

Geshin Impact total Wish approximation

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Abstract

This paper examines the Masterless Starglitter System in Genshin Impact (miHoYo, 2020) from the perspective of a player reinvesting their Wish-earned Glitter into new Wishes. The goal is to calculate the total number of Wishes a player can make starting with a certain amount of Primogems/Wishes.

To simplify the calculations for players, certain assumptions are made. Through a systematic mathematical analysis, we derive a general formula.

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1 Introduction

1.1 Rules

As stated in the Genshin Impact Wish details, the relevant rules for a Character Banner are as follows:

1. 4-Star:

- (a) A player is guaranteed a 4-Star or above item at least once per 10 attempts.
- (b) A 4-Star weapon will always also give 2 Masterless Starglitter.
- (c) A 4-Star character will also give 2 Masterless Starglitter if the player already owns this character. From the 8th copy onwards, 5 Masterless Starglitter are given instead.

2. 5-Star:

- (a) A player is guaranteed a 5-Star character at least once per 90 attempts.
- (b) The Character Banner does not give any 5-Star weapons.
- (c) A 5-Star character will also give 10 Masterless Starglitter if the player already owns this character. From the 8th copy onwards, 25 Masterless Starglitter are given instead.

In the Paimon's Bargain item shop, we can exchange 5 Masterless Starglitter for 1 Intertwined Fate.

1.2 Assumptions

- 1. Exactly every 10th pull is a 4-Star.
- 2. Every 4-Star pull gives 2 Masterless Starglitter.

1.3 Assumption induced errors

- 1. A 4-Star can be pulled more frequently than only on every 10th pull.
- 2. A 4-Star only gives Masterless Starglitter if duplicate or weapon.
- 3. A 4-Star can give 5 Masterless Starglitter if constellations are at max.
- 4. 5-Star pulls are not taken into account

2 Calculations

2.1 Naming Conventions

W_T := Total Wish amount. (Number in Question)

P_0 := Raw Primogems available.

W_0 := Raw Intertwined Fate available.

e_0 := Extra Wishes after spending P_0 Primogems.

e_1 := Extra Wishes after spending e_0 Wishes.

$E := (e_n)_{n \in \mathbb{N}}$ Sequenz of Extra Wishes. e_0, e_1, \dots

2.2 Calculations

The Total Wish amount W_T should be calculated as:

$$W_T := \frac{P_0}{160} + \sum_{n=0}^N e_n$$

The first Element e_0 of E is calculated with:

$$e_0 := \frac{P_0}{160} \cdot \frac{1}{10} \cdot 2 \cdot \frac{1}{5} = \frac{P_0}{4.000}$$

$\frac{P_0}{160}$ gives us the amount of Wishes available at the start with P_0 Primogems. We divide it by 10 to get the amount of 4-Star pulls. We multiply this by 2 because each 4-Star pull gives 2 Masterless Starglitter. We divide this by 5 because we need 5 Masterless Starglitter to buy another Wish.

The following Elements e_n of E are defined recursively with:

$$e_n := e_{n-1} \cdot \frac{1}{10} \cdot 2 \cdot \frac{1}{5} = \frac{e_{n-1}}{25}$$

e_{n-1} does not need to be divided by 160 because it already is a Wish number rather than a Primogem number.

We can express the n -th Element of E as:

$$e_n = e_0 \cdot \frac{1}{25^n} = \frac{P_0}{4.000} \cdot \frac{1}{25^n}$$

Therefore the Total Wish amount can be expressed as:

$$W_T = \frac{P_0}{160} + \frac{P_0}{4.000} \cdot \sum_{n=0}^N \frac{1}{25^n}$$

Which contains a Geometric series and can therefore be written as:

$$W_T = \frac{P_0}{160} + \frac{P_0}{4.000} \cdot \frac{1 - (\frac{1}{25})^{N+1}}{1 - (\frac{1}{25})}$$

We can easily calculate a Limit of this function

$$\lim_{N \rightarrow \infty} \frac{1 - (\frac{1}{25})^{N+1}}{1 - (\frac{1}{25})} = \frac{1 - 0}{1 - (\frac{1}{25})} = \frac{25}{24}$$

Which now gives us our final approximation of our Total Wishes

$$W_T = \frac{P_0}{160} + \frac{P_0}{4.000} \cdot \frac{25}{24}$$

$$W_T = \frac{P_0}{160} + \frac{P_0}{3840}$$

3 Summary

As seen in the Assumption section above this is not an accurate formula and doesn't take some unknown factors into account. But due to its simplicity it can give a quick and easy overview of the to expected Total Wishes. The Formula gets even simpler when using our Intertwined Fate count W_0 instead of our Primogem count P_0 :

$$W_T = W_0 + \frac{W_0}{24} = W_0 \cdot \left(1 + \frac{1}{24}\right) = W_0 \cdot \frac{25}{24}$$

Or in other words; We will have 4,16% additional Wishes .
For most Travelers this is negligible as the Number of extra Wishes with 90 Pulls comes down to 3,75 using this Formula.

We can also calculate how many starting Wishes W_0 we would need to get to a total amount of W_T Wishes:

$$W_0 = \frac{24}{25} \cdot W_T$$

Or in other words; We need 96% of our desired Total Wish amount.

4 References

Genshin Impact (miHoYo, 2020) *Character Banner Details*

Genshin Impact (miHoYo, 2020) *Pimons Bargain item Shop*