MATH 157: Mathematics in the world
Homework 2 (Due February 19th, 2019 at 1:00PM)

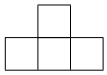
Problem 1

Write a short paragraph (50-100 words) about a mathematical idea or technique you learned recently. Why was it interesting to you and where can you imagine applying it in the future?

Problem 2

The following questions ask about the possibility of tiling a board with pieces of a given shape. Overlaps are not allowed.

1. Can you tile an 8×8 board with 1×3 pieces?
2. Can you tile an 8×8 board with one corner missing with 1×3 pieces?
3. Can you tile a 10×10 board with pieces of the following shape?[1]



Problem 3

1. In how many ways can you place 8 peaceful rooks on a chessboard?
2. In how many ways can you place 14 peaceful bishops on a chessboard?

Problem 4

1. The traveller continued a journey and met another couple of strangers and then an unusual thing happened. He asked one of them: "Is one of you a knight?". The first stranger answered his question and the traveller immediately understood who was who. How did he do it and who were those strangers?

[1] The following picture is obtained with the package *youngtab* of LaTeX, if you want to have some fun with the pictures in your pset.

2. A traveller came to the island of Knights and Knaves, where knights always tell truth and knaves always lie. He met 4 strangers and asked them: "Who are you?". Here are the responses that he got:

   1st: "All of us are knaves".

   2nd: "There is 1 knave among us".

   3rd: "There are 2 knaves among us".

   4th: "I never lied and I am not lying now".

   The traveller quickly figured out who is the 4th stranger. How did he do it and who were those strangers?

Problem 5

In class (Lecture 1), we showed that if each point in the integer plane is colored with one of two colors, then there always exists a monochromatic rectangle.

Extend the argument we presented to show that if each point in the plane is colored with one of n colors, then there must be a monochromatic rectangle.