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About One way of Encoding Alphanumeric and Symbolic Information

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Abstract

The number of letters and various symbols in the computers do not exceed 256 symbols, which caused a problem in a different encryption codes in various languages around the world, that's why in this article proposes a new way to increase the number of symbols,
A new coding method for alphanumeric information is described, It is based on the M-form of the Fibonacci code, which allows to increase, the number of coded characters and provides the control of the characters formation storage and transmission.

Keywords: *Fibonacci numbers, alphanumeric and symbolic information, Encoding.*

1 Introduction

So far as person and computer may operate the same information, there are two ways of representing the information: visual and automatic. Visual way of representing the information has convenient form and it is easy to percept. Automatic representing must supply effective processing of digital automatons.

That is why there is a necessity of transforming visual way of representing the information into automatic. This process is called information encoding. Encoding is a process when symbol's order of source is changed by order of code symbols – code combination (code word) [1].

Encoding has several aims. The first is to present information in such symbolic system which would supply simplicity and safety for hardware support of informational appliance and its necessary effectiveness.

The second aim of encoding is to supply the best equivalent of source information characteristics with characteristics of link. We achieve saving of transmission time by using this equivalent. It also means growth of system effective-

ness. At last, when we have interception, encoding may supply sufficiently high probability of transmission and information processing.

Dual code, which is widely used in transmission processing, in saving and processing information, is inconvenient during insertion and removal of information, because it is hard for the operator to handle with unusual dual numbers. Besides, writing numbers in dual code is hungus.

2 Alphanumeric and symbolic information

Modern computers process not only numeric but text information. In other words alphanumeric information which include numbers, letters, separators, mathematic and other symbols. Economic, production planning, accounting information, and also program text which is written in algorithmic language has just that character. This information has such characteristics, while displaying it we use words with different length.

The possibility of insertion, processing and displaying of alphanumeric information has important meaning for solving mathematical problems. It helps to arrange calculation results in convenient way, such as tables with necessary topics and explanations or formulas.

The package of all symbols which are used in computer system is its alphabet. Computer's information unit corresponds to symbol. This order group, which serves to display symbols in computer, uses different variants of coding symbols with codes of different length [2,7].

While choosing way of coding, it is necessary to take into account the amount of alphabet symbols and demands, connected with simplification of automatic data processing. The greatest distribution has displaying alphanumerical information in binary calculus system with the help of eight-digit structure which is called byte. One may encode 256 different digits with the help of byte. But using computers there is a necessity to use large amount of symbols, which appears by inputting additional features of eight-digital structures. Besides, eight-digital symbols representation does not provide control of correctness formation code of pressed button. To remove this shortcoming, earlier it was suggested to control by adding one checking digit to seven-digital structure. But using this, the amount of probable encoding symbols was two times less in comparison with eight-digital structure [5,6].

It is recommended to use Fibonacci code to enlarge the amount of encoded symbols and to provide control of forming code symbols [3,4,8].

3 Coding Method

It is known [3,4] that any positive whole number may be represented as

$$N = \sum_{i=1}^{n} \alpha_i . \varphi_p(i) \qquad (1)$$

where $a_i = \{0,1\}$; $\varphi_p(i)$, p - is i Fibonacci number, which is calculated with the help of recurrence relations

$$\varphi_p(i) = \varphi_p(i-1) + \varphi_p(i-p-1) \qquad (2)$$

For $\varphi_p(0) = 0$;

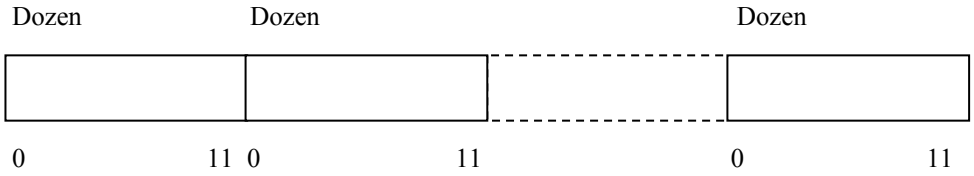
$$\varphi_p(1) = \cdots = \varphi_p(p) = 1 \quad i = p+1;\ p+2, \ldots \quad p = 1, 2, \ldots$$

Sequence a_n , a_{n-1}, …, a_2, a_1, which is on (1) is called Fibonacci p-code for number N. Fibonacci p-codes are redundant codes, that is why any number in "Fibonacci" set of numbers has set of images (different codes), and one single image is picked out among them (M-form). M-form ensures control after code combination correctness.

Availability of units in (p+1) next byte is the feature of M-form breach.

The least redundant are Fibonacci p-codes when p=1, that's why they have the greatest usage.

It is necessary to use 12 digits of 1-code Fibonacci to provide encoding of more than 256 symbols. The composition of such length which is used to encode symbols is called a dozen.



For dozen we will have the following sequence of value digits

233 144 89 55 34 21 13 8 5 3 2 1

When you use only M-form code, then the given sequence of value digits provides image of 377 different symbols.

The increment of value of possible codes allows to input to known symbols additionally symbols of Greece, Arabic and Russian alphabet and some mathematic symbols [1].

The division of different symbols depends on division of symbols into groups: Russian, Latin and Greece, and Arabic alphabets (capital and small letters), numbers 0-9, the groups of indicating and special symbols, the groups of mathematical symbols, the groups of functional symbols (see table 1).

Table 1

0	0	0	0	0	0	0	0	0	1	1	1	1	1
1	0	0	0	0	0	1	1	1	0	0	0	0	0
2	0	0	0	1	1	0	0	0	0	0	0	1	1
3	0	0	1	0	0	0	0	1	0	0	1	0	0
4	0	1	0	0	1	0	1	0	0	1	0	0	1

5	6	7	8	9	10	11	N	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	–	log			ESC		0		\	⊗			F1
0	0	0	0	0	0	1	1	{	Ln	A	a	PrSc	A	1	A	,	⊕	a	α	F2
0	0	0	0	0	1	0	2	}	x^y	B	b	ScLc	B	2	Б	[	·	б	β	F3
0	0	0	0	1	0	0	3	©	inv	C	c	Paus	X	3	B	]	∫	в	χ	F4
0	0	0	0	1	0	1	4	®	hyp	D	d	Tab	Δ	4	Г	:	∬	г	δ	F5
0	0	0	1	0	0	0	5	!	0,,,	E	e	Cps	E	5	Д	≈	∭	д	ε	F6
0	0	0	1	0	0	1	6	?	sin	F	f	Sh	Φ	6	E	<	∮	е	ϕ	F7
0	0	0	1	0	1	0	7	^	cos	G	g	Ctrl	Γ	7	Ж	>	∯	ж	γ	F8
0	0	1	0	0	0	0	8	|	tg	H	h	Alt	H	8	З	%	∰	з	η	F9
0	0	1	0	0	0	1	9	;	$\sqrt{x^2}$	I	i	Ins	I	9	И	≅	+	и	ι	F10
0	0	1	0	0	1	0	10	@	x!	J	j	Hom	K		Й	∅	-	й	φ	F11
0	0	1	0	1	0	0	11	#	x	K	k	PgU	Λ		К	∞	=	к	κ	F12
0	0	1	0	1	0	1	12	⇒	n	L	l	PgD	M		Л	(	≠	л	λ	
0	1	0	0	0	0	0	13	⇐	σn	M	m	End	N		M	)	÷	м	μ	
0	1	0	0	0	0	1	14	⇔	MR	N	n	Del	O		Н	∪		н	ν	
0	1	0	0	0	1	0	15	⎡	∑	O	o	Num	П		О	∩	±	о	ο	
0	1	0	0	1	0	0	16	↑	π	P	p	Del .	Θ		П	≤	×	п	π	
0	1	0	0	1	0	1	17	↓	EXP	Q	q	Ins 0	P		P	≥		р	θ	
0	1	0	1	0	0	0	18	→		R	r		Σ		C	| |		с	ρ	
0	1	0	1	0	0	1	19	←		S	s		T		T	∨		т	σ	
0	1	0	1	0	1	0	20	⎣		T	t		Y		У	∧		у	τ	
1	0	0	0	0	0	0	21	◊		U	u		Ω		Ф	⊂		ф	υ	
1	0	0	0	0	0	1	22	“		V	v		Ξ		Х	⊄		х	ϖ	
1	0	0	0	0	1	0	23	∇		W	w		Ψ		Ц	∈		ц	ω	
1	0	0	0	1	0	0	24	¤		X	x		Z		Ч	∉		ч	ξ	
1	0	0	0	1	0	1	25	*		Y	y				Ш	⊆		ш	ψ	
1	0	0	1	0	0	0	26	&		Z	z				Щ	⊇		щ	ζ	
1	0	0	1	0	0	1	27	$							Ы			ы		
1	0	0	1	0	1	0	28	~							Э			э		
1	0	1	0	0	0	0	29	№							Ю			ю		
1	0	1	0	0	0	1	30								Я			я		
1	0	1	0	0	1	0	31								Ь			ь		
1	0	1	0	1	0	0	32								Ъ			ъ		
1	0	1	0	1	0	1	33													

While making the table we will follow the next rule: the symbols of all above mentioned groups are encoded by the same codes. A group feature defines as some code combination. The amount of digits which are necessary for encoding all symbols from the group we will choose on the basis of maximal amount of symbols in a group.

The group which has maximal mount of symbols is a group of Russian alphabet (31 symbol).
That is why to encode the symbols we will use 7 digits.

A 5-digit code combination will be used as a feature. Thereby the code table will have such size 34x13. But not all cells will have symbols. On the basis of M-form features, we have such rules: if the lower digit of code combination is 1, then the high-order digit code can not have 1. That is when lower digit of code combination is 1, then the codes of symbols, which has 1 in the high-order digit is not used.
The codes of proposed Fibonacci symbols computer alphabet are given in the table 1.

Below there are examples of encoding alphanumeric codes while using Fibonacci code in word "Jordan" and number -5.239.

Word „Jordan":

J o r d
000100010010. 000100100010. 001000101000. 001000000101.
a n
001000000001. 001000100001.

Number - 5, 239

\- 5 .
100010010010. 010010001000. 100000000001.
2 3 9
010010000010. 010010000100. 010010010001.

The coefficient of error detection for M-form, n-bit Fibonacci p-code is calculated by the formula [3]:

$$S_{\text{det.}} = 1 - \frac{\varphi_p(n)}{2^n}.$$

For a dozen $S_{det.}$ = 0, 908, which significantly exceeds the rate of error detection code for the control of parity, which is equal to 0, 5.

4 Conclusion

The proposed method of encoding symbols using the M-form of Fibonacci code allows increasing mount of symbols, and provides control of the formation, storage and transmission of character code.

5 Open Problem

The development of computer systems always require the search for new numbering systems that able to resolve the problems in the current computer system, including that there are computer systems designed based on the Fibonacci numbering system, as proven systems on their ability and success in many cases, such as accuracy of the calculations. For this reason, incoming importance of developing this system in terms of encryption and increase the speed and the implementation of the calculations and other.

References

[1] B. M. Kagan Electronic computers and systems. - M.: Energoatomizdat, (1991) 592 p.

[2] I. V, Kuzmin, V. A. Kedrus. Fundamentals of Information Theory and Coding /- 2 -:high school. Leading Publishing House, (1986) 238 p.

[3] A.P. Stakhov and V.A. Luzhetsky, Machine arithmetic of digital computers in Fibonacci codes and golden proportion. M., Scientific Council of Academy of Science of the USSR on complex problem. Cybernetics: (1981) 64p.

[4] A.P. Stakhov, Fibonacci matrices, a generalization of the cassini formula and a new coding theory, *Chaos Solitons and Fractals* 30 (2006), pp. 56–66. Article.

[5] Sakamura, Ken. "Multi-language Character Sets Handling in TAD." TRON Project 1987 Open-Architecture Systems: Proceedings of the Third TRON Project Symposium. Tokyo: Springer-Verlag, (1987), pp. 97-111. (The contents of this paper are available on TRON Web, click here.)

[6] Sakamura, Ken. "Multilingual Computing as a Global Communications Infrastructure." *Proceedings of the 12th TRON Project International Symposium*. Los Alamitos: IEEE Computer Society Press, (1995), pp. 2-14.

[7] http://tronweb.super-nova.co.jp/characcodehist.html, Last updated: August 6, 2004.

[8] Manjusri Basu, Bandhu Prasad, The generalized relations among the code elements for Fibonacci coding theory, Science direct, Volume 41, Issue 5, 15 September 2009, pp2517-2525.