

# UNIVERSITY OF CALIFORNIA, BERKELEY

## DEPARTMENT OF STATISTICS

STAT-155: Game Theory

Fall 2013

Instructor: Antar Bandyopadhyay

GSI: Sujayam Saha

Assignment # 3

Date Given: September 23, 2013 (Monday)  
Date Due: September 30, 2013 (Monday)

Total Points: 20

1. Answer the following questions

- (a) Find the *Nim-Sums* of  $12 \oplus 21$ ,  $15 \oplus 10 \oplus 5$ .
- (b) Show that  $x \oplus y = 0$  if and only if  $x = y$ .

2. Consider the following Combinatorial Game

- The game starts with a  $8 \times 8$  standard *chess board* with 1 chip placed on each of the squares. So a total of 64 chips are on the board.
  - There are two players, namely, Players I and II who alternate their moves.
  - At each move a player selects a number of (non-empty) squares which are on a *north-west* to *south-east* diagonal of the board. The player then moves one or more chips from these squares to squares which are just *north* or *east* of them. Note that in a move a player can move more than one chip from a square and can empty a square but has to move at least one. The player can also move chips from more than one square but all such squares must be on a south-west diagonal. Note a square may contain more than one chip in it and no chip is allowed to go out of the board.
  - The game ends when all the 64 chips are at the *north-east* corner of the board and the last player to make a move is the winner.
- (a) For the above game find the *P* and *N* positions.
  - (b) Which player has a winning strategy and why?