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Issued on September 15, 2017
Due: 14:40, September 22, 2017

CS204

Fall 2017, Assignment #2

Problem 1. *2 + 3 + 3 pts*

There are 5 types of tetrominos(if we see flipped tetrominos are the same): I, O, L, S, and T. Show that the checkerboard with size 6×6 cannot be covered using

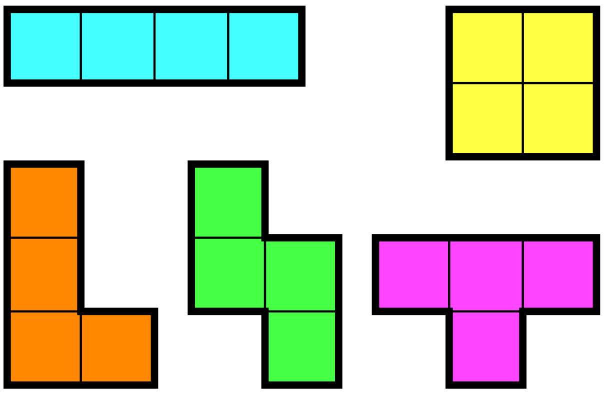

FIGURE 1. I, O, L, S, T tetrominoes.

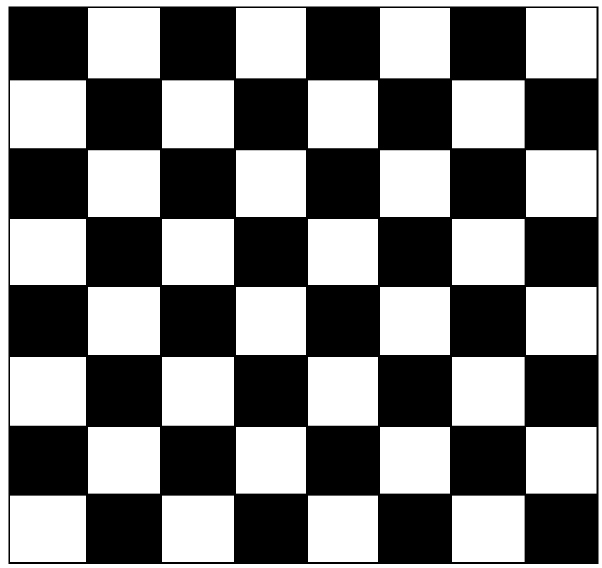

FIGURE 2. A familiar 8×8 checkerboard.

a) T-type tetrominos;
b) L-type tetrominos;
c) I-type tetrominos.

Problem 2. *2 + 3 + 3 pts*

Define a **modulo** operator $\equiv_p$ $(p > 0)$ as: for every integer a, b, $a \equiv_p b$ if there exists an integer c such that $a = cp + b$. Using this operator, prove followings by finding appropriate cases:

a) Prove there is no integral solution for $x^2 + y^2 = 1048575$.
b) Change a) into $x^2 + y^2 + z^2 = 1048575$. Prove still there is no integral solution.
c) Given a positive integer $n \geq 5$, prove that at lease one of $n, n+2, n+4$ is not a prime number.

Problem 3. *4 + 5 pts*

a) Show that the number of primes is infinite by contradiction.
b) Show that given $N \geq 2$, there exist a unique k-tuple $(p_1, \dots, p_k)$ where $p_1 \leq p_2 \leq \dots \leq p_k$ such that p_i is prime and $N = p_1 p_2 \dots p_k$ using strong induction.