G4G11 Gift Exchange: Polygons Folding into Three Different Boxes

Ryuhei Uehara

Japan Advanced Institute of Science and Technology
http://www.jaist.ac.jp/~uehara
uehara@jaist.ac.jp

At G4G9, I prepared a pack of polygons that fold into two different boxes as the Gift Exchange item. Later, my student, Hiroaki Matsui, and I found a common development of two boxes of size $1 \times 1 \times 5$ and $1 \times 2 \times 3$ that also folds to a box of size $0 \times 1 \times 11$ (Figure 1). This is a nice puzzle to fold them all (it's not so easy!), but the last one is not really a box. Recently, my colleague, Toshihiro Shirakawa, and I finally found an infinite amount of polygons that fold into three different boxes. No cheating! You can obtain three different real boxes from the polygon in Figure 2 by folding along the orthogonal lines! A hint: the sizes of three boxes are $2 \times 13 \times 58$, $7 \times 14 \times 38$, and $7 \times 8 \times 56$. You can find the solution at http://www.jaist.ac.jp/~uehara/etc/origami/nets/3box.pdf. If you are interested in more details, please check the following journal paper:

> Common Developments of Three Incongruent Orthogonal Boxes, Toshihiro Shirakawa and Ryuhei Uehara, *International Journal of Computational Geometry and Applications*, Vol. 23, No. 1, pp. 65-71, 2013.

The conference version is also available at http://2012.cccg.ca/papers/paper3.pdf. Have fun!!

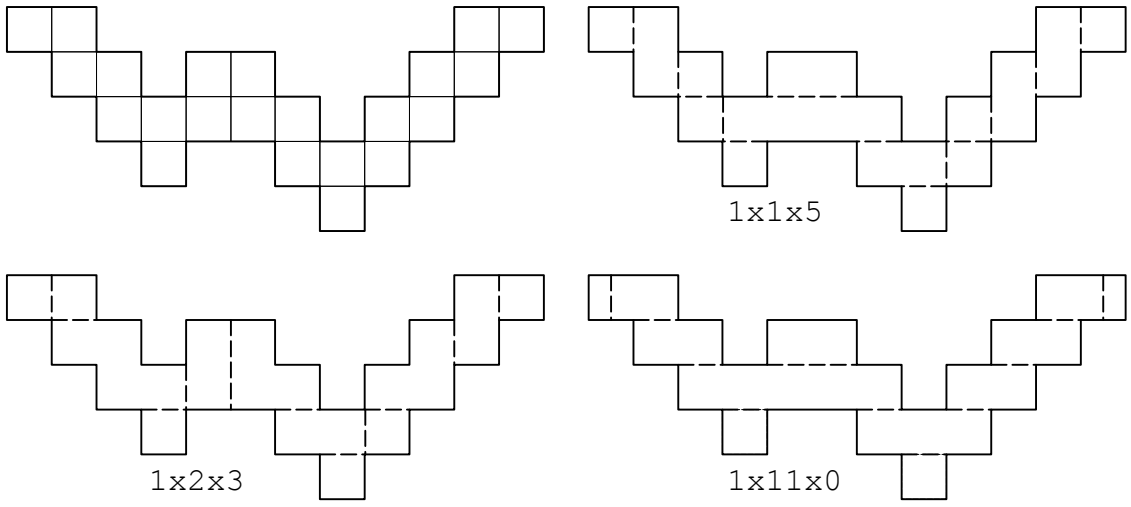

Figure 1: A polygon that folds into two boxes of size $1 \times 1 \times 5$ and $1 \times 2 \times 3$ and another box(?) of size $0 \times 1 \times 11$.

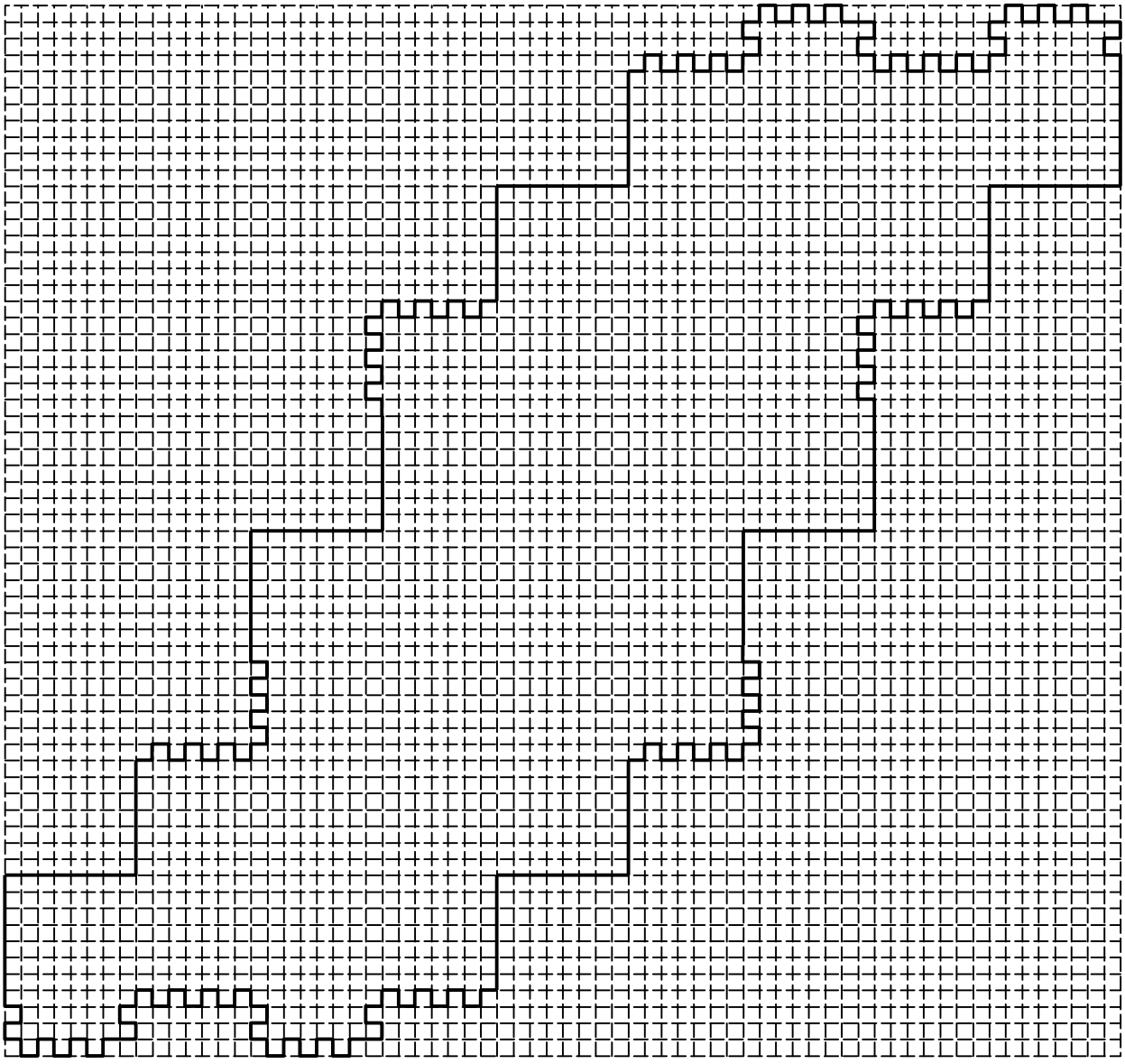

Figure 2: A polygon that folds into three boxes!