Individual Test Weight Function

Harvard-MIT Math Tournament

Evan Chen

Last updated February 13, 2018

1 Function

For each individual test, if problem n is solved by $N > 0$ contestants, its weight is

$$w(n, N) = \exp(n/20) + \max(8 - \lfloor \ln N \rfloor, 2).$$

The student's score on each test, as well as their individual total, is computed by simply summing the weights of solved problems.

2 Table of values

The following table lists the possible values of $w(n, N)$ above for concreteness.

	$P1$	$P2$	$P3$	$P4$	$P5$	$P6$	$P7$	$P8$	$P9$	$P10$
$N \geq 404$	3.051	3.105	3.162	3.221	3.284	3.350	3.419	3.492	3.568	3.649
$N \in [149, 403]$	4.051	4.105	4.162	4.221	4.284	4.350	4.419	4.492	4.568	4.649
$N \in [55, 148]$	5.051	5.105	5.162	5.221	5.284	5.350	5.419	5.492	5.568	5.649
$N \in [21, 54]$	6.051	6.105	6.162	6.221	6.284	6.350	6.419	6.492	6.568	6.649
$N \in [8, 20]$	7.051	7.105	7.162	7.221	7.284	7.350	7.419	7.492	7.568	7.649
$N \in [3, 7]$	8.051	8.105	8.162	8.221	8.284	8.350	8.419	8.492	8.568	8.649
$N \in [1, 2]$	9.051	9.105	9.162	9.221	9.284	9.350	9.419	9.492	9.568	9.649

3 Design Properties

- Ties are unlikely, due to the transcendental e.
- Solving a very difficult problem (where $N \leq 20$, say) is highly rewarded.
- The possible weights lie roughly in $[3, 10]$ to give some consistency with previous years (see table).
- A student's score is simply the sum of their weights (for simplicity). The function definition is simple and can be understood.
- The weights are not too sensitive (due to the floor), and unlikely to change due to small errors in grading, because of the floor function. For example, it is not necessary to distinguish scores of zero from students who did not participate. Also, results from different tests do not depend on each other.