

Emily Gunawan, postdoc @ University of Oklahoma

① Cluster algebras

② Box-ball system

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cluster algebras A type A_2 cluster algebra \mathcal{A} :

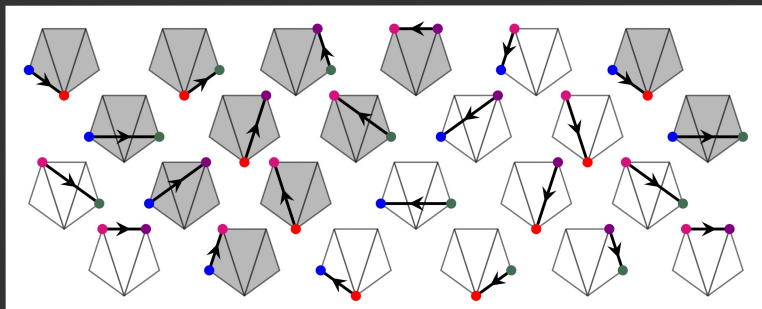
subring of $\mathbb{Q}(x_1, x_2)$ generated by

cluster variables

$$x_1, x_2, \frac{1+x_2}{x_1}, \frac{1+x_1}{x_2}, \frac{x_1+1+x_2}{x_1 x_2}$$

friezes

	1	1	1	1	1	1	1
(Row 2)	3	1	2	2	1	3	1
	2	2	1	3	1	2	2
	1	1	1	1	1	1	1



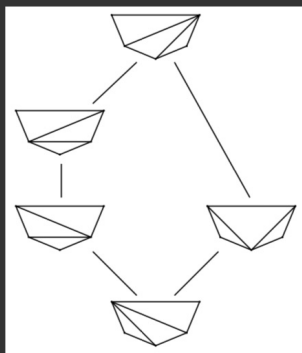
homomorphisms

$$\mathcal{A} \rightarrow \mathbb{Z}$$

$$\det \begin{bmatrix} a & b \\ c & d \end{bmatrix} = 1$$

diagonals \leftrightarrow cluster variables

Cambrian lattices

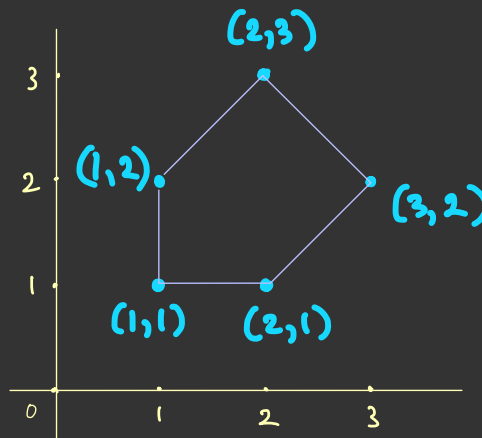


A_2

- * A quotient of weak order on the symmetric group S_3
- * Exchange graph of A_2 cluster algebra
- * An associahedron

OPEN PROJECT —
seeking collaborators
who likes polytopes!

Friezahedron

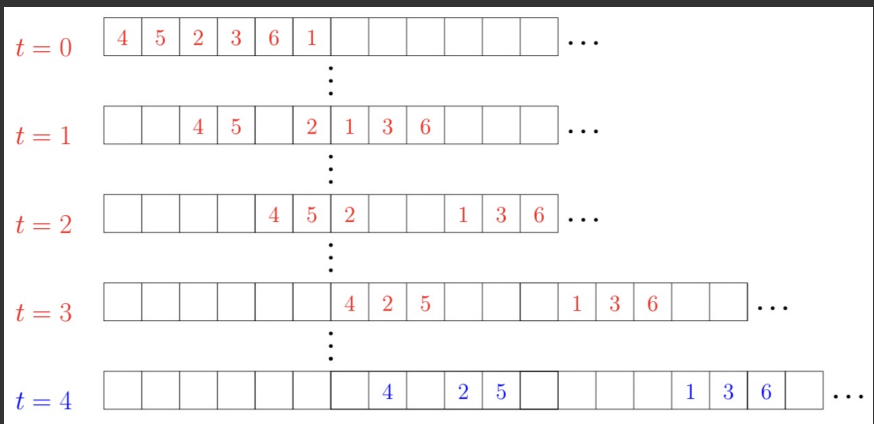


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Current research with undergraduate students pg 3/3

Box-ball system

$$\pi = 452361$$



RSK algorithm:

permutations $\pi \leftrightarrow$
 pairs $P(\pi), Q(\pi)$
 of standard tableaux

$$\pi = 452361$$

$$P(\pi) = \begin{array}{|c|c|c|} \hline 1 & 3 & 6 \\ \hline 2 & 5 & \\ \hline 4 & & \\ \hline \end{array}, \quad Q(\pi) = \begin{array}{|c|c|c|} \hline 1 & 2 & 5 \\ \hline 3 & 4 & \\ \hline 6 & & \\ \hline \end{array}$$

Steady state starting at $t=3$
 soliton decomposition

1	3	6
2	5	
4		