

# Goldsmith Functions

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# **1 Abstract**

This paper presents the Goldsmith functions. These functions describe a fully adjustable system for quality scoring, notation and handling. One of the main advantages is standardisation. Since the functions are customizable in terms of range, sensitivity and scaling, they can operate from single digit ppq (parts per quadrillion) up to 12N (99.999999999%) inputs and even outside of that range, offering a standardized notation for almost all branches of industry, science, medicine, education, engineering and mathematics.

## **2 Introduction**

text (introduction)

## 3 Proceedings

### 3.1 Inputs

The formulas have several inputs. While some are used as placeholders in definitions, others have actual meaning in the context of the application of the functions.

#### 3.1.1 Definition of Input Variables

Universal input variables of the function set:

$r$  is a variable which controls the sensitivity of the  $\Lambda_0, \Lambda_{n_s}, \Phi_e, \Phi_0$  and  $\Phi_{n_s}$  functions.  $r \in \mathbb{Z}$

$n_s$  is a variable which controls the scaling strength of the  $Rd_{n_s}, Ex_{n_s}, \Phi_{n_s}$  and  $\Lambda_{n_s}$  functions.

$n_s \in \mathbb{N}_0$

$s$  is the score calculated from  $c$  using  $\Phi_0$  or  $\Phi_{n_s}$ .  $s \in [100 \cdot (1 - 10^{-n_s}); 100]$

$q$  controls whether  $\Gamma_{n_r}$  and  $\Omega_{n_r}$  use flooring (truncation) or rounding.  $q \in \{0; 1\}$

## 3.2 Formulas

$$Rd_{n_s}(x) = x \cdot 10^{n_s} + 100 \cdot (1 - 10^{n_s}) \quad (1)$$

$$Ex_{n_s}(x) = Rd_{-n_s}(x) \quad (2)$$

$$\Theta(r) = (1 + 10^{-r})^{-9} \quad (3)$$

$$\beta(r) = 9 \cdot \log_{10}(1 + 10^{-r}) \quad (4)$$

$$\Phi_e(c; r) = 100 \cdot \sqrt{1 + \frac{\log_{10}(c)}{\beta(r)}} \quad (5)$$

$$\Phi_0(c; r) = \begin{cases} \Phi_e(c; r) & \text{for } c \geq \Theta(r) \\ 0 & \text{for } c < \Theta(r) \end{cases} \quad (6)$$

$$(7)$$

$$\Phi_{n_s}(c; r) = Rd_{n_s}(\Phi_0(c; r)) \quad (8)$$

$$\Lambda_0(s; r) = 10^{\beta(r) \cdot \left(\left(\frac{s}{100}\right)^2 - 1\right)} \quad (9)$$

$$\Lambda_{n_s}(s; r) = \Lambda_0(Ex_{n_s}(s); r) \quad (10)$$

$$\delta(x) = -\log_{10}(1 - x) \quad (11)$$

$$\delta_s(x) = \lfloor -\log_{10}(1 - x) \rfloor \quad (12)$$

$$\chi(x) = \sum_{k=1}^x \left( \frac{9}{10^k} \right) = 1 - 10^{-x} \quad (13)$$

$$\Gamma_{n_r}(x; q) = \frac{\lfloor x \cdot 10^{n_r} + 0.5 \cdot q \rfloor}{10^{n_r}} \quad (14)$$

$$\mathcal{U}_{n_r}(x; q) = \begin{cases} \Gamma_{n_r-1-\lfloor \log_{10}(|x|) \rfloor}(x; q) & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases} \quad (15)$$

$$(16)$$

$$(17)$$

## 3.3 Explanation

### 3.3.1 Explanation of Functions

- $Rd_{n_s}(x)$ :
- $Ex_{n_s}(x)$ :
- $\Theta(r)$ :
- $\beta(r)$ :
- $\Phi_e(c; r)$ :
- $\Phi_0(c; r)$ :
- $\Phi_{n_s}(c; r)$ :
- $\Lambda_0(s; r)$ :
- $\Lambda_{n_s}(s; r)$ :
- $\delta(x)$ :

- $\delta_s(x)$ :
- $\chi(x)$ :
- $\Gamma_{n_r}(x)$ :
- $\mathcal{U}_{n_r}(x)$ :

### 3.4 Outputs

#### 3.4.1 Interpretation of outputs

### 3.5 Examples

There are several possible areas of application for the goldsmith functions. Some of these applications include the purity of precious metals, reliability, accuracy of AI algorithms, data fidelity, purity of silicon in the semiconductor industry and many more.

Below there are some example values.

- 99.999998% *gold*  $\doteq 88.19r8 - 0$  *gold*
- 99.9999999954% *silicon*  $\doteq 69.92r12 - 0$  *silicon*
- 10.0% *gold content in ore*  $\doteq 79.43r0 - 0$  *gold content in ore*
- 58.3% *gold content in 14k gold*  $\doteq 60.91r1 - 0$  *gold content in 14k gold*
- 93.0% *forgor*  $\doteq 43.55r2 - 0$  *forgor*
- 0.6% *copper content in ore*  $\doteq 42.42r0 - 0$  *copper content in ore*
- 99.5% *uptime*  $\doteq 66.54r4 - 0$  *uptime*

The general notation is given by the following standart.

- $[100 \cdot c]\% [quantity] \doteq [\Phi_{n_s}(c; r)]r[r] - [n_s] [quantity]$

The notation standard is intended for the use in various fields listed in the abstract and is deliberately kept concise.

## 4 Conclusions

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## 5 References

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## 6 Appendices

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