Graph Games and Assumptions on Environment

- Two player games are used to model important problems in computer science and cyber physical systems.
- Harry has a winning objective and needs to find a strategy to win from a given vertex. Requires assumption that Snape is adversarial.
- Finding a strategy for parity objective takes quasipolynomial time.

Parity objective
- Maximum of label seen infinitely often is even.

Büchi objective
- Visit the marked vertices infinitely often.

coBüchi objective
- Eventually stay in the marked vertices.

Question: How can Snape help Harry satisfy his objective? What can Harry assume about Snape’s behavior?

- Harry must not expect too much from Snape!
- Harry needs SIM assumptions on Snape:
  - Efficient enough for him to be able to satisfy the objective,
  - Implementable by Snape,
  - Maximally permissive, allowing all non-adversarial behaviors.

Experiments

<table>
<thead>
<tr>
<th>Name</th>
<th>#Vertices</th>
<th>#Edges</th>
<th>Colors</th>
<th>Time</th>
<th>CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lily+Herm</td>
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<td>322</td>
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<td>1811</td>
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<tr>
<td>arda decomposed</td>
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<td>1618</td>
<td>4</td>
<td>0.124</td>
<td>0.067</td>
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<tr>
<td>tiiy+herm</td>
<td>3566</td>
<td>3364</td>
<td>7</td>
<td>0.074</td>
<td>2293.02</td>
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<tr>
<td>tiiy+herm</td>
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<td>5572</td>
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<td>1,608,862</td>
<td>5</td>
<td>2902.149</td>
<td>Timeout</td>
</tr>
</tbody>
</table>

Conclusions
- Our algorithm runs in polynomial time, and works much better than the previous works, in practice.
- Our algorithm always succeeds in computing SIM assumptions, while previous ones fail to even compute sufficient assumptions.
- Our algorithm is the first to compute maximally permissive assumptions.