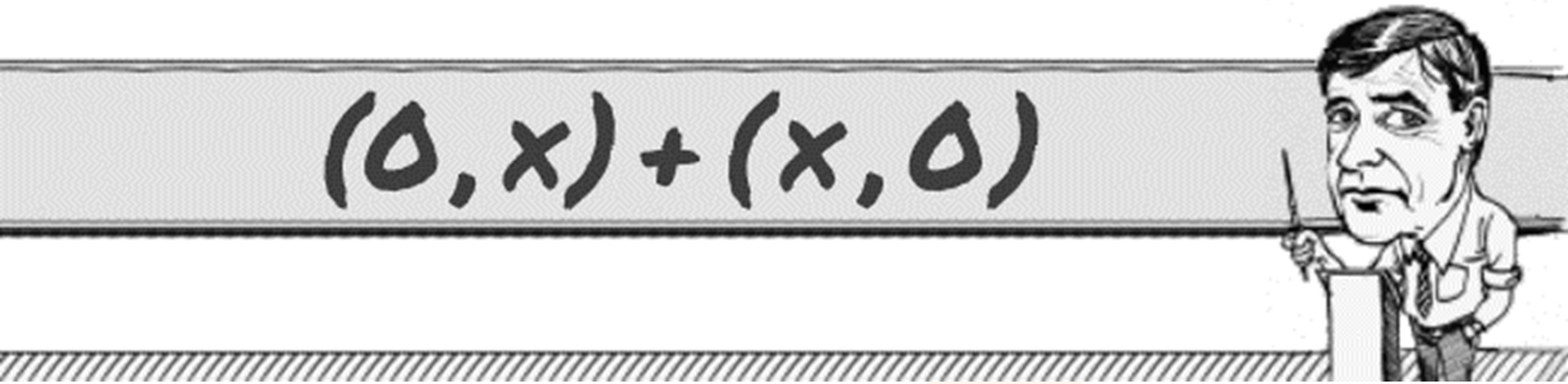
Ken Iverson, 1920–2020



Some Thoughts about the Future of Iverson Notation

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Iverson@100 – Dec 17th, 2020

```
sin←1 ○ angle
```

Will the notation survive?

Yes!

Iverson did not invent APL...

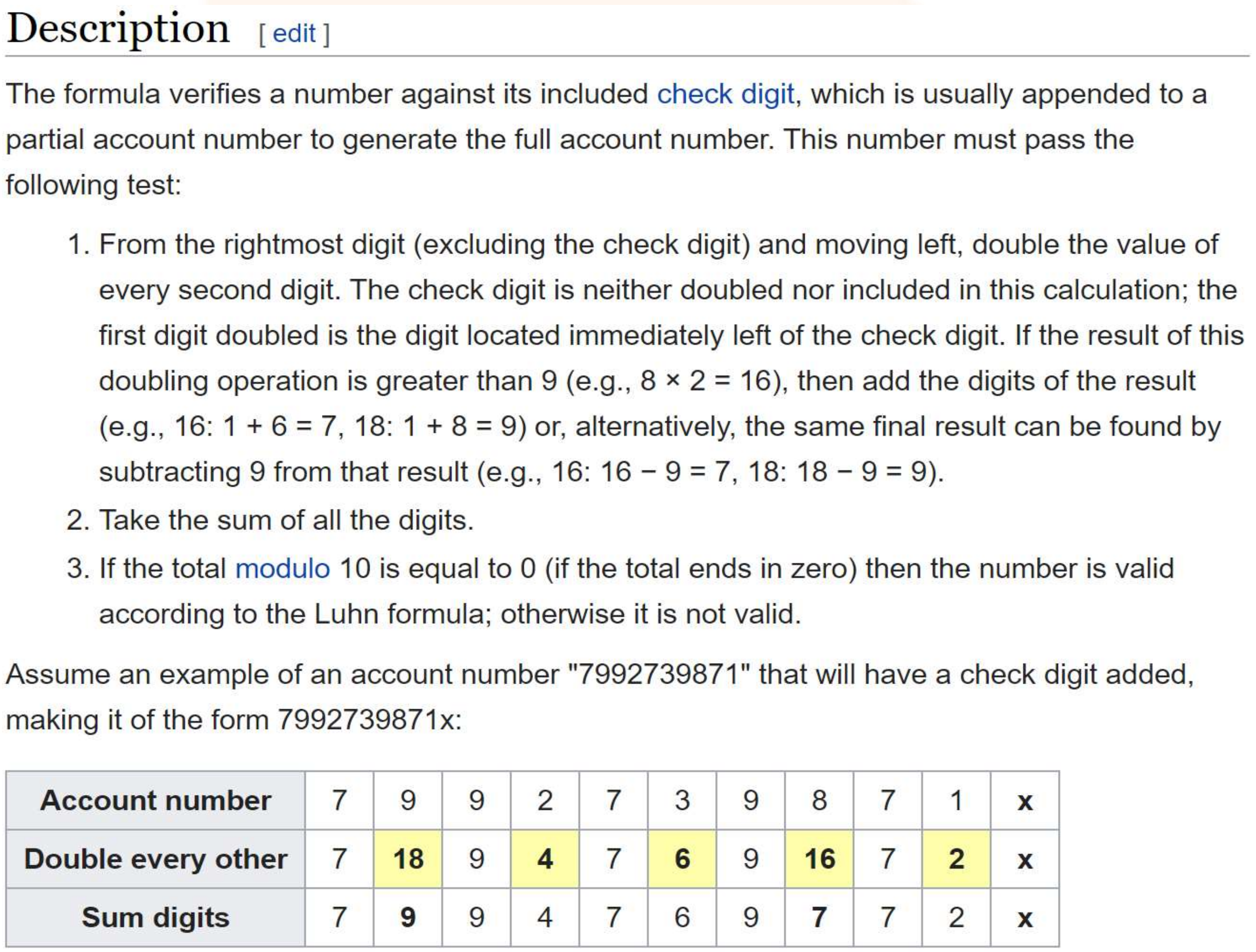
He ***discovered*** it!

(Bernard Legrand)

Notation
vs
Programming Language

The most successful APL users did not have programming as their primary skill

The Luhn algorithm (according to WikiPedia)



Description [edit]

The formula verifies a number against its included check digit, which is usually appended to a partial account number to generate the full account number. This number must pass the following test:

1. From the rightmost digit (excluding the check digit) and moving left, double the value of every second digit. The check digit is neither doubled nor included in this calculation; the first digit doubled is the digit located immediately left of the check digit. If the result of this doubling operation is greater than 9 (e.g., 8 × 2 = 16), then add the digits of the result (e.g., 16: 1 + 6 = 7, 18: 1 + 8 = 9) or, alternatively, the same final result can be found by subtracting 9 from that result (e.g., 16: 16 − 9 = 7, 18: 18 − 9 = 9).
2. Take the sum of all the digits.
3. If the total modulo 10 is equal to 0 (if the total ends in zero) then the number is valid according to the Luhn formula; otherwise it is not valid.

Assume an example of an account number "7992739871" that will have a check digit added, making it of the form 7992739871x:

Account number	7	9	9	2	7	3	9	8	7	1	**x**
Double every other	7	**18**	9	**4**	7	**6**	9	**16**	7	**2**	**x**
Sum digits	7	**9**	9	4	7	6	9	**7**	7	2	**x**

Array Oriented Luhn

CardNo

7	9	9	2	7	3	9	8	7	1	3

```
Body←(Count←¯1+≢CardNo)↑CardNo
```

```
Check←⊢/CardNo
```

Body

7	9	9	2	7	3	9	8	7	1

3	Check

```
Weights←Count⍴(2|Count)⌽1 2
```

Weights

1	2	1	2	1	2	1	2	1	2

```
Products←Body×Weights
```

Products

7	18	9	4	7	6	9	16	7	2

```
Digits←0 10⊤Products
```

Digits

0	1	0	0	0	0	0	1	0	0
7	8	9	4	7	6	9	6	7	2

SumDigits

67

```
SumDigits←+/,Digits
```

```
Check←10|-SumDigits
```

3	Check

Functional

+

Array Orientation

=

Mechanical Sympathy

Criticisms of APL

Criticisms of the APL **Language**

Weird Symbols

Infix Notation for ALL functions

Operators vs Functions

No Type Declarations

Dynamic Scope / Global by Default

Strengths of the APL **Language**

Wonderful Symbols
Infix Notation for ALL functions
Operators vs Functions
No Type Declarations
Dynamic Scope / Global by Default

Oh all right then,
we *have* added...

control structures
local-by-default lexical scope
and OOP (if you must)

but

:Repeat … :Until

and

:Implements Constructor

… are not part of ***the notation***

How do we ensure that the notation is still relevant on Iverson's 200th birthday...

(in other words, when Python and Javascript have been swept aside,
[web] platforms have matured,
GUI and Security API madness is behind us?)

NOT by making the language more like Python & JavaScript!

Criticisms of APL

Criticisms of APL **Eco-Systems**

Poor libraries & poor library support in the language
Insufficient training materials and samples
Closed, ageing community
"Corporate" rather than "Hacker" vibe

... fair enough, we will work on these

There is a steady supply
of people who want to learn
how to solve problems
on a computer...

I am a high school student.
This is the fourth year I am entering this competition.
I really enjoy it every year.

I am a big fan of the array-oriented approach I get to use with APL.
I feel like I spend a lot more time focusing on solving the problem
instead of having to focus on syntax like with other languages.

I am also familiar with C# and Python
but APL is definitely my favourite language.

Poetry

```
      rippleShuffle ← {⍵[⍋⍒(⍴⍵)⍴1 0]}
      rippleShuffle ⍳10
0 5 1 6 2 7 3 8 4 9
```

```
      nestDepth ← {+\-⌿'()' ∘.= ⍵}
      nestDepth 'a←(2×(3+4))÷10'
(formatted)   00111222210000
```

```
      nextPascal ← {(0,⍵)+(⍵,0)}
      nextPascal 1 3 3 1
1 4 6 4 1
```

```
      mean ← +⌿ ÷ ≢
      mean 1 2 3 4
2.5
```

```
      palindrome ← ▯≡⌽⌽≡▯
      palindrome 'ABBA'
1
```

```
      leapYear ← 0 ≠.= 4 100 400 ∘.| ⊢
      leapYear 2020
1
```

```
      {(⍳2×⍵ ⍵)∊↓⍉⍵+⌊⍵×1 2 ∘.○ ○+\200/0.01} 5
0 0 1 1 1 1 1 1 0 0
0 1 0 0 0 0 0 0 1 0
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
0 1 0 0 0 0 0 0 1 0
0 0 1 1 1 1 1 1 0 0
```

You have been using the same programming language for more than 30 years, and you are still smiling!?

(comment from young Indian programmer after an APL talk at FunctionalConf, Bangalore)

```
      {(⍳2×⍵ ⍵)∊↓⌽⍵+⌊⍵×1 2 ∘.○ ○+\200/0.01} 5
0 0 1 1 1 1 1 1 0 0
0 1 0 0 0 0 0 0 1 0
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0 1
0 1 0 0 0 0 0 0 1 0
0 0 1 1 1 1 1 1 0 0
```

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