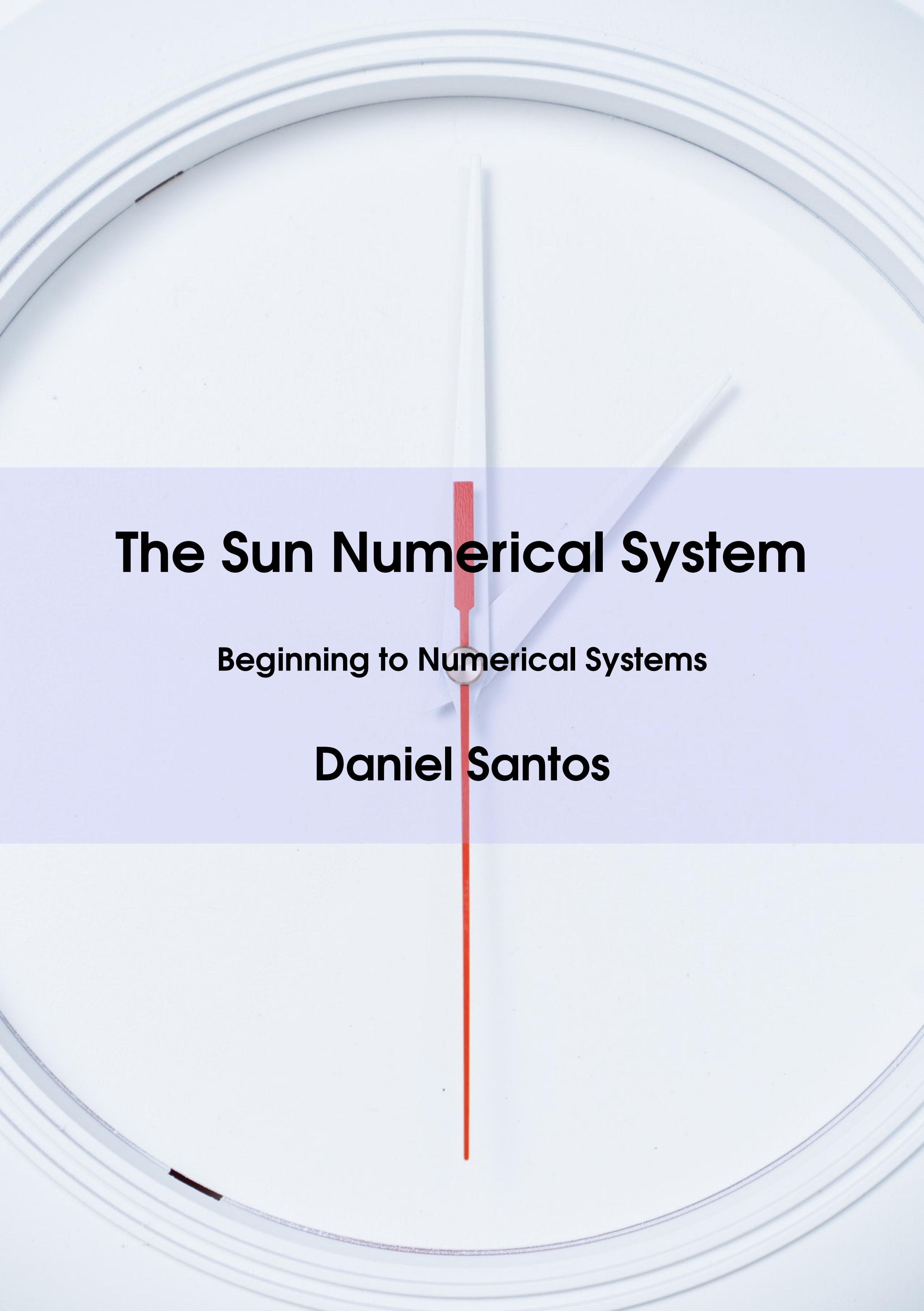

The Sun Numerical System

Beginning to Numerical Systems

Daniel Santos

PRAISE FOR THE SUN NUMERICAL SYSTEM

This book helps to understand better different numerical systems. Also, the author highlights some issues of existing numerical systems and provides interesting approaches to avoid these issues. The book could be interesting for people who like mathematics, computing theory, any related fields like programming, or just want to have a good time training their brains!
- Hleb Kastseika, Senior Software Engineer, Finland

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For Ana, Sister, and Mom

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Part One

1. Introducing dimensions

1.1 Dimensions

Comprehending the dimensions, is important to comprehend the nature of numbers.

So, let me introduce you to what I call **dimensions**.

There is the first dimension, that is a *point*. This dimension represents the "is". In this dimension, there can only be known "is" or a "ain't". Since a "ain't" is not recognized, in this dimension it can only be known "what is". If "it is", a point can be used to represent it.

The second dimension, it is represented by a *line segment*; or, as I like to call it, a *line*. This line, as well as everything; it finite. It has a beginning and an end. The conception of an infinite line makes little sense; as well as a conception of something infinite. So, I like to call a line segment as just a *line*.

This second dimension adds 2 more concepts (besides the already explained concept of "is"). It adds the concept of forward and backward. This second dimension, you can know what is, and you can know if *is* *backward* or if *is forward*.

The second dimension is much like a train line: there can be a train (the is) and this train can only go forward or backward. These are the only options. And if the train is still, it can be said that the train *is*... just is.

The third dimension, it is represented by a *circle* (and the circle internal space). In this circle you can go to the front, to the back and to *the sides*.

Like a compass, imagine that to the front is North, then, in this dimension you can go Southeast, Northeast, East, West, South, North, etc.. You have a wide range of possibilities, like we have with our bare foot on Earth. You can also go 32° to the right of Northwest, as an example of a possibility.

The forth dimension is a *sphere* (and its internal space). This forth dimension adds 2 more concepts: the *upward* and the *downward*.

Like 2 compass making a cross, you can go North North which will mean going to the front upwards. You can also go West South which will mean going to the left and downward in a proportional way (which is with an angle of 45° between the West and the South axis). Much like we have when navigating in outer-space, the 4th dimension is navigating in outer-space, free from the gravity pull.

This introduces to what I mean by dimensions (first dimension, second dimension, third dimension, etc.). I am writing about dimensions because I want to tell you that numbers belong to the second dimension.

Much like a train, with bare numbers, you can only go front and back.

Nowadays, we call a number "bigger than other" number, like the number is upper than the other; but what we should be calling is a number is "in front of" another number. Since trains can only go to the front and back (and in a line), you can only go forward or backward. So a number, in relation to the other number, can only be in front, or on the back; or be the same number.

This means that the "nature of numbers" is second-dimensional (unidimensional in today's terms). Knowing that dimensions relates to space, and how the numbers *stand* in space. A number is in the front or is in the back or is the same.

By using numbers, we are representing the second dimension.

1.2 The reference point

Things should always start with what is called *the reference point*.

This reference point can be a topic of the conversation; the current location where you are standing; the family of species that you are decided to investigate.

Everything starts with the *reference point*.

The reference point determines the "is".

In terms of dimensions, the reference point correlates to the first dimension. Only after the first dimension being established, can we go to the second dimension. This second dimension is the dimension of numbers, as I have said earlier.

So, the reference point of the numerical system of this book, is, what we know as the number 1. The number 1 represent the concept of the "is" in numbers. In this second dimension, this concept takes the form of the number 1. And is the 1st (first) number of this numerical system. (Contrary to the decimal system, which the 1st number is the number zero, 0)

This numerical system, the Sun numerical system, begins with this *reference point*, which is the number 1 (one).

2. The Zero Problem

2.1 The Zero Problem

Numbers serve for counting.

The first number on the decimal system is zero, and counts nothing.

This is silly. Have you ever *seen* nothing? No. Have you ever *seen* one thing? Yes. I *see* one in everything, every time. How about yourself?

For me, it makes sense that 1 (one) is the basic number; the *reference point* of the numerical system. Let's be bold! I am going to use a numerical system that starts with 1.

So, 1 (one) is the 1st (first) number. It make sense! It is logical.

2.2 Sequential numbering

If I use a numerical system were numbers go from 1 until 9, the numbers go as this:

1 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 21 22 23 ...

Pretty normal, yes?

Coming from the decimal system, you may find this normal. In fact, this sequences of numbers makes sense. But what may have escaped you, is that the *decimal system* has an abnormal sequence of numbers.

2.3 Abnormal Decimal Sequence

In the decimal system, the number sequence goes as the following:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 ...

So, analysing this thoroughly, the first number is 0.

When all the *one digit numbers* (also known as *numerals*) are used, the decimal numerical system uses its *second number* (the number 1) with the rest of the one digit numbers (see 9 ***10*** **1**1 **1**2 ...). We never use the first number (the number 0) when we ended up using the one digit numbers.

This skip of the number 0, makes the decimal system number sequence, abnormal.

A normal sequence of the decimal system would be:

0 1 2 3 4 5 6 7 8 9 01 02 03 04 05 06 07 08 09 10 11 12 13 ...

This unfortunately is not what the decimal system is about. The decimal system features a *infinite reference point* or an *absolute reference point*, or, as I like to call it, an *infinite base point*. Which is the *infinite zero*.

2.4 Infinite Reference Point?

In the decimal system:

00 = 0, 000 = 0, 0000 = 0, ...

this made 0 an infinite number.

This infinite number is kind of primitive. The infinite number is also the root cause of the abnormal sequence of the decimal system.

R Experimenting and working with the soroban abacus, makes this feature of zero being an infinite number, easier to understand to the mind.

So, I could make the number 1 an *infinite base point* for this new numerical system. This would be *standard*. But, in this new numerical system, I want to tackle both the *worthless* and the *infinity*. By making the first number, the number 1, I am getting rid of the worthless zero; and now I want to tackle *infinity*.

So, the first number on the Sun numerical system will be a normal base number, not an *infinite base point*. This takes care of the *infinity*, in the proprieties of the first number. But still, there is *infinity*... the numbers can grow towards *infinity*. For this, I am introducing a new concept: *domains*.

The Sun numerical system will use *Domains*, because it is my opinion that they are the best approach for numerical systems. But since the notion of domains is not quite well understood by many people, let me first explain what *domains* in a numerical system is.

3. Theory of the Sun System

3.1 Domains

Domains are zones with boundaries. Domains are: *the scope of the current analysis*.

Domains say where to start from, and where it (the numbers) can reach to; creating a sort of a field. For example, a domain may start in 1 and reach until 99. In this case, the 1-99 range of numbers, is what is called the *number domain*.

Domains came from the notion of containers. For example, a bag or a cup. There is limited number of units that a bag or a cup can hold. This is why *domains* make sense. All the containers can hold only limited amounts of units.

And with *domains*, there is also other concepts that come along. I will introduce them in the next section.

3.2 Domain Number Theory

Domain Number Theory is the theory of *number domain*. See the following diagram:

$$\underbrace{\varnothing}_{\text{Empty}}$$

$$\underbrace{1\,2\,3\,4\,5\,6\,7\,8\,9\,11\,12\,13\ldots71\,72\,73}_{\text{Number Domain}}$$

$$\underbrace{\oplus}_{\text{Full}}$$

According to this theory there are 3 concepts: *Empty*, *Number Domain* and *Full*. I must reinforce that these are *concepts*, not numbers. They are similar to the concepts of nothing, something and everything.

The *Empty* concept is no number.

The *Full* concept is the number that cannot fit into the domain.

The *Number Domain* concept is the range of numbers that fit into the domain. For example, a domain may be a small cup and we may be counting the number of rice grains.

So, as you can see, in *Domain Number theory*, the numbers don't go into the infinity, and the number range, also known as *Number Domain* is surrounded by *Empty* and *Full*.

This gives some peace of mind to the counting people... the counting has a stop.

There is also 2 more concepts to know, that happen to be numbers, so these are part of the *Number Domain*: the *Minimum* and the *Maximum*.

The *Minimum* is also the first number of the *number domain*, and the *Maximum* is also the last number of the *number domain*.

In this case the *Minimum* is 1 and the *Maximum* is 73.

There is no 0 (zero) or 74. If you want to say 74 or a number above, you say *Full*. If you want to say 0 or a number below, you say *Empty*.

3.3 Numeral Placement

The numeral placement is the same used in most, if not all, numerical systems. It is an equal-numeral case placement; meaning that each case support an equal number of numerals.

For example, if the numerical system is from 1 until 9, each case supports 9 different numerals.

The case placement of a numeral represents the cycle number of the last case placement.

Except for the units case place, which represents the existing number of units.

This is exactly the same as with the decimal numerical system.

The direction order in which the numbers are read and written is a bit different.

3.4 Direction Order of Number

In English (and, I believe, in all European languages) we write words and letters from the left to the right.

So, it would make sense if the number's *unit place*, which is the place in which I start to count our numbers, was on the left. And expanded to the right. This would correlate with letters expanding into words, and words growing into phrases.

But, the direction order in the decimal numerical system that I got taught, is from the right to the left. This means that the units place is on the right, and it expands to the left.

In English this direction order of the decimal numerical system numbers is contrary to the flow of our writing, and I propose that the writing direction of numbers maintains from the left to the right, beginning with the units place on the left. So, the units place should be on the left of the number.

In the numerical system of this book, I am going to write numbers with the units place on the left, from now on. And expanding to the right. Like so:

1 2 3 4 5 6 7 8 9 11 21 31 41 51 61 71 81 91 12 22 32 ...

> **R** Arabic countries, which was where the numerals of the decimal system was created, write from the right to the left. And their numbers expand from the right to the left, with the units place on the right.
>
> Maybe this explains why, today, we write decimal numbers the way we do, with the units place on the right, contrary to our writing and reading direction.

3.5 Number Speaking

Now that the direction order of numerals are corrected, let me makes one more complication fall down: number speaking.

Today, when I have a big decimal number, for example, 473892, it is said as: four hundred seventy-three thousand eight hundred ninety-two. This means that, for the decimal way of a number to be spoken, I have to start to read from the left and count the number of cases until the end of the number (!); then I may begin saying the first digit word (on the left).

After that I repeat the same process for the rest of the digits. This process is overwhelming for the brain. There is a lack of flow in this process.

So, this numerical system will have none of that complication. To say any numbers, I will speak a digit one by one; since it is simpler and it reaches the same goal as the decimal way of saying a number.

So, to say the decimal number 473892, first, I am going to convert it to the 1 until 9 numerical system (the Sun numerical system) using a software, which gives me the corresponding number of 791946. Then I invert the order of the numerals, so that the units place is on the left. It gives me the number 649197. Now I say the number, like this: six four nine one nine seven. This is the Sun numerical system way of saying a number, from the above decimal number of 473892.

R The steps of using the software to convert the number from other numerical system is only necessary when I am picking up a number from a different then the Sun numerical system. If the number already is in the Sun numerical system, the conversion step is skipped.

I have made the software for conversion of numbers between different numerical systems available at: https://gitlab.com/alexandre1985/numericx-c/

To say the number, I simply say each numeral (or digit) how it is presented. I don't need to count the number of cases and I don't need to know twelve, forties, hundreds, thousands, all of that big wording just to say a number. In this system there is only 9 words, and I can say all the numbers that I like. Simple, effective.

3.6 Golden Rules for Numeral System

Let's establish some golden rules for this type of numeral system:

1. any number can not represent nothing (empty) and can not represent everything (full)! Any number can represent something only (the number domain).
2. to represent empty (nothing) or to represent full (everything) a *concept* may be used, in the same manner that ∞ (infinity) is a concept nowadays.
3. direction order of a number is the same as the direction order of words.

Part Two

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