Experimental Game Data: Instructions

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1 Data description

- Data citation: Nguyen, T.H., Wright, M., Wellman, M.P., Singh, S. (2018). Multi-Stage Attack Graph Security Games: Heuristic Strategies, with Empirical Game-Theoretic Analysis – Dataset. University of Michigan Deep Blue Data Repository. `https://doi.org/10.7302/Z2F18WX2`.
- Each *-summary.json is a raw file which has a payoff matrix of a game instance and other information regarding experimental settings which can be ignored in analysis. Use the command line *jq . < *-summary.json* to view a specific file (replace * with the corresponding file number).
- Each *-ga.json file contains a payoff matrix of a game instance, derived from the corresponding *-summary.json file. In each file,
  - The field "players" has a list of players in the game. In our dataset, there are two players: a defender and an attacker.
  - The field "strategies" has a list of heuristic strategies for each player. For example, *RANDOM_WALK:numRWSample_100_qrParam_1.0* is a heuristic strategy of the attacker.
  - The field "profiles" has a list of strategy profile with corresponding payoffs of players. For example, considering the following element:

    {
    "attacker": [[
    "NOOP:",
    1,
    0
    ]],
    "defender": [[
    "GOAL_ONLY:maxNumRes_10.0_minNumRes_1.0_numResRatio_0.3_logisParam_1.0_stdev_0.0",
    1,
    -31.577873149685754
    ]]
    },

    this element indicates that if the attacker plays the "NOOP " strategy and the defender plays "GOAL_ONLY:maxNumRes_10.0_minNumRes_1.0_numResRatio_0.3_logisParam_1.0_stdev_0.0", the attacker receives a payoff of zero while the defender receives a payoff of -31.577873149685754.

- For each *-ga.json file, there is a corresponding *-result-thanh.json file which contains all Nash equilibria of the game described in the *-ga.json file. In particular, the field "pure-equilibria" has a list of pure equilibria of the game. The "attacker" field consists of the attacker's equilibrium pure strategy; the pure strategy involved in the pure Nash equilibrium has a value of 1 while others have a value of 0.
- The *Robustness* folder has the dataset of the Robustness experiment part in the paper. The *Strategy Comparison* folder has the dataset of the Strategy Comparison experiment part. In addition, the *LayeredDAG* and *RandDAG* folders have the datasets of experiments on layered and random directed acyclic graphs respectively. The *0%AndNode* and *50%AndNode* folders correspond to the experiments on graphs with 0% and 50% AND nodes. Finally, *HighNoise* and *LowNoise* and *NoNoise* folders include the datasets in three cases when the defender has a high-noise, low-noise, and no-noise observation of the attacker's activity on the graphs.