $n$ customers wants exactly $m$ distinct fruits, and each of the $k$ fruits is desired by exactly $m$ distinct customers. Prove or disprove that this implies that $n = k$. You may assume that $m > 0$.

3. [10 pts] For Wenting’s birthday, Shawn decides to get her a cake with 100 candles. Since Wenting is a CIS 160 TA, Shawn decides to model her cake as a graph, where the candles are vertices and lines of frosting drawn between different candles are edges. Shawn wants the cake to be as pretty as possible and so decides to use candles of three different colors such that no two adjacent candles share the same color. One way for Shawn to determine whether the candles can be arranged in such a way is to examine all possible 3-colorings of the candles. If a computer can check 1 million colorings per second, about how long would it take to check all possible 3-colorings? (You may use a calculator).