

# Universal Partial Cycles

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## Abstract

A De Bruijn cycle is a cyclic sequence of symbols that contains each word of length  $n$  exactly once. A universal partial cycle, or upcycle, covers each word of length  $n$  exactly once, even more compactly, using a “do not know” symbol that covers every letter of the alphabet. Upcycles have highly constrained structure and seem to be rare. Previously it was not known whether any upcycles existed for  $n > 4$ . We present several examples of upcycles with  $n = 8$ . We then present novel approaches to constructing new upcycles from old ones, so that each of these new examples generates an infinite family of upcycles. At the same time, we find that upcycles are more structurally constrained than previously known and satisfy certain pseudorandomness properties, and we prove new nonexistence results.

This talk is based on joint work with Bennet Goeckner, Corbin Groothuis, Cyrus Hettle, Brian Kell, Pamela Kirkpatrick, and Ryan Solava and joint work with Dylan Fillmore, Bennet Goeckner, Jasmine Martin, and Daniel McGinnis.

**Keywords:** De Bruijn cycle, upcycle.