

# Math 233 — Worksheet (Week 2)

## Project 2

DEADLINE: 0900 MONDAY 6 MARCH

### 1 Reading

- Read chapter 3 and revise chapters 1 and 2 of [https://www.cims.nyu.edu/~regev/teaching/discrete\\_math\\_fall\\_2005/dmbook.pdf](https://www.cims.nyu.edu/~regev/teaching/discrete_math_fall_2005/dmbook.pdf)
- Note: you may be asked quiz questions on the reading without further warning. Read the reading *before* the lecture.

### 2 Project 2

There is no requirement to submit your answers.

- If your student number is  $n$ , then write out a proof for the extended Nim game listed in the class work below and numbered  $n(\text{modulo}4) + 1$

## Classwork

In groups of 2:

Write out the proof of the theorem, “In the game of standard Nim there is a winning strategy for the second player”

Now develop extended *proofs* for the extended Nim games - you will be allocated one:

1. The first player has 50 tokens to arrange in rows as they please, up to a maximum of 7 rows. The second player is the first to remove. *Prove* which player has the winning strategy

2. Suppose there was no maximum on the number of rows? *Prove* which player has the winning strategy
3. In a game of standard Nim, each player has the right, instead of taking away, to replace tokens they have previously removed, in any row they choose, but in one row only. *Prove* which player has the winning strategy
4. Suppose the tokens could be replaced into more than one row? *Prove* which player has the winning strategy