Putnam Mathematical Competition

The Putnam Competition takes place each year on the first Saturday of December. This competitive examination is open to regularly enrolled undergraduates in colleges and universities of the United States and Canada.

There is a four times per lifetime participation limit.

Meritorious participation in this competition will be rewarded.

For details, talk to

Daniel Onofrei, 632 PGH, `onofrei@math.uh.edu`
William Ott, 603 PGH, `ott@math.uh.edu`
Andrew Török, 672 PGH, `torok@math.uh.edu`

To register (deadline around Oct. 12) please contact Andrew Török.

For more information, including past problems, see the UH Putnam page at

`www.math.uh.edu/~torok/Putnam`

You do not have to participate even if registered.

The competition consists of two three-hour sessions (9am-noon and 2-5pm). There are 6 problems in each session, and each problem is worth 10 points.

In 2014 a score of 10 points (1 problem solved) placed a contestant in the top 38% (rank 1635 out of 4320 participants), a score of 20 (2 problems) in the top 14% (623 out of 4320); ranks are similar for other years.

Here are two problems from each of the 2007 and 2010 sessions. You can find more problems at the above web-site.

A1 ('10) Given a positive integer n, what is the largest k such that the numbers $1, 2, \ldots, n$ can be put into k boxes so that the sum of the numbers in each box is the same? [When $n = 8$, the example $\{1, 2, 3, 6\}, \{4, 8\}, \{5, 7\}$ shows that the largest k is *at least* 3.]

A2 ('10) Find all differentiable functions $f : \mathbb{R} \to \mathbb{R}$ such that

$$f'(x) = \frac{f(x+n) - f(x)}{n}$$

for all real numbers x and all positive integers n.

B1 ('10) Is there an infinite sequence of real numbers $a_1, a_2, a_3, \ldots$ such that

$$a_1^m + a_2^m + a_3^m + \cdots = m$$

for every positive integer m?

B2 ('10) Given that A, B, and C are noncollinear points in the plane with integer coordinates such that the distances AB, AC, and BC are integers, what is the smallest possible value of AB?

A1 ('07) Find all values of α for which the curves $y = \alpha x^2 + \alpha x + \frac{1}{24}$ and $x = \alpha y^2 + \alpha y + \frac{1}{24}$ are tangent to each other.

A2 ('07) Find the least possible area of a convex set in the plane that intersects both branches of the hyperbola $xy = 1$ and both branches of the hyperbola $xy = -1$. (A set S in the plane is called *convex* if for any two points in S the line segment connecting them is contained in S.)

B1 ('07) Let f be a polynomial with positive integer coefficients. Prove that if n is a positive integer, then $f(n)$ divides $f(f(n)+1)$ if and only if $n = 1$. [Editor's note: one must assume f is nonconstant.]

B2 ('07) Suppose that $f : [0,1] \to \mathbb{R}$ has a continuous derivative and that $\int_0^1 f(x)\,dx = 0$. Prove that for every $\alpha \in (0,1)$,

$$\left| \int_0^\alpha f(x)\,dx \right| \leq \frac{1}{8} \max_{0 \leq x \leq 1} |f'(x)|.$$