

# ART GALLERY THEOREMS AND A METHOD TO RATE BRIDGE PLAYERS

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We discuss two problems in combinatorics. The first is a variation of a classic problem in computational geometry. The second arises from dissatisfaction with the current method for rating bridge players and leads to a problem in matrix theory with a pleasing combinatorial solution.

**1.** What is the maximum number of guards needed to protect a polygonal art gallery with  $n$  walls? Chvátal's Art Gallery Theorem gives the answer:  $\lfloor n/3 \rfloor$ . What if each guard is required to be visible to at least one other guard—say, to prevent ambush? We present the recent solution to this art gallery problem for “guarded guards” (Joint work with Val Pinciu)

**2.** We propose a new method to rate individuals who play duplicate bridge. Our method accounts for the strengths of a player's partners and is motivated by the notion of least squares from statistics. The final step in computing our ratings requires us to solve a linear system. We show that determining whether the linear system is singular is a purely combinatorial problem. Our bridge scenario motivates a recent result in advanced matrix theory on diagonally dominant complex matrices. (Joint work with Tom Quint)