1. Hex. (i) Draws are not possible. For any positive integer \( n \), prove that the empty \( n \times n \) board is an \( N \)-position.

   (ii) Prove that each of these is an \( L \)-position (so bLack wins as first player and as second player).

   \[
   \begin{array}{cccc}
   B & B & B & B \\
   W & . & W & W \\
   W & . & W & W \\
   B & W & . & W \\
   B & B & W & . \\
   B & B & B & \\
   \end{array}
   \]

2. For each game, for each outcome class \( L, R, N, P \), give a position in that class, or explain why there is none:

   - nim
   - hackenbush
   - green hackenbush
   - domineering
   - cram

   2x2 hex (define any hex position in which any player has already won as a \( P \)-position).

   2x2 go, komi 1/2. (final net score is black stones+territory \(-\) (0.5 + white stones+territory).)

3. Go. are these x-groups unconditionally safe? safe under alternating play? explain.

   \[
   \begin{array}{cc}
   x & x \\
   x & x \\
   \end{array}
   \]

4. Describe the game \( \{ | 0, -1 \} \) using only these symbols: \{ \} | ,

5. Draw a 4-cell domineering position whose game notation is \( \{ | 0, -1 \} \).

6. For every domineering position with at most 4 cells, give the game notation and draw the game tree.

7. Below is the sum table for the classes \( P, L, R, N \). Prove that each entry is correct.

   E.g. for row \( P \) and column \( L \), you need to prove that if \( G \) is a \( P \)-position and \( H \) is an \( L \)-position, then \( G + H \) is an \( L \)-position. \( ? \) means that every outcome class is possible, so for row \( L \) and column \( R \) you need to do this: prove that if \( G \) is an \( L \)-position and \( H \) is an \( R \)-position, then \( G + H \) can be in any of the four classes (so give examples for \( G, H \) for each case). \( L/N \) means \( L \) or \( N \).

   \[
   \begin{array}{ccccc}
   & P & L & R & N \\
   \hline
   P & P & L & R & N \\
   L & L & ? & L/N \\
   R & R & R/N \\
   N & ? \\
   \end{array}
   \]