

## Problem Set 1

*Lecturer: Prof. Peter Chin**Due: February 7, 2018*

- ◇ Please email the written portion (either type up your answer or scan your handwritten solution) & code and report to [ken.q.zhou@gmail.com](mailto:ken.q.zhou@gmail.com) by 23:59PM on the due date.
- ◇ Late policy: there will be a penalty of 10% per day, up to three days late. After that no credit will be given.

**1. Reading Assignment**

- (a) Read Chapter 1 of Osborn.
- (b) Read [http://www-history.mcs.st-andrews.ac.uk/Biographies/Von\\_Neumann.html](http://www-history.mcs.st-andrews.ac.uk/Biographies/Von_Neumann.html)
- (c) Read about Prisoner's Dilemma in chapter 2 of Osborn.

**2. Generalize the Take-Away Game:**

- (a) Suppose in a game with a pile containing a large number of chips, you can remove any number from 1 to 6 chips at each turn. What is the winning strategy? What are the P-positions?
- (b) If there are initially 31 chips in the pile, what is your winning move, if any?

**3. Find the set of P-positions for the subtraction games with subtraction sets**

- (a)  $S = \{1, 3, 5, 7\}$
- (b)  $S = \{1, 3, 6\}$
- (c)  $S = \{1, 2, 4, 8, 16, \dots\} = \text{all powers of 2.}$
- (d) Who wins each of these games if play starts at 100 chips, the first player or the second?

**4. Programming assignment - taste of repeated games** Think about the following game. Suppose person A plays prisoner's dilemma with person B one thousand times. What's the best strategy for person A and person B? Write a quick program with your choice of programming languages to find your best strategy.. (Please don't try to search for answers in the internet? the point of this exercise is to have you think about this by writing a quick computer simulation.)