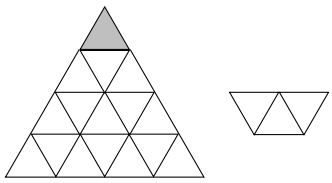
Trapezoidal Tiling

This is a **regular task**. You must submit a PDF, which can be produced using the LaTeX template on Moodle, exported from a word processor, hand-written or any other method.

Let n be a power of two. An equilateral triangle is partitioned into smaller equilateral triangles by parallel lines dividing each of its sides into $n > 1$ equal segments. The topmost equilateral triangle is chopped off (indicated in solid black in the diagram below). We want to tile the remaining equilateral triangles with trapezoids, each of which is composed of three equilateral triangles. A valid tiling has two properties:

- Every equilateral triangle must be covered by at least one trapezoid.
- No equilateral triangle may be tiled by more than one trapezoid.



In this example, the sides are divided into $n = 4$ segments.

Design a divide and conquer algorithm to tile the grid with a valid tiling, using only trapezoids. Using induction or otherwise, justify the correctness of the algorithm and analyse its time complexity.

Note. *A tiling always exists.*

Advice.

If your inductive hypothesis operates on a grid with side length 2^k, what size grid should your inductive step operate on?

If you are solving recursively, you should ensure that your subproblems have the same properties/restrictions (except for input size).

Expected length: Up to one page.