

# Goldsmith Functions

Andreas G.

24th of July 2025

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# **1 Abstract**

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## **2 Introduction**

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## 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 Variables (by function)

- $\Xi(v; w; x; y; z)$ : All inputs to this function are placeholders.  $v, w, x, y, z \in \mathbb{R}$
- $Rd_n(x)$ ;  $Ex_n(x)$ : All inputs to this function are placeholders.  $x \in [0; 100]$ ;  $n \in \mathbb{N}_0$
- $\Theta(r)$ ;  $\beta(r)$ :  $r$  is a variable which controls the sensitivity of the  $\Phi_e, \Phi_0$  and  $\Phi_n$  functions.  $r \in \mathbb{Z}$
- $\Phi_e(c; r)$ ;  $\Phi_0(c; r)$ ;  $\Phi_n(c; r)$ :  $c$  is the main input variable of the  $\Phi_e, \Phi_0$  and  $\Phi_n$  functions. It can be thought of as „purity“ or other qualities. (see Examples section for more details.)  $c \in [0; 1]$  (for  $\Phi_e$   $c \in [\Theta(r); 1]$ );  $r$  is a variable which controls the sensitivity of the  $\Phi_e, \Phi_0$  and  $\Phi_n$  functions.  $r \in \mathbb{Z}$
- $\Lambda_0(s; r)$ ;  $\Lambda_n(s; r)$ :  $s$  is the score calculated from  $c$  using  $\Phi_0$  or  $\Phi_n$ .  $s \in ]-\infty; 100]$ ;  $r$  is a variable which controls the sensitivity of the  $\Lambda_0$  and  $\Lambda_n$  functions.  $r \in \mathbb{Z}$
- $\delta(x)$ ;  $\delta_s(x)$ : All inputs to this function are placeholders.  $x \in [0; 1[$
- $\chi(x)$ : All inputs to this function are placeholders.  $x \in [0; \infty[$

### 3.2 Formulas

$$\Xi(v; w; x; y; z) = \begin{cases} v & \text{for } y > z \\ w & \text{for } y = z \\ x & \text{for } y < z \end{cases} \quad (1)$$

$$Rd_n(x) = x \cdot 10^n + 100 \cdot (1 - 10^n) \quad (2)$$

$$Ex_n(x) = Rd_{-n}(x) \quad (3)$$

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

$$\beta(r) = 9 \cdot \log_{10}(1 + 10^{-r}) \quad (5)$$

$$\Phi_e(c; r) = 100 \cdot \sqrt{1 + \frac{\log_{10}(c)}{\beta(r)}} \quad (6)$$

$$\Phi_0(c; r) = \Xi(\Phi_e(c; r); \Phi_e(c; r); 0; c; \Theta(r)) \quad (7)$$

$$\Phi_n(c; r) = Rd_n(\Phi_0(c; r)) \quad (8)$$

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

$$\Lambda_n(s; r) = \Lambda_0(Ex_n(s); r) \quad (10)$$

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

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

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

### 3.3 Explanation

#### 3.3.1 Explanation of Functions

- $\Xi(v; w; x; y; z)$ :
- $Rd_n(x)$ :
- $Ex_n(x)$ :
- $\Theta(r)$ :
- $\beta(r)$ :
- $\Phi_e(c; r)$ :
- $\Phi_0(c; r)$ :
- $\Phi_n(c; r)$ :
- $\Lambda_0(s; r)$ :
- $\Lambda_n(s; r)$ :
- $\delta(x)$ :
- $\delta_s(x)$ :
- $\chi(x)$ :

### 3.4 Outputs

### 3.5 Interpretation of outputs

### 3.6 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.

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

The general notation is given by the following standart.

- $[100 \cdot c]\% [quantity] \doteq [\Phi_n(c; r)]r[r] - [n] [quantity]$

The notation standart is intended for the use in various industries and is deliberately kept concise.

## 4 Conclusions

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## 5 References

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## 6 Appendices

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