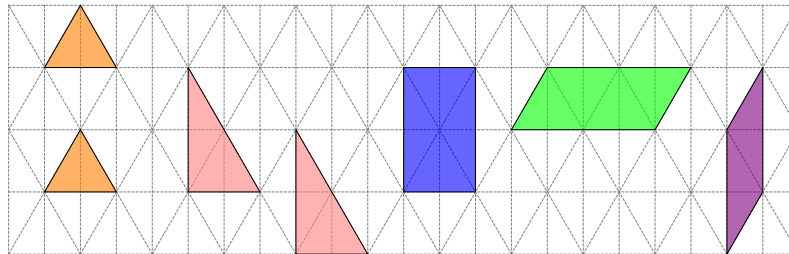


MATH PROBLEMS OF THE MONTH

November 2018 (Fall Series III of IV)

1. Assembly. The seven puzzle pieces below have been drawn on a grid of 30-60-90° triangles. Show how the seven pieces can be arranged to form (1) an equilateral triangle, (2) a parallelogram, and (3) a convex hexagon. Each shape should use all seven puzzle pieces, which may be flipped or rotated. A nice, clear drawing for each shape is all that's needed. There's a grid for drawing on the back of this sheet.



2. Scheduling. *Skat* is a card game for three players. The St. Peter skat club has nine players: Alfred, Brenda, Cassius, Del, Edda, Flint, Gaby, Hugo and Ingrid. Determine the minimum number of games they must play, in order for every pair of players to play together in at least one game, and give a schedule that achieves the minimum number.

3. Infinite Shift. Construct a sequence of real numbers $\{x_k\}$ with infinitely many nonzero terms, such that

$$(1) \quad \sum_{k=0}^{\infty} x_k^2 = 1$$

and

$$(2) \quad \sum_{k=0}^{\infty} x_k x_{k+d} = 0 \text{ for every positive integer } d.$$

For credit, show proof that your sequence has the required properties.

Solutions are welcome from all Gustavus students, faculty, and staff! Each month's solvers will be announced along with a running scoreboard for the Fall Series. Prizes of \$125 (first place) and \$50 (runner up) will be awarded to the top student solvers at the end of the Fall Series; students who have solved at least three problems during the Fall Series are eligible for the prizes. To enter the contest:

- (1) Email solutions to jsiehler@gustavus.edu, or
- (2) Submit written solutions to Professor Siehler's mailbox (by the door of Olin Hall 310).

Please include your name and email address with written solutions. Points will be awarded for each correct, complete solution received during the month of November, 2018. Find the problems online at <https://mcs.blog.gustavus.edu/tag/potm/>.

