1. **Random Band**

   In a group of ten people, seven can play the keyboard, five can play the guitar, four can play the violin, four can play the keyboard and the guitar, three can play the keyboard and the violin, two can play the guitar and the violin, and one person can play all three instruments.

   (a) Suppose a person is picked uniformly at random from the group. Draw a Venn Diagram and use it to calculate the probability that this person can play at least one instrument.

   (b) Let \( P(K) \) be the probability a randomly chosen person plays the keyboard, \( P(G) \) be the probability a randomly chosen person plays the guitar, and \( P(V) \) be the probability that a randomly chosen person plays the violin. Use the Inclusion-Exclusion principle to calculate the same probability as in part (a).

2. **Boy or Girl Paradox**

   (a) Mr. Smith has two children, at least one of whom is a boy. What is the probability that both children are boys?
(b) Mr. Smith has two children, one of whom is a boy born on a Tuesday. What is the probability that both children are boys?

3. Prove that in every probability space, if $A$ and $B$ are independent events, then $\overline{A}$ (not $A$) and $\overline{B}$ (not $B$) are also independent. *Hint: use Inclusion-Exclusion.*