Title: Security Games with Arbitrary Schedules: A Branch and Price Approach
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Reviewer: Gyuseok Lee
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- Overview of paper content (0.5 points)
The motivation of this paper is that state of the art algorithms in security games either fail to scale or to provide a correct solution for large problems with arbitrary scheduling constraints (you can think that large problems as large numbers of defenders of different types).

To solve this problem, the authors proposed a new algorithm, ASPEN, which is composed of a decomposing of SPARS to enable column generation and the integration of ORGIGAMI-S to substantially speed up the branch and bound search.

Specifically, column generation is used to avoid representing the full (exponentially) strategy space for the defender. In addition to it, ORGIAMI-S based on ORGIAMI algorithm is a novel branch and bound method for searching the space of the attacker strategies.

As a result, this paper solves far more general instances of scheduling problems and substantially faster than a standard implementation of branch and price for game-theoretic problems.

- Strengths (0.5 points)
This paper would like to solve the problem of strategy space caused by large, arbitrary schedules for attacker and defender. Therefore, it shows the more efficient algorithm than baseline algorithm.
Specially, ASPEN looks like binary search tree algorithm, which is one of the most efficient algorithms. Therefore, I think that its efficiency is guaranteed to some extent.

- Weaknesses (0.5 points)
Since generating the optimal column is performed iteratively, the larger the scale, the more difficult it is to find the optimal solution. I thought that this would reduce the novelty proposed in this paper.
Plus, too many notations made it difficult to understand the main part of the paper and I could not accept that too many formulas proposed in this papers is really valid form.

- Questions or Discussion (0.5 points)
I wonder how the ideas proposed in the paper can be used in other domains other than simple security games. If it is available in other domains, I wonder if it is possible to adapt to other domains with what is learned in security games. Plus, I wonder how the schedule, which is different from the arbitrary schedules, is devised. (i.e., rule based).