UNIVERSITY OF CALIFORNIA, BERKELEY

DEPARTMENT OF STATISTICS

STAT-155: Game Theory

Fall 2013

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Assignment # 5

Date Given: October 07, 2013 (Monday)   **Total Points: 20**
Date Due: October 14, 2013 (Monday)

1. Let G be a subtraction game with subtraction set S and let g be its *Sprague-Grundy function*. Consider a new game H which is also a subtraction game with subtraction set S but we allow removing all chips in one turn. Let h be the *Sprague-Grundy function* for this new game H. Show that

$$h(x) = g(x-1) + 1 \ \forall \ x \geq 1.$$

   Remark: This new game H is sometime called the *impatient* version of the subtraction game G.

2. Let G be a single pile subtraction game where in a turn if the pile consists of n chips then a player is only allowed to remove m-chips from it where m is a divisor of n but $m \neq n$. For example, if there are 18 chips on the board then the legal moves are to remove $1, 2, 3, 6$ or 9 chips from the board. Find the *Sprague-Grundy function* of this game G.

   Suppose the game is played starting with 18 chips. Which player do you think has a winning strategy and why?