Worms and Caterpillars

Nela Lekić

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Introduction

Based on paper

Phylogenetic partitions and ternary permutation constraint satisfaction problems on two linear orders

by

Leo van Iersel, Steven Kelk, Nela Lekić, Simone Linz

Introduction

- A ternary Permutation-CSP is specified by a subset Π of the symmetric group S_3
- An instance of such a problem consists of a set of variables (or taxa) X and a multiset of constraints
- The constraints are ordered triples of distinct variables of X
- The objective is to answer weather all constraints given by an instance of Π can be satisfied by a number of linear orders

The complexity of the 11 ternary permutations CSPs

		1LO	2LO
Π_0 (linear ordering)	123	P	NPC
Π_1	123, 132	P	NPC
Π_2	123, 213, 231	P	P
Π_3	123, 231, 312, 321	P	P
Π_4	123, 231	NPC	NPC
Π_5 (betweenness)	123, 321	NPC	NPC
Π_6	123, 132, 231	NPC	NPC
Π_7 (circular ordering)	123, 231, 312	NPC	P
Π_8	$S_3 \setminus$ 123, 231	NPC	P
Π_9 (non-betweenness)	$S_3 \setminus$ 123, 321	NPC	NPC
Π_{10}	$S_3 \setminus$ 123	NPC	P

An example

Problem $2 - \Pi_5$ consists of constraints of form $(123, 321)$. To say that a linear order satisfies a Π_5-constraint $c = (abc)$ is to say that in that linear order either triple abc or triple cba is satisfied.

Some phylogenetic background

- A binary rooted phylogenetic on n leaves
- Caterpillar
- Triplet
- When a tree is *displayed* by another tree

k-Caterpillar Compatibility

Instance A set R of rooted triplets.

Question Do there exist at most k caterpillars such that each element in R is displayed by at least one such caterpillar?