1. (40 points) When you roll a (fair) 6-sided die, there are six possible outcomes.
   
   (a) (10 points) If the box below represents the sample space \( \Omega \), draw and label all the possible outcomes.

   \[
   \begin{array}{cc}
   & 1 & 2 \\
   3 & & 4 \\
   5 & 6 &
   \end{array}
   \]

   (b) (10 points) In the sample space above, highlight the event that the roll is less than four.

   (c) (10 points) What is the probability of rolling less than 4? Show your work, don’t just write down a number.

   **Solution:**
   
   \[
   P(\text{Less than 4}) = P(1) + P(2) + P(3) = \frac{1}{6}
   \]

   (d) (10 points) In the dice rolling example, let \( E_1 \) be the event that your roll a 1 or a 2 and let \( E_2 \) be the event that your roll a 1 or a 4. Calculate \( P(E_1 \cup E_2) \).

   **Solution:**
   
   \[
   P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2) = \frac{2}{6} + \frac{2}{6} - \frac{1}{6} = \frac{3}{6}
   \]