On the Impact of Network Connectivity in Colonel Blotto Games

James Headrick, Jenny Liang and Emrah Akyol

ECE, Binghamton University, State University of New York
Email: {jheadri1, jliang31, eakyol}@binghamton.edu

Abstract

We numerically analyze the networked Colonel Blotto game used in cyber-security. The network connects the cyber-nodes that are vulnerable to attacks to the physical nodes that have significance to the players. We consider the case where there are multiple attackers in a war with a common defender. We numerically analyze the impact of network connectivity on the Nash equilibrium of this game.

The Colonel Blotto game models a scenario in which two players having certain resource levels fight over a finite number of battlefields [1, 2]. The players decide on the amount of resource they deploy on each battlefield in order to maximize their payoff which is defined as the number of battles won. Here, we formulate a three-stage Colonel Blotto game where there are two adversaries fighting a common defender (or two systems defending against a common attacker). We incorporate a network between the cyber-nodes (that are not secure, but not valuable) and the physical nodes (that are connected to cyber-nodes through the network). We numerically compute the Nash equilibrium of the game in various parameter regions. Our preliminary numerical results (shown below) indicate that under some conditions, the players may have an incentive to add battlefields or form a coalition as it improves their expected payoffs. In particular, it might be beneficial for security agencies to increase the number of entities that can be under attack and/or form a coalition with other security agencies to share resources, which increases the overall security.

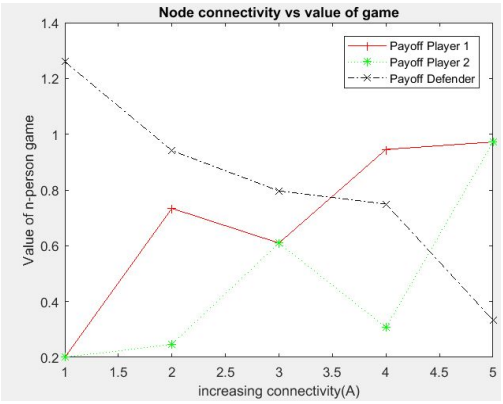

Figure 1: Payoff versus connectivity

References

[1] E. Borel and J. Ville, Applications de la theorie des probabilites aux jeux de hasard. J. Gabay, 1938

[2] O. Gross and R. Wagner, A continuous Colonel Blotto game, RAND, 1950.