prudentia

HIGH IQ SOCIETY FOR THE TOP 1/250 OF THE POPULATION

VOLKO TEST OF ORIGINAL THINKING

THE UNIVERSE AS AUTOMATON

CAN THE STATE OF THE UNIVERSE BE STORED ON A COMPUTER?

Journal Issue #5 – March 8th, 2019

EDITORIAL

Welcome to the fifth issue of Prudentia Journal!

In this issue the new "Volko Test of Original Thinking" is presented. Moreover, I republished two articles on the universe, which I wrote already a couple of years ago and originally published in IQ Nexus Journal and WIN ONE, respectively.

I hope you will enjoy the test, and I am looking forward to your answers.

Enjoy reading!

Claus Volko, cdvolko (at) gmail (dot) com

VOLKO TEST OF ORIGINAL THINKING

About this test: This test is supposed to measure the ability of original thinking, that is, the ability to come up with ideas that make sense. This is an important ability in problem solving.

This test is scored twice: you get an absolute score for the number of answers I accept, plus bonus points, and you get a score for the ratio between the outcome and the time invested. For this reason please do not forget to measure the time you spend on this test and please be honest about it in order not to contort the statistics. It is recommended that you do not spend more than a hour on this test.

Send your answers to cdvolko (at) gmail (dot) com and please be patient as I am a busy person.

1. A number sequence starts with: 1, 2, 4. What could be the next two numbers in this sequence? Write down non-random answers that make sense in your eyes and provide logical explanations for them. The more answers that make sense you write down, the higher will be your score. You will, in addition, get a bonus point for each logical principle by which the fifth number in the sequence becomes lower than the fourth number.

2. What may an apple and a pear have in common? Again, the more possible answers you provide, the higher your score.

3. What may be the differences between a (particular) city and a (particular) village? Again, the more possible answers you provide, the higher your score.

4. What can a pencil be used for? Again, the more possible answers you provide, the higher your score.

5. How long did you work on this test, so that I can calculate a ratio between the outcome and the time invested?

Claus Volko, cdvolko (at) gmail (dot) com

THE UNIVERSE AS AUTOMATON

Preface: I am not a physicist by training, but the following text will contain a few thoughts about physics from the perspective of a theoretical computer scientist.

Recently there have been several publications by members of high IQ societies concerning the universe and, most of all, the question of the number of dimensions that there are. Here are my thoughts on that matter.

I believe there are really only three dimensions of space. I believe so because human beings can only move in these three dimensions, even if we make use of all the technical gadgets we have. If, as I also believe, space is discrete - that is, it consists of many small points similar to the pixels of a screen - the current state of the universe could be modeled as a three-dimensional matrix. Einstein considered time the fourth dimension, but this was a formalism to better describe his theory. In my opinion, however, time is something different than space. Nevertheless one may add time as a fourth dimension to this matrix; this results in a four-dimensional matrix able to represent the state of the universe at any point in time. (NB: This representation is only theoretical as it is not possible to have something that is as large as the entire universe represented by a computer - except, maybe, if it has enough redundancy that a suitable data compression algorithm could be applied...)

Would the use of even more dimensions make sense? Yes; at least one more dimension would make sense. Some people believe in the existence of parallel universes. And even those who don't believe in that usually concede that not everything is happening in a deterministic manner. So there are several possible states per point in time. These states could be represented by a fifth dimension. What is especially interesting is the question where transitions between states are possible. And that's basically what physics is all about. If it is possible to have the universe represented by a five-dimensional matrix, then what physics deals with is the possible transitions between the states. This would make the universe what theoretical computer scientists call a deterministic, finite automaton.

I haven't talked about the size of the universe yet. If the hypothesis is right that there was initially just one point and the universe expanded with time, this means that the number of states per unit of time is growing with time, as well as the number of transitions. I consider this idea intriguing. I also admit that it is probably not too original since it is quite natural to come up with it for someone educated in theoretical computer science. Stephen Wolfram's "A New Kind of Science" seems to head into a similar direction; also, google up the keyword "cellular automata".

One thing that is interesting (amongst others) is that every deterministic finite automaton can be represented by a regular language. Might it be possible that the universe can be represented by a regular language? If it is, then this is the "theory of everything" which physicists are currently searching for. That said, I honestly think this concept is worth pursuing!

Claus Volko, cdvolko (at) gmail (dot) com

CAN THE STATE OF THE UNIVERSE BE STORED IN A COMPUTER?

This article is a follow-up to my essay "The Universe as Automaton". There, I developed the idea that the state of the universe might be modeled as a three-dimensional matrix and that the entire history of the universe could be represented as a state machine (automaton). In this article I also wrote: "It is not possible to have something that is as large as the entire universe represented by a computer - except, maybe, if it has enough redundancy that a suitable data compression algorithm could be applied." This is what I would like to investigate further now. Can a state of the universe be stored on a computer harddrive? What obstacles are connected with this endeavour?

As a computer is part of the universe, it is obvious that the state of the universe can be stored on its harddrive only if we use some sort of encoding that acts as a data compressor. After all, the file that stores the state of the universe must restore itself upon unpacking since it is part of the universe. In other words, the problem number one is whether it is possible to create a compressed file that, on unpacking, recreates itself, apart from recreating everything else.

Unless we answer this question, it makes no sense speculating about the effort required to predict the next state of the universe based on a compressed file containing the current one, and whether this prediction can be done approximately in real-time or whether the universe will be already ahead a couple of states before we finish our prediction.

Let us simplify the question. Let us assume a linear memory consisting of n bits, where n = a + b, with a being the number of bits in the memory that are not part of the compressed file (but will be reflected by the contents of the compressed file) and b the space reserved for the compressed file to be created. The compressed file is supposed to have a size of b bits, but its contents must, upon unpacking, amount to the entire memory consisting of n bits. Is this possible?

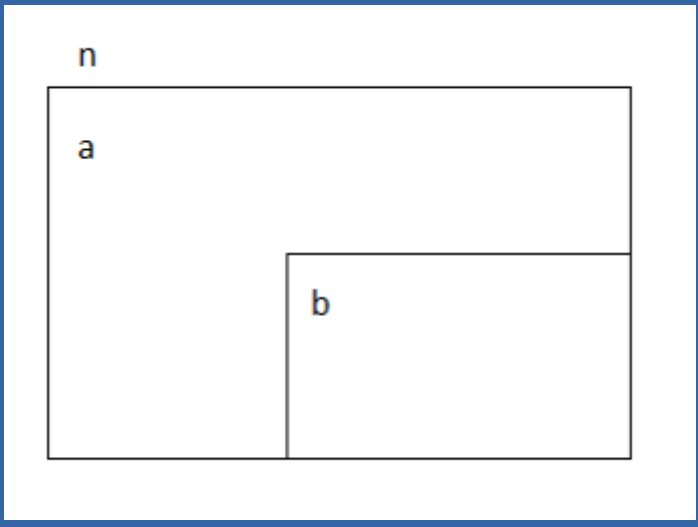

Figure 1: The entire memory consists of n bits. It is divided into a part of a bits and a part of b bits, where the latter part is reserved for the compressed file which, upon unpacking, must reflect all of the n bits of the entire memory.

There are many compression algorithms used in computer science, one of them being run-length encoding (RLE). So if the data we want to compress consists of a lot of zeros following one another, we can write into the compressed file the digit zero followed by the number of repetitions. If the data consists of a lot of zeros and ones alternating each other, then we can write into the compressed file the number two to signify that it is two different digits that alternate, followed by these digits (zero and one), finally followed by the number of repetitions. If we reserve three bits for the number of digits alternating and ten bits for the number of repetitions, then we can store a sequence of seven bits that is repeated 1023 times in just 3 + 8 + 10 = 21 bits, while in the uncompressed data this repeated sequence would amount to 7161 bits - so we have saved 99.7% of the original space. This shows that, in theory, RLE is a very powerful compression algorithm.

Of course, we must also consider that there might be sequences that cannot be compressed this way. If we wanted to store just one digit (zero or one), we would have to use 1 + 1 + 10 = 12 bits, which is very much considering that a single digit (zero or one) occupies only one bit in the original file. The solution would be to use special codes for turning RLE off and on again, such as a sequence of four digits 0000 and 1111, where 00001111 would be interpreted as four ones and only the next incidence of 1111 would turn RLE on again.

If we do it this way, we might really be able to encode n bits in b bits, where b is less than n. However, there might be a requirement regarding the relation of b to a, i. e. a minimum size. This we would have to further investigate. Also, we must consider that the pointer that points to the data that is to be compressed will sooner or later reach the beginning of b, in which point of time b can be divided into b' (which is the encoded state of a) and c (which has not been written yet and is going to start with the encoded state of b'). As soon as the pointer has reached c, we can further divide it into c' and d in an analogous fashion, and once d is reached, we can divide it into d' and e, and so on. Ultimately, the size of c', d', e', ... must converge to zero, otherwise it will not work. What is the relation of c to b' required to make this work? That is also something that should be investigated.

If we ever reach the state that the rest of the file is about to encode itself - can this be achieved? Yes, it can: We can achieve this if RLE has been turned off. Then the file corresponds to itself. Alas, is it always possible to achieve that once this state is reached, RLE is turned off? Is it also possible to succeed if RLE is turned on at this point of time? Are there any restrictions regarding the remaining space? All of these are highly interesting questions and I will leave it to you to speculate about them.

Claus Volko, cdvolko (at) gmail (dot) com

LEGAL STUFF

Official website of Prudentia Journal:
http://www.prudentia.club/