1. $\nu(G)$ is the outcome class of $G$. $R$ is the outcome class Right, meaning that $R$ wins $G$ when $R$ plays first and when $R$ plays second. What are the outcome classes $L, N, P$? For a combinatorial game $G$, we write $G > 0$ if $\nu(G) = L$. What does $G < 0$ mean? $G = 0$? $G||0$? 

2. Recall that $G - H$ is defined at $G + (-H)$. Let $Z$ be the game zero = $\{\ | \}$. Let $Y$ be any game with $\nu(Y) = P$. Prove that $Y - Z = 0$. 

3. Let $W = \{-1 \mid \}$. Describe $W$ using only $\{ \mid \}$ symbols. Describe $W$ as a tree. Repeat for $-W$. Prove that $W = 0$. Recall that the canonical form of a game $G$ is the game $H$ with fewest nodes that satisfies such that $G = H$. Give the canonical form of $W$. 

4. For games $G, H$, $G \geq H$ means $G > H$ or $G = H$. Prove or disprove: $G \geq H$ if and only if Left wins $G - H$ when $R$ plays first. 

5. Define a partial order. Define an equivalence relation. For combinatorial games, is = a partial order, an equivalence relation, or neither? Repeat this question for $\geq$. 

6. Answer this question for each of the two domineering games below: (i) give the complete game tree (ii) give the tree of the canonical form (iii) prove that game and its canonical form are equal, i.e. $G - G' = 0$ (iv) prove that the canonical form cannot be further reduced. 

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7. Recall that for all integers $n > 0$, $n$ is defined recursively as the game $\{(n - 1) \mid : \}$. Express the game 3 (i) using the formula (ii) as a game tree (iii) as a hackebush game (iv) as a domineering game. Let $x, y$ be positive integers with $z = x + y$. Prove that the game $z$ equals the game sum of the game $x$ and the game $y$. 

8. Recall that $1/2$ is the game $\{0 \mid 1\}$. Give (i) a hackenbush game that equals the game $1/2$. (ii) Repeat (i) for domineering. For the game $E$ above (iii) prove that $E + E + 1 = 0$ (iv) prove that $E + 1/2 \neq 0$. 

9. Recall that for $m$ positive odd and $j$ positive, the dyadic game $m/q$ with $q = 2^j$ is defined as the game with left option the game $(m - 1)/q$ and right option the game $(m + 1)/q$. Let $S$ be the game $3/4$. Express $S$ (i) using the definition (ii) with its game tree as a (sum of) (iii) domineering or (iv) hackenbush game(s). 

10. Do you think there is any dyadic rational game that equals the game $E$ above, or the game $*$? Explain briefly.