DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

Champernowne Constant (C10)

Abhishek Rajput
aries.abhi55@gmail.com

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INTRODUCTION

In mathematics, the Champernowne constant C10 is a transcendental real constant whose decimal expansion has important properties. It is named after economist and mathematician D. G. Champernowne, who published it as an undergraduate in 1933. For base 10, the number is defined by concatenating representations of successive integers:

$$C10 = 0.12345678910111213141516\cdots$$

Champernowne constants can also be constructed in other bases, similarly, for example:

$$C2 = 0.11011100101110111\cdots$$

$$C3 = 0.12101112202122\cdots$$

The Champernowne constants can be expressed exactly as infinite series:

$$C_m = \sum_{n=1}^{\infty} \frac{n}{10_b^{\left(\sum_{k=1}^{n} \left\lceil \log_{10_b}(k+1) \right\rceil\right)}}$$

where $\lceil x \rceil = \lceil x \rceil = ceiling(x), 10_b^x = b^x 10_b^x = b^x inbase10, \log_{10_b}(x) = \log_{b_{10}}(x) \log_{10_b}(x) = \log_{b_{10}}(x)$ $and b\ is\ the\ base\ of\ the\ constant.$

A slightly different expression is given by Eric W. Weisstein (MathWorld):

$$C_m = \sum_{n=1}^{\infty} \frac{n}{m^{\left(n+\sum_{k=1}^{n-1} \lfloor \log_m(k+1) \rfloor\right)}} where \lfloor x \rfloor = \lfloor x \rfloor = floor(xx).$$

REFERENCES

https://en.wikipedia.org/wiki/Champernowne_constant