

Equations of the Goblet Of Fire

First of all, assume the Goblet of Fire picks student names randomly.

Let B represent the number of Beauxbatons students who placed their name in the Goblet of Fire.

Let D represent the number of Durmstrang students who placed their name in the Goblet of Fire.

Let H represent the number of Hogwarts students who placed their name in the Goblet of Fire.

The probability for a selection in any order is:

$$\frac{1}{B} \times \frac{1}{D} \times \frac{1}{H}$$

The probability of finding picking a specific student is

$$\frac{1}{D + B + H}$$

The minimum is $\frac{1}{3}$

Note that there must be at least 1 Beauxbatons student, 1 Durmstrang student, and 1 Hogwarts student who entered their name in the Goblet of Fire.

As a result,

$$\frac{1}{1 + 1 + 1} = \frac{1}{3}$$