Definitions – per CH-01.

Overview – This document specifies a community-biased method by which the total prize pool for a tournament may be broken down among eligible skill-separated divisions. The method allows prize compensation to be adjusted according to the amount of content generated by the division, instead of fixing the proportion before registration is complete.

Formulation – Prize distribution conforms to the general equation below:

$$T = \sum_{i=1}^{n} G_i R_i$$

Where "T" is the total prize money available to compensate all eligible players, "n" is the number of divisions eligible to earn prize money, "G_i" is the number of games played by that division, and "R_i" is the "rate" of the division, a way of biasing winnings according to skill. The convention for this specification is that lower numbers represent higher-tier divisions in a tournament.

Therefore, for tournaments with only the top two divisions eligible for prizes, the equation for "T" becomes:

$$T = G_1 R_1 + G_2 R_2$$

With prizes for only the top three divisions:

$$T = G_1 R_1 + G_2 R_2 + G_3 R_3$$

And et-cetera:

$$T = G_1 R_1 + G_2 R_2 + G_3 R_3 + \ldots G_n R_n$$

However, most tournaments do not pay their winners "by-the-game", but instead have fixed prize-pools that the rates depend on. To reflect this, the above equation is divided by smallest rate "R_n":

$$\frac{T}{R_n} = G_1 \frac{R_1}{R_n} + G_2 \frac{R_2}{R_n} + G_3 \frac{R_3}{R_n} + \ldots G_n$$

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These values of "R_1/R_n", "R_2/R_n", "R_3/R_n", etc. are known as the relative rates for each division, and it is incumbent upon the tournament to provide them, typically as an array whose length is equal to one less than the number of prize-eligible divisions. Letting:

$$\frac{R_1}{R_n}=r_1, \frac{R_2}{R_n}=r_2, \frac{R_3}{R_n}=r_3$$

The working equation for the previous page becomes:

$$\frac{T}{R_n}=G_1 r_1+G_2 r_2+G_3 r_3+\ldots G_n$$

Finally, solving for the minimum absolute rate:

$$R_n=\frac{T}{G_1 r_1+G_2 r_2+G_3 r_3+\ldots G_n}$$

The relative rates specified by the tournament, $\bar{r}=[r_1, r_2, r_3, etc.]$ indicate the value it places on skilled play, and the amounts of content produced by lower-skilled divisions in order to earn an equal fraction of the total prize pool. For instance, if a tournament provided a relative rate vector of $\bar{r}=[5]$, it would mean that the second-highest division would need to produce five times as much content as the highest-ranked division, in order to receive the same fraction of the total prize pool.

<u>Example 1 – A Simple Expression for Minimum Absolute Rate</u>: *A tournament with \$6,500 in prize money places relative values on its top three, prize-eligible divisions as follows: r = [10, 5]. Derive an expression for the "absolute rate" of the third division:*

Plugging in numbers, the formula becomes:

$$R_n=\frac{T}{G_1 r_1+G_2 r_2+G_3 r_3+\ldots G_n}=\frac{\$6{,}500}{10 G_1+5 G_2+G_3}$$

Without knowing the number of games played in each division, it is impossible to go further.

<u>Example 2 – Calculating Distribution of Total Tournament Prize Pool</u>: *A Round-Robin style tournament has raised 348 dollars in total prize money, and has a division game break-down with final game-count as follows: Platinum (highest) 51, Gold 190, Silver 236, Copper (lowest) 83. The relative rates are 8,4, and 2 respectively. Calculate the Copper Division Rate and the breakdown of the total prize money among the four divisions.*

For the Copper Division Rate:

$$R_{Cu}=\frac{T}{G_{Pt} r_{Pt}+G_{Au} r_{Au}+G_{Ag} r_{Ag}+G_{Cu}}=\frac{348}{8*51+4*190+2*236+83}=\frac{348}{408+760+472+83}=\frac{348}{1723}=\frac{\$0.202}{game}$$

Thus, the Copper Division Rate is slightly larger than 20 cents per game, in this example. The breakdown of the total prize money among four divisions would be:

$$T_{Cu}=G_{Cu}R_{Cu}=(83\,games)\frac{\$348}{1723\,games}=\$16.76$$

$$T_{Ag}=r_{Ag}G_{Ag}R_{Cu}=2(236\,games)\frac{\$348}{1723\,games}=\$95.33$$

$$T_{Au}=r_{Au}G_{Au}R_{Cu}=4(190\,games)\frac{\$348}{1723\,games}=\$153.50$$

$$T_{Pt}=r_{Pt}G_{Pt}R_{Cu}=8(51\,games)\frac{\$348}{1723\,games}=\$82.41$$

Totaling this breakdown, a check is performed confirming the accuracy of these calculations by returning the original value:

$$T=T_{Cu}+T_{Ag}+T_{Au}+T_{Pt}=\$16.76+\$95.33+\$153.50+\$82.41=\$348$$

Conclusion – The method of prize-distribution presented in this document can account for divisions of different size, while allowing tournaments to attract higher-skilled players with skill-biasing factors. Tournaments not using this method or something similar declare the breakdown of total prize pool in advance and hope that enough games are played in each division to justify the compensation. Finally, it should be noted that these division size weights ("*G*") are based on the number of games played by the entire division, and *not* the number of games played personally. This is an intentional feature designed so that players will encourage their similarly-skilled friends to sign-up, bolstering community engagement.

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