HW3 Molecular Programming

MPRI 2.11.1

10.02.2022 - **Due on Thu. 24/02 before 08:45**

You are asked to complete the exercise marked with a [★] and to send me your solutions to:

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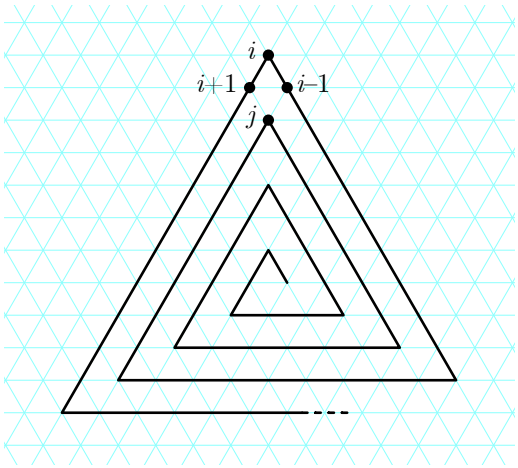
as a PDF file named **HW3-Lastname.pdf** on **Thu. 24/02 before 08:45**.

[★] Exercise 1 (Oritatami — Impossible triangle path). We want to prove that no deterministic oritatami system with delay $\delta \leqslant 2$ can fold according to the infinite triangular spiral below. Recall that the transcript t of an oritatami system (t is the sequence of bead types) is *ultimately periodic*, i.e. there is an i_0 and a period T such that for all $i \geqslant 0$, $t_{i_0+i} = t_{i_0+T+i}$.

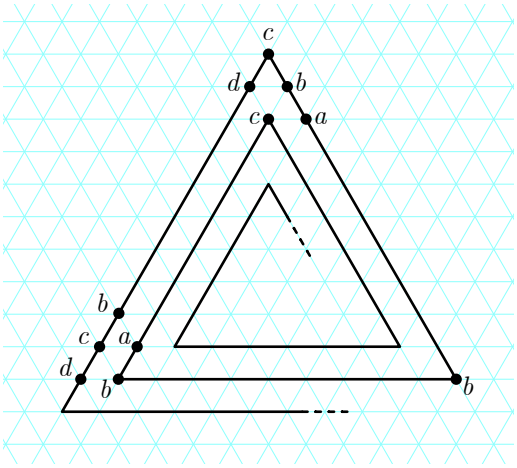


► ***Question* 1.1)** *Prove than no deterministic delay-1 oritatami system can fold according to this spiral.*

Let us consider now a deterministic delay-2 oritatami system that would fold according to the infinite triangular spiral.

► ***Question* 1.2)** *Prove that 2 bonds are required to place the bead correctly at each corner.*

► ***Question* 1.3)** *Show that there are 4 consecutive bead types a, b, c, d in the transcript that get placed as follows:*



► ***Question* 1.4*)*** *Show that in order to stabilize c in the lower left corner, c must bind with a.*

► ***Question* 1.5*)*** *Conclude that c cannot be placed deterministically at the top corner.*

► ***Question* 1.6 (★★★*)*** *What about deterministic oritatami systems with larger delays?*