ORTHOGONAL MATRIX IN CRYPTOGRAPHY

Yeray Cachón Santana

Member of CriptoRed (U.P.M.)

ABSTRACT

In this work is proposed a method using orthogonal matrix transform properties to encrypt and decrypt a message. It will be showed how to use matrix's functions to create complex encryptions.

Because orthogonal matrix are always diagonalizable on R, and the exponential of a diagonal matrix is easy to compute, the exponential of orthogonal matrix will be used to encrypt text messages.

INTRODUCTION

In several works about cryptography, matrix is used as an application that a vector of plaintext is transform in a vector of ciphertext and, to decrypt, the reverse of the application is used. So, giving a message **M** and a encoding matrix A, the encrypted message is giving by **X**=**A*****M**. To decrypt, the reversal matrix is used, so the original message is giving by $\mathbf{M}=\mathbf{A}^{-1}*\mathbf{X}$. Other works described the application of Quadratic forms because the inverse of nonsingular matrices of higher order is much difficult [2].

Orthogonal matrices have several properties that make them interesting to diagonalize and find its reverse. This paper proposes a method to encrypt and decrypt a message using the properties of these matrices. Some of these properties will be used and are quicker than other matrix method to decrypt:

- Fast inversion
- Real eigenvalues
- Orthogonal eigenvector

METHOD

Let be **A** an orthogonal matrix. Because **A** is orthogonal, **A** is diagonalizable, and can be written as a product of matrix, one of them a diagonal matrix.

It will be showed how to encrypt using exponential of matrix, so firstly, let's see how to compute the exponential of a matrix. So, $\mathbf{A}=\mathbf{C}^{-1}\mathbf{D}\mathbf{C}$, where **C** and $\mathbf{C}^{-1}$ are the change of base matrix and **D** is the diagonal matrix. Let's be λ_i the eigenvalues of **A**, and $\mathbf{v}_i$ the eigenvectors associated. So, to calculate the exponential of **A**:

$$e^{\boldsymbol{A}} = \boldsymbol{C}^{-1}e^{\boldsymbol{D}}\boldsymbol{C} = \boldsymbol{C}^{-1}\begin{pmatrix} e^{\lambda_1} & & & \\ & e^{\lambda_2} & & \\ & & \ddots & \\ & & & e^{\lambda_n} \end{pmatrix}\mathbf{C}$$

Let's see how to calculate the exponential of a matrix A that is diagonalizable:

$$\begin{aligned} e^{\mathbf{A}} = \sum_n \frac{\mathbf{A}^n}{n!} = \sum_n \frac{(\mathbf{C}^{-1}\mathbf{D}\mathbf{C})^n}{n!} \\ = \sum_n \frac{\mathbf{C}^{-1}\mathbf{D}\mathbf{C}\mathbf{C}^{-1}\cdots\mathbf{C}\mathbf{C}^{-1}\mathbf{D}\mathbf{C}}{n!} \\ = \mathbf{C}^{-1}\left(\sum_n \frac{\mathbf{D}^n}{n!}\right)\mathbf{C} = \mathbf{C}^{-1}e^{\mathbf{D}}\mathbf{C} \end{aligned}$$

So, the exponential of the matrix D will be:

$$e^{D}=\sum_{n}\frac{\mathbf{D}^{n}}{n!}=\sum_{n}\frac{1}{n!}\begin{pmatrix}\lambda_1^n & & & & \\ & \lambda_2^n & & & \\ & & \lambda_3^n & & \\ & & & \ddots & \\ & & & & \lambda_n^n\end{pmatrix}$$

$$=\sum_{n}\begin{pmatrix}\frac{\lambda_1^n}{n!} & & & & \\ & \frac{\lambda_2^n}{n!} & & & \\ & & \frac{\lambda_3^n}{n!} & & \\ & & & \ddots & \\ & & & & \frac{\lambda_n^n}{n!}\end{pmatrix}$$

$$=\begin{pmatrix}e^{\lambda_1} & & & & \\ & e^{\lambda_2} & & & \\ & & e^{\lambda_3} & & \\ & & & \ddots & \\ & & & & e^{\lambda_n}\end{pmatrix}$$

In fact, for any Taylor expandable function, f(**A**), if **D** is the diagonal matrix:

$$f(\boldsymbol{A})=\boldsymbol{C}^{-1}f(\boldsymbol{D})\boldsymbol{C}=$$

$$\boldsymbol{C}^{-1}\begin{pmatrix}f(\lambda_1) & & & \\ & f(\lambda_2) & & \\ & & \ddots & \\ & & & f(\lambda_n)\end{pmatrix}\mathbf{C}$$

Because calculate an inversion it takes a long time of computation (if the dimensions of the matrix **A** are large), it can be taken an orthogonal matrix ($\mathbf{C}^{-1}=\mathbf{C}^{T}$). It will see later than, in fact, having 2 matrices with the public and private keys, if the matrix of public and private keys are orthogonal, their product, will be also orthogonal:

$$\begin{aligned}\mathbf{C}*\mathbf{C}^{T}&=\left(\mathbf{k}_{pub}\,\mathbf{k}_{priv}\right)\left(\mathbf{k}_{pub}\,\mathbf{k}_{priv}\right)^{T}\\&=\left(\mathbf{k}_{pub}\,\mathbf{k}_{priv}\right)\left(\mathbf{k}_{priv}^{T}\,\mathbf{k}_{pub}^{T}\right)\\&=\mathbf{k}_{pub}\left(\mathbf{k}_{priv}\,\mathbf{k}_{priv}^{T}\right)\mathbf{k}_{pub}^{T}\end{aligned}$$

So, because k_{pub} and k_{priv} are orthogonal, $\mathbf{k}_{priv}\,\mathbf{k}_{priv}^{T}=\mathbf{k}_{pub}\,\mathbf{k}_{pub}^{T}=\mathbb{I}$, and, then:

$$\mathbf{C}*\mathbf{C}^{T}=\mathbf{k}_{pub}\left(\mathbf{k}_{priv}\,\mathbf{k}_{priv}^{T}\right)\mathbf{k}_{pub}^{T}=\mathbf{k}_{pub}*\mathbf{k}_{pub}^{T}=\mathbb{I}$$

But, if $\mathbf{C}=\mathbf{k}_{pub}\,\mathbf{k}_{priv}$, the decomposition of an orthogonal matrix in several orthogonal matrix it's not unique. Let's see why:

Proof: Let be **A** and **B** orthogonal matrix:

$$\mathbf{A}=\begin{pmatrix}\cos\Theta_1 & -\sin\Theta_1\\ \sin\Theta_1 & \cos\Theta_1\end{pmatrix},$$

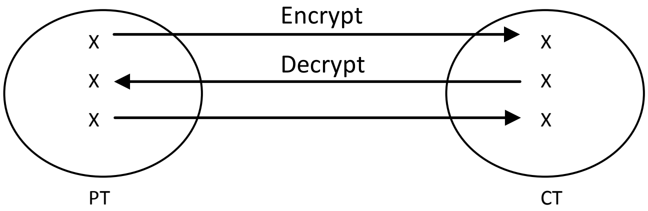
$$\mathbf{B}=\begin{pmatrix}\cos\Theta_2 & -\sin\Theta_2\\ \sin\Theta_2 & \cos\Theta_2\end{pmatrix}$$

Their product **A*****B** will also be and orthogonal matrix:

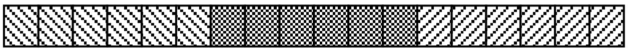
$$\mathbf{A}*\mathbf{B}=\begin{pmatrix}\cos(\Theta_1+\Theta_2) & -\sin(\Theta_1+\Theta_2)\\ \sin(\Theta_1+\Theta_2) & \cos(\Theta_1+\Theta_2)\end{pmatrix}$$

Being **A*B** orthogonal, any matrix **A** and **B** orthogonal give an **A*B** orthogonal, so the decomposition is not unique.■

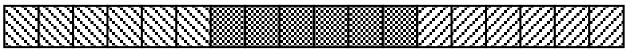
An exponential function is used because is a one-to-one function and it's well-defined in $\Re$ and it's invertible in all $\Re$. So, the one-to-one function is the relationship between the plaintext space (PT) and the ciphertext space (CT):



The encryption of the message will be done by blocks, so each plaintext block will be encrypt in a cyphertext block, as it's shown:



Block 1 PT1
Block 2 PT2
Block 3 PT3



CT1 CT2 CT3

As it will see later, the n-cipher block will be encrypted in a C-space given by C^{n}. Let be **C** the matrix transform from the plain-text to the ciphertext first-space.

PT → $CT^{(1)}$

Using several times the matrix transform, the ciphertext of the n-th space will be computed:

PT→$CT^{(1)}$→$CT^{(2)}$→….. →$CT^{(n)}$

Because after n-th times the n-th power of $\mathbf{C}^n = I$, it's not necessary to compute all n-power of C. So, if k is the order of **C**:

$$\mathbf{C}^n = \mathbf{C}^{k*p+m} = (\mathbb{I})^p * \mathbf{C}^n = \mathbf{C}^n$$

APPLICATION

Let see how to encrypt the word "CRYPTOGRAPHY" choosing blocks of 4 letters. Let **C** the following orthogonal matrix:

$$\mathbf{C} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$

We will use a exponential function as operator because it's a one-to-one function (trigonometric functions aren't one-to-one) and it's well defined in ℝ. Firstly, because it's been chosen blocks of 4 letters (matrix 4x4), the word will be split in blocks of 4 letters:

CRYP | TOGR | APHY

So, to encrypt, we will use as eigenvalues and eigenvector each of the number of alphabet matched with each letter:

C : $\lambda_{1,1} = 3$
R : $\lambda_{1,2} = 18$
Y : $\lambda_{1,3} = 25$
P : $\lambda_{1,4} = 16$

T : $\lambda_{2,1} = 20$
O : $\lambda_{2,2} = 15$
G : $\lambda_{2,3} = 7$
R : $\lambda_{2,4} = 18$

A : $\lambda_{3,1} = 1$
P : $\lambda_{3,2} = 16$
H : $\lambda_{3,3} = 8$
Y : $\lambda_{3,4} = 25$

It will be taken $x_{i,j} = \lambda_{i,j}$.

Once that **C** has been chosen and the eigenvalues and eigenvectors, it will be create the vectors on the space cryptographic.

For each block:

Block 1: "CRYP"

$$\mathbf{Y}_1 = \mathbf{C}^{-1}\mathbf{D}\mathbf{C}\mathbf{X}_1 = \frac{1}{2}\begin{pmatrix} 1 & 1 & 0 & 0 \\ -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & -1 & 1 \end{pmatrix}\begin{pmatrix} e^3 & 0 & 0 & 0 \\ 0 & e^{18} & 0 & 0 \\ 0 & 0 & e^{25} & 0 \\ 0 & 0 & 0 & e^{16} \end{pmatrix}\begin{pmatrix} 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 1 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 18 \\ 25 \\ 16 \end{pmatrix} = \frac{1}{2}\begin{pmatrix} 21e^{18} - 15e^3 \\ 21e^{18} + 15e^3 \\ 41e^{16} + 9e^{25} \\ 41e^{16} - 9e^{25} \end{pmatrix}$$

Block 2: "TOGR"

$$\mathbf{Y}_2 = (\mathbf{C}^2)^{-1}\mathbf{D}\mathbf{C}^2\mathbf{X}_2 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{pmatrix}\begin{pmatrix} e^{20} & 0 & 0 & 0 \\ 0 & e^{15} & 0 & 0 \\ 0 & 0 & e^7 & 0 \\ 0 & 0 & 0 & e^{18} \end{pmatrix}\begin{pmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \end{pmatrix}\begin{pmatrix} 20 \\ 15 \\ 7 \\ 18 \end{pmatrix} = \begin{pmatrix} 20e^{15} \\ 15e^{20} \\ 7e^{18} \\ 18e^7 \end{pmatrix}$$

Block 3: "APHY"

$$\mathbf{Y}_3 = (\mathbf{C}^3)^{-1}\mathbf{D}\mathbf{C}^3\mathbf{X}_3 = \frac{1}{2}\begin{pmatrix} -1 & 1 & 0 & 0 \\ -1 & -1 & 0 & 0 \\ 0 & 0 & -1 & 1 \\ 0 & 0 & -1 & -1 \end{pmatrix}\begin{pmatrix} e & 0 & 0 & 0 \\ 0 & e^{16} & 0 & 0 \\ 0 & 0 & e^8 & 0 \\ 0 & 0 & 0 & e^{23} \end{pmatrix}\begin{pmatrix} -1 & -1 & 0 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & -1 & -1 \\ 0 & 0 & 1 & -1 \end{pmatrix}\begin{pmatrix} 1 \\ 16 \\ 8 \\ 25 \end{pmatrix} = \frac{1}{2}\begin{pmatrix} 17e - 15e^{16} \\ 17e + 15e^{16} \\ 33e^8 - 17e^{25} \\ 33e^8 + 17e^{25} \end{pmatrix}$$

To decrypt the cipher-block, once the system has received the cipher-blocks, it can decrypt by the reverse process.

To decrypt, the receiver receive $\mathbf{k}_{pub}$. Because he has $\mathbf{k}_{priv}$, he can compute $\mathbf{C} = \mathbf{k}_{priv} * \mathbf{k}_{pub}$.

To decrypt the cipher-block, once the system has received the cipher-blocks, it can decrypt by the reverse process:

$$\mathbf{T_1} = \mathbf{CY_1} = \frac{1}{2}\begin{pmatrix} 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 1 & 1 \end{pmatrix}\begin{pmatrix} 21e^{18} - 15e^{3} \\ 21e^{18} + 15e^{3} \\ 41e^{16} + 9e^{25} \\ 41e^{16} - 9e^{25} \end{pmatrix} = \begin{pmatrix} -15e^{3} \\ 21e^{18} \\ 9e^{25} \\ 41e^{16} \end{pmatrix}$$

$$\mathbf{T_2} = \mathbf{C^2Y_2} = \begin{pmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \end{pmatrix}\begin{pmatrix} 20e^{15} \\ 15e^{20} \\ 7e^{18} \\ 18e^{7} \end{pmatrix} = \begin{pmatrix} 15e^{20} \\ 20e^{15} \\ -18e^{7} \\ 7e^{18} \end{pmatrix}$$

$$\mathbf{T_3} = \mathbf{C^3Y_3} = \frac{1}{2}\begin{pmatrix} -1 & -1 & 0 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & -1 & -1 \\ 0 & 0 & 1 & -1 \end{pmatrix}\begin{pmatrix} 17e - 15e^{16} \\ 17e + 15e^{16} \\ 33e^{8} - 17e^{25} \\ 33e^{8} + 17e^{25} \end{pmatrix} = \begin{pmatrix} -17e \\ -15e^{16} \\ -33e^{8} \\ -17e^{25} \end{pmatrix}$$

Because, to encrypt it was used the matrix **C** and its reverse, whereas to decrypt, only one time is necessary, some values can be negative. So, because all values will be considered positive, absolute values of components will be considered:

$$\mathbf{T_1} = \mathbf{CY_1} = \begin{pmatrix} 15e^{3} \\ 21e^{18} \\ 9e^{25} \\ 41e^{16} \end{pmatrix}$$

$$\mathbf{T_2} = \mathbf{C^2Y_2} = \begin{pmatrix} 15e^{20} \\ 20e^{15} \\ 18e^{7} \\ 7e^{18} \end{pmatrix}$$

$$\mathbf{T_3} = \mathbf{C^3Y_3} = \begin{pmatrix} 17e \\ 15e^{16} \\ 33e^{8} \\ 17e^{25} \end{pmatrix}$$

Using the values of the table (see Appendix), for each value it can be found the exponent of exponential, so find the value of the plaintext. So, for $\mathbf{T}_1$:

$15e^{3}$: Exponent 3, so, the first character is “C”

$22e^{18}$: Exponent 18, so, “R”

$9e^{25}$: Exponent 25, so “Y”

$41e^{16}$: Exponent 16, so “P”

And so on.

Because each letter matched with a number, in the way that:

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26
a	b	c	d	e	f	g	h	i	j	k	l	m
27	28	29	30	31	32	33	34	35	36	37	38	39
n	o	p	q	r	s	t	u	v	w	x	y	z
40	41	42	43	44	45	46	47	48	49	50	51	52
space	0	1	2	3	4	5	6	7	8	9		
53	54	55	56	57	58	59	60	61	62	63		

The cipher-blocks will be:

X_1 == “CRYP”

X_2 == “TOGR”

X_3 == “APHY”

And the text “CRYPTGORAPHY” will be decrypted.

It could be possible to use a permutation matrix in the way to change the values of the output, and make more difficult an attack. So, for example, using the matrix P

$$\mathbf{P} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

The output of the message encrypt, once permuted, will be:

Block 1: “CRYP”

$$\mathbf{Y_1^P} = \mathbf{PC^{-1}DCX}_1$$
$$= \frac{1}{2}\begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}\begin{pmatrix} 1 & 1 & 0 & 0 \\ -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & -1 & 1 \end{pmatrix} *$$
$$* \begin{pmatrix} e^{3} & 0 & 0 & 0 \\ 0 & e^{18} & 0 & 0 \\ 0 & 0 & e^{25} & 0 \\ 0 & 0 & 0 & e^{16} \end{pmatrix}\begin{pmatrix} 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 1 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 18 \\ 25 \\ 16 \end{pmatrix}$$
$$= \frac{1}{2}\begin{pmatrix} 21e^{18} + 15e^{3} \\ 41e^{16} + 9e^{25} \\ 41e^{16} - 9e^{25} \\ 21e^{18} - 15e^{3} \end{pmatrix}$$

Block 2: “TOGR”

$$\mathbf{Y_2^P} = \mathbf{P^2}(\mathbf{C^2})^{-1}\mathbf{DC^2X}_2 = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}\begin{pmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{pmatrix} *$$

$$* \begin{pmatrix} e^{20} & 0 & 0 & 0 \\ 0 & e^{15} & 0 & 0 \\ 0 & 0 & e^{7} & 0 \\ 0 & 0 & 0 & e^{18} \end{pmatrix}\begin{pmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \end{pmatrix}\begin{pmatrix} 20 \\ 15 \\ 7 \\ 18 \end{pmatrix} = \begin{pmatrix} 7e^{18} \\ 18e^{7} \\ 20e^{15} \\ 15e^{20} \end{pmatrix}$$

Block 3: “APHY”

$$\mathbf{Y_3^P} = \mathbf{P^3}(\mathbf{C^3})^{-1}\mathbf{DC^3X}_3$$

$$= \frac{1}{2}\begin{pmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}\begin{pmatrix} -1 & 1 & 0 & 0 \\ -1 & -1 & 0 & 0 \\ 0 & 0 & -1 & 1 \\ 0 & 0 & -1 & -1 \end{pmatrix}$$

$$* \begin{pmatrix} e & 0 & 0 & 0 \\ 0 & e^{16} & 0 & 0 \\ 0 & 0 & e^{8} & 0 \\ 0 & 0 & 0 & e^{23} \end{pmatrix}\begin{pmatrix} -1 & -1 & 0 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & -1 & -1 \\ 0 & 0 & 1 & -1 \end{pmatrix}\begin{pmatrix} 1 \\ 16 \\ 8 \\ 25 \end{pmatrix}$$

$$= \frac{1}{2}\begin{pmatrix} 33e^{8} + 17e^{25} \\ 17e - 15e^{16} \\ 17e + 15e^{16} \\ 33e^{8} - 17e^{25} \end{pmatrix}$$

To decrypt the message, let’s take the inverse matrix:

$$P^{-1} = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

$$P^{-2} = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$$

$$P^{-3} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$\mathbf{Y}_1 = \mathbf{P}^{-1}\mathbf{C}^{-1}\mathbf{DCX}_1 = \frac{1}{2}\begin{pmatrix} 21e^{18} - 15e^{3} \\ 21e^{18} + 15e^{3} \\ 41e^{16} + 9e^{25} \\ 41e^{16} - 9e^{25} \end{pmatrix}$$

$$\mathbf{Y}_2 = \mathbf{P}^{-2}(\mathbf{C}^{2})^{-1}\mathbf{DC^2X}_2 = \begin{pmatrix} 20e^{15} \\ 15e^{20} \\ 7e^{18} \\ 18e^{7} \end{pmatrix}$$

$$\mathbf{Y}_1 = \mathbf{P}^{-3}(\mathbf{C}^{3})^{-1}\mathbf{DC^3X}_3 = \frac{1}{2}\begin{pmatrix} 17e - 15e^{16} \\ 17e + 15e^{16} \\ 33e^{8} - 17e^{25} \\ 33e^{8} + 17e^{25} \end{pmatrix}$$

And, using the same procedure showed before, the system can find the vectors $\mathbf{T}_{\mathrm{i}}$.

So, the plaintext message will be:

“CRYPTOGRAPHY”

ATTACK

Suppose that attacker receives the encrypt text of "CRTYP"

$$\mathbf{Y}_1 = \mathbf{PC}^{-1}\mathbf{DCX}_1 = \frac{1}{2}\begin{pmatrix} 21e^{18} + 15e^{3} \\ 41e^{16} + 9e^{25} \\ 41e^{16} - 9e^{25} \\ 21e^{18} - 15e^{3} \end{pmatrix}$$

Taking linear combinations:

$Y_{11}+Y_{14}=21e^{18}=1378859352$

$Y_{12}+Y_{23}=41e^{16}=364330531{,}3$

$Y_{12}-Y_{14}=15e^{3}=301{,}2830538$

$Y_{12}-Y_{23}=9e^{25}=648044094036{,}47$

Because the encryption is based on combinations, attacker must found a combination of exponentials to find 21 and 18 (and only if he knows that there's exponentials). Even so, the way would be trying several values of a and b in sense that, knowing c, $a*e^{b}=c$. But, the second block cipher is like:

$$\mathbf{Y}_2 = \mathbf{P}^{2}(\mathbf{C}^{2})^{-1}\mathbf{DC}^{2}\mathbf{X}_2$$

And the method used for decrypt the first block won't be possible in this case because in this case the matrix is $\mathbf{C}^2$, so the attacker must use the same method but for a different matrix.

Because each character is codified by an exponential $e^{[char]}$, in sense that, A is codified by e, B, by e^2 and so on, there's not linear combinations, and that difficult much more an attack by frequencies. Also, the final cyphertext is a combination of several ciphers, so it will be very difficult to separate them (ex, $21e^{18} + 15e^{3}$ is the combination of encryption of letters "C" and "R"). The matrix permutation **P** changes the position of each cyphertext, and that makes more difficult to decrypt the message without **P**.

EXTENSIONS

The method proposed can be extended to other function rather than exponential (hyperbolic sinus and hyperbolic cosines). Because there's a relationship between exponential function and hyperbolic functions, the same method could be applied.

It has shown that, for the exponential function,, the matrix is:

$$e^{\mathbf{A}} = \boldsymbol{C}^{-1}e^{\boldsymbol{D}}\boldsymbol{C} = \boldsymbol{C}^{-1}\begin{pmatrix} e^{\lambda_1} & & & \\ & e^{\lambda_2} & & \\ & & \ddots & \\ & & & e^{\lambda_n} \end{pmatrix}\mathbf{C}$$

So, using hyperbolic sinus:

$$sinh\mathbf{A} = \frac{e^{\mathbf{A}}-e^{-\mathbf{A}}}{2} =$$

$$\boldsymbol{C}^{-1}\begin{pmatrix} \frac{e^{\lambda_1}-e^{-\lambda_1}}{2} & & & \\ & \frac{e^{\lambda_2}-e^{-\lambda_2}}{2} & & \\ & & \ddots & \\ & & & \frac{e^{\lambda_n}-e^{-\lambda_n}}{2} \end{pmatrix}\mathbf{C}$$

$$sinh\mathbf{A} = \boldsymbol{C}^{-1}\begin{pmatrix} sinh\lambda_1 & & & \\ & sinh\lambda_2 & & \\ & & \ddots & \\ & & & sinh\lambda_n \end{pmatrix}\mathbf{C}$$

Because the sinh is not periodic in $\Re$, it can be also used as the same method seen before.

CONCLUSSIONS

In this work, it has showed how to use Hermitian matrix to encrypt and decrypt messages by cipher-block. Because each cipher-block is a linear combination of several cipher-blocks, it makes much difficult to plain an attack. Using the properties of hermitian matrix, it will be faster to calculate the reverse of the matrix to generate the ciphertext and the plaintext.

REFERENCES

[1] George B. Arfken and Hans J. Weber. Mathematical Method for Physics

[2] http://www.ijcta.com/documents/volumes/vol1issue1/ijcta2010010115.pdf

Values of file*e^{col}

f*e^{c}	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2,72	7,39	20,09	54,60	148,41	403,43	1096,63	2980,96	8103,08	22026,47	59874,14	162754,79	442413,39	1202604,28	3269017,37
2	5,44	14,78	40,17	109,20	296,83	806,86	2193,27	5961,92	16206,17	44052,93	119748,28	325509,58	884826,78	2405208,57	6538034,74
3	8,15	22,17	60,26	163,79	445,24	1210,29	3289,90	8942,87	24309,25	66079,40	179622,43	488264,37	1327240,18	3607812,85	9807052,12
4	10,87	29,56	80,34	218,39	593,65	1613,72	4386,53	11923,83	32412,34	88105,86	239496,57	651019,17	1769653,57	4810417,14	13076069,49
5	13,59	36,95	100,43	272,99	742,07	2017,14	5483,17	14904,79	40515,42	110132,33	299370,71	813773,96	2212066,96	6013021,42	16345086,86
6	16,31	44,33	120,51	327,59	890,48	2420,57	6579,80	17885,75	48618,50	132158,79	359244,85	976528,75	2654480,35	7215625,70	19614104,23
7	19,03	51,72	140,60	382,19	1038,89	2824,00	7676,43	20866,71	56721,59	154185,26	419118,99	1139283,54	3096893,74	8418229,99	22883121,61
8	21,75	59,11	160,68	436,79	1187,31	3227,43	8773,07	23847,66	64824,67	176211,73	478993,13	1302038,33	3539307,14	9620834,27	26152138,98
9	24,46	66,50	180,77	491,38	1335,72	3630,86	9869,70	26828,62	72927,76	198238,19	538867,28	1464793,12	3981720,53	10823438,56	29421156,35
10	27,18	73,89	200,86	545,98	1484,13	4034,29	10966,33	29809,58	81030,84	220264,66	598741,42	1627547,91	4424133,92	12026042,84	32690173,72
11	29,90	81,28	220,94	600,58	1632,54	4437,72	12062,96	32790,54	89133,92	242291,12	658615,56	1790302,71	4866547,31	13228647,13	35959191,10
12	32,62	88,67	241,03	655,18	1780,96	4841,15	13159,60	35771,50	97237,01	264317,59	718489,70	1953057,50	5308960,70	14431251,41	39228208,47
13	35,34	96,06	261,11	709,78	1929,37	5244,57	14256,23	38752,45	105340,09	286344,06	778363,84	2115812,29	5751374,10	15633855,69	42497225,84
14	38,06	103,45	281,20	764,37	2077,78	5648,00	15352,86	41733,41	113443,17	308370,52	838237,98	2278567,08	6193787,49	16836459,98	45766243,21
15	40,77	110,84	301,28	818,97	2226,20	6051,43	16449,50	44714,37	121546,26	330396,99	898112,13	2441321,87	6636200,88	18039064,26	49035260,59
16	43,49	118,22	321,37	873,57	2374,61	6454,86	17546,13	47695,33	129649,34	352423,45	957986,27	2604076,66	7078614,27	19241668,55	52304277,96
17	46,21	125,61	341,45	928,17	2523,02	6858,29	18642,76	50676,29	137752,43	374449,92	1017860,41	2766831,45	7521027,66	20444272,83	55573295,33
18	48,93	133,00	361,54	982,77	2671,44	7261,72	19739,40	53657,24	145855,51	396476,38	1077734,55	2929586,25	7963441,06	21646877,11	58842312,70
19	51,65	140,39	381,63	1037,36	2819,85	7665,15	20836,03	56638,20	153958,59	418502,85	1137608,69	3092341,04	8405854,45	22849481,40	62111330,08
20	54,37	147,78	401,71	1091,96	2968,26	8068,58	21932,66	59619,16	162061,68	440529,32	1197482,83	3255095,83	8848267,84	24052085,68	65380347,45
21	57,08	155,17	421,80	1146,56	3116,68	8472,00	23029,30	62600,12	170164,76	462555,78	1257356,98	3417850,62	9290681,23	25254689,97	68649364,82
22	59,80	162,56	441,88	1201,16	3265,09	8875,43	24125,93	65581,08	178267,85	484582,25	1317231,12	3580605,41	9733094,62	26457294,25	71918382,19
23	62,52	169,95	461,97	1255,76	3413,50	9278,86	25222,56	68562,03	186370,93	506608,71	1377105,26	3743360,20	10175508,02	27659898,54	75187399,57
24	65,24	177,34	482,05	1310,36	3561,92	9682,29	26319,20	71542,99	194474,01	528635,18	1436979,40	3906114,99	10617921,41	28862502,82	78456416,94
25	67,96	184,73	502,14	1364,95	3710,33	10085,72	27415,83	74523,95	202577,10	550661,64	1496853,54	4068869,79	11060334,80	30065107,10	81725434,31
26	70,68	192,12	522,22	1419,55	3858,74	10489,15	28512,46	77504,91	210680,18	572688,11	1556727,68	4231624,58	11502748,19	31267711,39	84994451,68
27	73,39	199,50	542,31	1474,15	4007,16	10892,58	29609,10	80485,87	218783,27	594714,58	1616601,83	4394379,37	11945161,58	32470315,67	88263469,06
28	76,11	206,89	562,40	1528,75	4155,57	11296,01	30705,73	83466,82	226886,35	616741,04	1676475,97	4557134,16	12387574,98	33672919,96	91532486,43
29	78,83	214,28	582,48	1583,35	4303,98	11699,44	31802,36	86447,78	234989,43	638767,51	1736350,11	4719888,95	12829988,37	34875524,24	94801503,80

Values of file*e^{col}

$f*e^c$	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
30	81,55	221,67	602,57	1637,94	4452,39	12102,86	32898,99	89428,74	243092,52	660793,97	1796224,25	4882643,74	13272401,76	36078128,52	98070521,17
31	84,27	229,06	622,65	1692,54	4600,81	12506,29	33995,63	92409,70	251195,60	682820,44	1856098,39	5045398,53	13714815,15	37280732,81	101339538,55
32	86,99	236,45	642,74	1747,14	4749,22	12909,72	35092,26	95390,66	259298,69	704846,91	1915972,53	5208153,33	14157228,54	38483337,09	104608555,92
33	89,70	243,84	662,82	1801,74	4897,63	13313,15	36188,89	98371,61	267401,77	726873,37	1975846,68	5370908,12	14599641,94	39685941,38	107877573,29
34	92,42	251,23	682,91	1856,34	5046,05	13716,58	37285,53	101352,57	275504,85	748899,84	2035720,82	5533662,91	15042055,33	40888545,66	111146590,66
35	95,14	258,62	702,99	1910,94	5194,46	14120,01	38382,16	104333,53	283607,94	770926,30	2095594,96	5696417,70	15484468,72	42091149,95	114415608,04
36	97,86	266,01	723,08	1965,53	5342,87	14523,44	39478,79	107314,49	291711,02	792952,77	2155469,10	5859172,49	15926882,11	43293754,23	117684625,41
37	100,58	273,40	743,16	2020,13	5491,29	14926,87	40575,43	110295,45	299814,11	814979,23	2215343,24	6021927,28	16369295,50	44496358,51	120953642,78
38	103,29	280,78	763,25	2074,73	5639,70	15330,29	41672,06	113276,40	307917,19	837005,70	2275217,39	6184682,07	16811708,90	45698962,80	124222660,15
39	106,01	288,17	783,34	2129,33	5788,11	15733,72	42768,69	116257,36	316020,27	859032,17	2335091,53	6347436,87	17254122,29	46901567,08	127491677,53
40	108,73	295,56	803,42	2183,93	5936,53	16137,15	43865,33	119238,32	324123,36	881058,63	2394965,67	6510191,66	17696535,68	48104171,37	130760694,90
41	111,45	302,95	823,51	2238,52	6084,94	16540,58	44961,96	122219,28	332226,44	903085,10	2454839,81	6672946,45	18138949,07	49306775,65	134029712,27
42	114,17	310,34	843,59	2293,12	6233,35	16944,01	46058,59	125200,24	340329,52	925111,56	2514713,95	6835701,24	18581362,46	50509379,93	137298729,64
43	116,89	317,73	863,68	2347,72	6381,77	17347,44	47155,23	128181,19	348432,61	947138,03	2574588,09	6998456,03	19023775,86	51711984,22	140567747,02
44	119,60	325,12	883,76	2402,32	6530,18	17750,87	48251,86	131162,15	356535,69	969164,49	2634462,24	7161210,82	19466189,25	52914588,50	143836764,39
45	122,32	332,51	903,85	2456,92	6678,59	18154,30	49348,49	134143,11	364638,78	991190,96	2694336,38	7323965,61	19908602,64	54117192,79	147105781,76
46	125,04	339,90	923,93	2511,51	6827,01	18557,72	50445,13	137124,07	372741,86	1013217,43	2754210,52	7486720,41	20351016,03	55319797,07	150374799,13
47	127,76	347,29	944,02	2566,11	6975,42	18961,15	51541,76	140105,03	380844,94	1035243,89	2814084,66	7649475,20	20793429,42	56522401,36	153643816,51
48	130,48	354,67	964,11	2620,71	7123,83	19364,58	52638,39	143085,98	388948,03	1057270,36	2873958,80	7812229,99	21235842,82	57725005,64	156912833,88
49	133,20	362,06	984,19	2675,31	7272,24	19768,01	53735,02	146066,94	397051,11	1079296,82	2933832,94	7974984,78	21678256,21	58927609,92	160181851,25
50	135,91	369,45	1004,28	2729,91	7420,66	20171,44	54831,66	149047,90	405154,20	1101323,29	2993707,09	8137739,57	22120669,60	60130214,21	163450868,62
51	138,63	376,84	1024,36	2784,51	7569,07	20574,87	55928,29	152028,86	413257,28	1123349,76	3053581,23	8300494,36	22563082,99	61332818,49	166719886,00
52	141,35	384,23	1044,45	2839,10	7717,48	20978,30	57024,92	155009,82	421360,36	1145376,22	3113455,37	8463249,15	23005496,38	62535422,78	169988903,37
53	144,07	391,62	1064,53	2893,70	7865,90	21381,73	58121,56	157990,77	429463,45	1167402,69	3173329,51	8626003,95	23447909,78	63738027,06	173257920,74
54	146,79	399,01	1084,62	2948,30	8014,31	21785,15	59218,19	160971,73	437566,53	1189429,15	3233203,65	8788758,74	23890323,17	64940631,34	176526938,11
55	149,51	406,40	1104,70	3002,90	8162,72	22188,58	60314,82	163952,69	445669,62	1211455,62	3293077,79	8951513,53	24332736,56	66143235,63	179795955,49
56	152,22	413,79	1124,79	3057,50	8311,14	22592,01	61411,46	166933,65	453772,70	1233482,08	3352951,94	9114268,32	24775149,95	67345839,91	183064972,86
57	154,94	421,18	1144,88	3112,09	8459,55	22995,44	62508,09	169914,61	461875,78	1255508,55	3412826,08	9277023,11	25217563,34	68548444,20	186333990,23
58	157,66	428,57	1164,96	3166,69	8607,96	23398,87	63604,72	172895,56	469978,87	1277535,02	3472700,22	9439777,90	25659976,74	69751048,48	189603007,60

Values of file*e^{col}

59	160,38	435,95	1185,05	3221,29	8756,38	23802,30	64701,36	175876,52	478081,95	1299561,48	3532574,36	9602532,69	26102390,13	70953652,77	192872024,98
60	163,10	443,34	1205,13	3275,89	8904,79	24205,73	65797,99	178857,48	486185,04	1321587,95	3592448,50	9765287,49	26544803,52	72156257,05	196141042,35
61	165,82	450,73	1225,22	3330,49	9053,20	24609,16	66894,62	181838,44	494288,12	1343614,41	3652322,64	9928042,28	26987216,91	73358861,33	199410059,72
62	168,53	458,12	1245,30	3385,09	9201,62	25012,59	67991,26	184819,40	502391,20	1365640,88	3712196,79	10090797,07	27429630,30	74561465,62	202679077,09
63	171,25	465,51	1265,39	3439,68	9350,03	25416,01	69087,89	187800,35	510494,29	1387667,35	3772070,93	10253551,86	27872043,70	75764069,90	205948094,47
64	173,97	472,90	1285,47	3494,28	9498,44	25819,44	70184,52	190781,31	518597,37	1409693,81	3831945,07	10416306,65	28314457,09	76966674,19	209217111,84

f*e^{c}	16	17	18	19	20	21	22	23	24	25	26
1	8886110,52	24154952,8	65659969,1	178482301	485165195	1318815734	3584912846	9744803446	26489122130	72004899337	1,9573E+11
2	17772221	48309905,5	131319938	356964602	970330391	2637631469	7169825692	19489606892	52978244260	1,4401E+11	3,91459E+11
3	26658331,6	72464858,3	196979907	535446903	1455495586	3956447203	10754738538	29234410339	79467366390	2,16015E+11	5,87189E+11
4	35544442,1	96619811	262639877	713929204	1940660782	5275262938	14339651385	38979213785	1,05956E+11	2,8802E+11	7,82918E+11
5	44430552,6	120774764	328299846	892411505	2425825977	6594078672	17924564231	48724017231	1,32446E+11	3,60024E+11	9,78648E+11
6	53316663,1	144929717	393959815	1070893806	2910991172	7912894407	21509477077	58468820677	1,58935E+11	4,32029E+11	1,17438E+12
7	62202773,6	169084669	459619784	1249376107	3396156368	9231710141	25094389923	68213624124	1,85424E+11	5,04034E+11	1,37011E+12
8	71088884,2	193239622	525279753	1427858408	3881321563	10550525876	28679302769	77958427570	2,11913E+11	5,76039E+11	1,56584E+12
9	79974994,7	217394575	590939722	1606340709	4366486759	11869341610	32264215615	87703231016	2,38402E+11	6,48044E+11	1,76157E+12
10	88861105,2	241549528	656599691	1784823010	4851651954	13188157345	35849128461	97448034462	2,64891E+11	7,20049E+11	1,9573E+12
11	97747215,7	265704480	722259661	1963305311	5336817150	14506973079	39434041307	1,07193E+11	2,9138E+11	7,92054E+11	2,15303E+12
12	106633326	289859433	787919630	2141787612	5821982345	15825788814	43018954154	1,16938E+11	3,17869E+11	8,64059E+11	2,34876E+12
13	115519437	314014386	853579599	2320269913	6307147540	17144604548	46603867000	1,26682E+11	3,44359E+11	9,36064E+11	2,54448E+12
14	124405547	338169339	919239568	2498752213	6792312736	18463420283	50188779846	1,36427E+11	3,70848E+11	1,00807E+12	2,74021E+12
15	133291658	362324291	984899537	2677234514	7277477931	19782236017	53773692692	1,46172E+11	3,97337E+11	1,08007E+12	2,93594E+12
16	142177768	386479244	1050559506	2855716815	7762643127	21101051752	57358605538	1,55917E+11	4,23826E+11	1,15208E+12	3,13167E+12
17	151063879	410634197	1116219475	3034199116	8247808322	22419867486	60943518384	1,65662E+11	4,50315E+11	1,22408E+12	3,3274E+12
18	159949989	434789150	1181879444	3212681417	8732973517	23738683221	64528431230	1,75406E+11	4,76804E+11	1,29609E+12	3,52313E+12
19	168836100	458944102	1247539414	3391163718	9218138713	25057498955	68113344077	1,85151E+11	5,03293E+11	1,36809E+12	3,71886E+12
20	177722210	483099055	1313199383	3569646019	9703303908	26376314690	71698256923	1,94896E+11	5,29782E+11	1,4401E+12	3,91459E+12
21	186608321	507254008	1378859352	3748128320	1,0188E+10	27695130424	75283169769	2,04641E+11	5,56272E+11	1,5121E+12	4,11032E+12

Values of file*e^{col}

f*e^{c}	16	17	18	19	20	21	22	23	24	25	26
22	195494431	531408961	1444519321	3926610621	1,0674E+10	29013946159	78868082615	2,14386E+11	5,82761E+11	1,58411E+12	4,30605E+12
23	204380542	555563913	1510179290	4105092922	1,1159E+10	30332761893	82452995461	2,2413E+11	6,0925E+11	1,65611E+12	4,50178E+12
24	213266652	579718866	1575839259	4283575223	1,1644E+10	31651577628	86037908307	2,33875E+11	6,35739E+11	1,72812E+12	4,69751E+12
25	222152763	603873819	1641499228	4462057524	1,2129E+10	32970393362	89622821153	2,4362E+11	6,62228E+11	1,80012E+12	4,89324E+12
26	231038874	628028772	1707159198	4640539825	1,2614E+10	34289209097	93207733999	2,53365E+11	6,88717E+11	1,87213E+12	5,08897E+12
27	239924984	652183724	1772819167	4819022126	1,3099E+10	35608024831	96792646846	2,6311E+11	7,15206E+11	1,94413E+12	5,2847E+12
28	248811095	676338677	1838479136	4997504427	1,3585E+10	36926840566	1,00378E+11	2,72854E+11	7,41695E+11	2,01614E+12	5,48043E+12
29	257697205	700493630	1904139105	5175986728	1,407E+10	38245656300	1,03962E+11	2,82599E+11	7,68185E+11	2,08814E+12	5,67616E+12
30	266583316	724648583	1969799074	5354469029	1,4555E+10	39564472034	1,07547E+11	2,92344E+11	7,94674E+11	2,16015E+12	5,87189E+12
31	275469426	748803535	2035459043	5532951330	1,504E+10	40883287769	1,11132E+11	3,02089E+11	8,21163E+11	2,23215E+12	6,06762E+12
32	284355537	772958488	2101119012	5711433631	1,5525E+10	42202103503	1,14717E+11	3,11834E+11	8,47652E+11	2,30416E+12	6,26335E+12
33	293241647	797113441	2166778982	5889915932	1,601E+10	43520919238	1,18302E+11	3,21579E+11	8,74141E+11	2,37616E+12	6,45908E+12
34	302127758	821268394	2232438951	6068398233	1,6496E+10	44839734972	1,21887E+11	3,31323E+11	9,0063E+11	2,44817E+12	6,65481E+12
35	311013868	845423346	2298098920	6246880534	1,6981E+10	46158550707	1,25472E+11	3,41068E+11	9,27119E+11	2,52017E+12	6,85054E+12
36	319899979	869578299	2363758889	6425362835	1,7466E+10	47477366441	1,29057E+11	3,50813E+11	9,53608E+11	2,59218E+12	7,04627E+12
37	328786089	893733252	2429418858	6603845136	1,7951E+10	48796182176	1,32642E+11	3,60558E+11	9,80098E+11	2,66418E+12	7,242E+12
38	337672200	917888205	2495078827	6782327437	1,8436E+10	50114997910	1,36227E+11	3,70303E+11	1,00659E+12	2,73619E+12	7,43773E+12
39	346558310	942043157	2560738796	6960809738	1,8921E+10	51433813645	1,39812E+11	3,80047E+11	1,03308E+12	2,80819E+12	7,63345E+12
40	355444421	966198110	2626398765	7139292039	1,9407E+10	52752629379	1,43397E+11	3,89792E+11	1,05956E+12	2,8802E+12	7,82918E+12
41	364330531	990353063	2692058735	7317774339	1,9892E+10	54071445114	1,46981E+11	3,99537E+11	1,08605E+12	2,9522E+12	8,02491E+12
42	373216642	1014508016	2757718704	7496256640	2,0377E+10	55390260848	1,50566E+11	4,09282E+11	1,11254E+12	3,02421E+12	8,22064E+12
43	382102752	1038662968	2823378673	7674738941	2,0862E+10	56709076583	1,54151E+11	4,19027E+11	1,13903E+12	3,09621E+12	8,41637E+12
44	390988863	1062817921	2889038642	7853221242	2,1347E+10	58027892317	1,57736E+11	4,28771E+11	1,16552E+12	3,16822E+12	8,6121E+12
45	399874973	1086972874	2954698611	8031703543	2,1832E+10	59346708052	1,61321E+11	4,38516E+11	1,19201E+12	3,24022E+12	8,80783E+12
46	408761084	1111127827	3020358580	8210185844	2,2318E+10	60665523786	1,64906E+11	4,48261E+11	1,2185E+12	3,31223E+12	9,00356E+12
47	417647194	1135282779	3086018549	8388668145	2,2803E+10	61984339521	1,68491E+11	4,58006E+11	1,24499E+12	3,38423E+12	9,19929E+12
48	426533305	1159437732	3151678519	8567150446	2,3288E+10	63303155255	1,72076E+11	4,67751E+11	1,27148E+12	3,45624E+12	9,39502E+12
49	435419416	1183592685	3217338488	8745632747	2,3773E+10	64621970990	1,75661E+11	4,77495E+11	1,29797E+12	3,52824E+12	9,59075E+12
50	444305526	1207747638	3282998457	8924115048	2,4258E+10	65940786724	1,79246E+11	4,8724E+11	1,32446E+12	3,60024E+12	9,78648E+12

Values of file*e^{col}

f*e^{c}	16	17	18	19	20	21	22	23	24	25	26
51	453191637	1231902590	3348658426	9102597349	2,4743E+10	67259602459	1,82831E+11	4,96985E+11	1,35095E+12	3,67225E+12	9,98221E+12
52	462077747	1256057543	3414318395	9281079650	2,5229E+10	68578418193	1,86415E+11	5,0673E+11	1,37743E+12	3,74425E+12	1,01779E+13
53	470963858	1280212496	3479978364	9459561951	2,5714E+10	69897233928	1,9E+11	5,16475E+11	1,40392E+12	3,81626E+12	1,03737E+13
54	479849968	1304367449	3545638333	9638044252	2,6199E+10	71216049662	1,93585E+11	5,26219E+11	1,43041E+12	3,88826E+12	1,05694E+13
55	488736079	1328522401	3611298303	9816526553	2,6684E+10	72534865397	1,9717E+11	5,35964E+11	1,4569E+12	3,96027E+12	1,07651E+13
56	497622189	1352677354	3676958272	9995008854	2,7169E+10	73853681131	2,00755E+11	5,45709E+11	1,48339E+12	4,03227E+12	1,09609E+13
57	506508300	1376832307	3742618241	1,0173E+10	2,7654E+10	75172496866	2,0434E+11	5,55454E+11	1,50988E+12	4,10428E+12	1,11566E+13
58	515394410	1400987260	3808278210	1,0352E+10	2,814E+10	76491312600	2,07925E+11	5,65199E+11	1,53637E+12	4,17628E+12	1,13523E+13
59	524280521	1425142212	3873938179	1,053E+10	2,8625E+10	77810128335	2,1151E+11	5,74943E+11	1,56286E+12	4,24829E+12	1,1548E+13
60	533166631	1449297165	3939598148	1,0709E+10	2,911E+10	79128944069	2,15095E+11	5,84688E+11	1,58935E+12	4,32029E+12	1,17438E+13
61	542052742	1473452118	4005258117	1,0887E+10	2,9595E+10	80447759803	2,1868E+11	5,94433E+11	1,61584E+12	4,3923E+12	1,19395E+13
62	550938852	1497607071	4070918087	1,1066E+10	3,008E+10	81766575538	2,22265E+11	6,04178E+11	1,64233E+12	4,4643E+12	1,21352E+13
63	559824963	1521762023	4136578056	1,1244E+10	3,0565E+10	83085391272	2,2585E+11	6,13923E+11	1,66881E+12	4,53631E+12	1,2331E+13
64	568711073	1545916976	4202238025	1,1423E+10	3,1051E+10	84404207007	2,29434E+11	6,23667E+11	1,6953E+12	4,60831E+12	1,25267E+13

f*e^{c}	27	28	29	30	31	32	33	34	35	36	37	38
1	5,3205E+11	1,4463E+12	3,9313E+12	1,0686E+13	2,9049E+13	7,8963E+13	2,14644E+14	5,83462E+14	1,58601E+15	4,31123E+15	1,17191E+16	3,1856E+16
2	1,0641E+12	2,8925E+12	7,8627E+12	2,1373E+13	5,8098E+13	1,57926E+14	4,29287E+14	1,16692E+15	3,17203E+15	8,62246E+15	2,34383E+16	6,3712E+16
3	1,5961E+12	4,3388E+12	1,1794E+13	3,2059E+13	8,7147E+13	2,36889E+14	6,43931E+14	1,75039E+15	4,75804E+15	1,29337E+16	3,51574E+16	9,5568E+16
4	2,1282E+12	5,785E+12	1,5725E+13	4,2746E+13	1,162E+14	3,15852E+14	8,58574E+14	2,33385E+15	6,34405E+15	1,72449E+16	4,68766E+16	1,2742E+17
5	2,6602E+12	7,2313E+12	1,9657E+13	5,3432E+13	1,4524E+14	3,94815E+14	1,07322E+15	2,91731E+15	7,93007E+15	2,15562E+16	5,85957E+16	1,5928E+17
6	3,1923E+12	8,6775E+12	2,3588E+13	6,4119E+13	1,7429E+14	4,73778E+14	1,28786E+15	3,50077E+15	9,51608E+15	2,58674E+16	7,03149E+16	1,9114E+17
7	3,7243E+12	1,0124E+13	2,7519E+13	7,4805E+13	2,0334E+14	5,52741E+14	1,50251E+15	4,08423E+15	1,11021E+16	3,01786E+16	8,2034E+16	2,2299E+17
8	4,2564E+12	1,157E+13	3,1451E+13	8,5492E+13	2,3239E+14	6,31704E+14	1,71715E+15	4,66769E+15	1,26881E+16	3,44899E+16	9,37531E+16	2,5485E+17
9	4,7884E+12	1,3016E+13	3,5382E+13	9,6178E+13	2,6144E+14	7,10667E+14	1,93179E+15	5,25116E+15	1,42741E+16	3,88011E+16	1,05472E+17	2,867E+17
10	5,3205E+12	1,4463E+13	3,9313E+13	1,0686E+14	2,9049E+14	7,8963E+14	2,14644E+15	5,83462E+15	1,58601E+16	4,31123E+16	1,17191E+17	3,1856E+17
11	5,8525E+12	1,5909E+13	4,3245E+13	1,1755E+14	3,1954E+14	8,68593E+14	2,36108E+15	6,41808E+15	1,74461E+16	4,74235E+16	1,28911E+17	3,5042E+17
12	6,3846E+12	1,7355E+13	4,7176E+13	1,2824E+14	3,4859E+14	9,47556E+14	2,57572E+15	7,00154E+15	1,90322E+16	5,17348E+16	1,4063E+17	3,8227E+17

Values of file*e^{col}

f*e^{c}	27	28	29	30	31	32	33	34	35	36	37	38
13	6,9166E+12	1,8801E+13	5,1107E+13	1,3892E+14	3,7764E+14	1,02652E+15	2,79037E+15	7,585E+15	2,06182E+16	5,6046E+16	1,52349E+17	4,1413E+17
14	7,4487E+12	2,0248E+13	5,5039E+13	1,4961E+14	4,0668E+14	1,10548E+15	3,00501E+15	8,16846E+15	2,22042E+16	6,03572E+16	1,64068E+17	4,4598E+17
15	7,9807E+12	2,1694E+13	5,897E+13	1,603E+14	4,3573E+14	1,18444E+15	3,21965E+15	8,75193E+15	2,37902E+16	6,46685E+16	1,75787E+17	4,7784E+17
16	8,5128E+12	2,314E+13	6,2901E+13	1,7098E+14	4,6478E+14	1,26341E+15	3,4343E+15	9,33539E+15	2,53762E+16	6,89797E+16	1,87506E+17	5,0969E+17
17	9,0448E+12	2,4586E+13	6,6833E+13	1,8167E+14	4,9383E+14	1,34237E+15	3,64894E+15	9,91885E+15	2,69622E+16	7,32909E+16	1,99225E+17	5,4155E+17
18	9,5769E+12	2,6033E+13	7,0764E+13	1,9236E+14	5,2288E+14	1,42133E+15	3,86358E+15	1,05023E+16	2,85482E+16	7,76022E+16	2,10945E+17	5,7341E+17
19	1,0109E+13	2,7479E+13	7,4695E+13	2,0304E+14	5,5193E+14	1,5003E+15	4,07823E+15	1,10858E+16	3,01343E+16	8,19134E+16	2,22664E+17	6,0526E+17
20	1,0641E+13	2,8925E+13	7,8627E+13	2,1373E+14	5,8098E+14	1,57926E+15	4,29287E+15	1,16692E+16	3,17203E+16	8,62246E+16	2,34383E+17	6,3712E+17
21	1,1173E+13	3,0371E+13	8,2558E+13	2,2442E+14	6,1003E+14	1,65822E+15	4,50752E+15	1,22527E+16	3,33063E+16	9,05359E+16	2,46102E+17	6,6897E+17
22	1,1705E+13	3,1818E+13	8,6489E+13	2,351E+14	6,3907E+14	1,73719E+15	4,72216E+15	1,28362E+16	3,48923E+16	9,48471E+16	2,57821E+17	7,0083E+17
23	1,2237E+13	3,3264E+13	9,0421E+13	2,4579E+14	6,6812E+14	1,81615E+15	4,9368E+15	1,34196E+16	3,64783E+16	9,91583E+16	2,6954E+17	7,3269E+17
24	1,2769E+13	3,471E+13	9,4352E+13	2,5648E+14	6,9717E+14	1,89511E+15	5,15145E+15	1,40031E+16	3,80643E+16	1,0347E+17	2,81259E+17	7,6454E+17
25	1,3301E+13	3,6156E+13	9,8283E+13	2,6716E+14	7,2622E+14	1,97407E+15	5,36609E+15	1,45865E+16	3,96503E+16	1,07781E+17	2,92979E+17	7,964E+17
26	1,3833E+13	3,7603E+13	1,0221E+14	2,7785E+14	7,5527E+14	2,05304E+15	5,58073E+15	1,517E+16	4,12363E+16	1,12092E+17	3,04698E+17	8,2825E+17
27	1,4365E+13	3,9049E+13	1,0615E+14	2,8853E+14	7,8432E+14	2,132E+15	5,79538E+15	1,57535E+16	4,28224E+16	1,16403E+17	3,16417E+17	8,6011E+17
28	1,4897E+13	4,0495E+13	1,1008E+14	2,9922E+14	8,1337E+14	2,21096E+15	6,01002E+15	1,63369E+16	4,44084E+16	1,20714E+17	3,28136E+17	8,9197E+17
29	1,5429E+13	4,1941E+13	1,1401E+14	3,0991E+14	8,4242E+14	2,28993E+15	6,22466E+15	1,69204E+16	4,59944E+16	1,25026E+17	3,39855E+17	9,2382E+17
30	1,5961E+13	4,3388E+13	1,1794E+14	3,2059E+14	8,7147E+14	2,36889E+15	6,43931E+15	1,75039E+16	4,75804E+16	1,29337E+17	3,51574E+17	9,5568E+17
31	1,6493E+13	4,4834E+13	1,2187E+14	3,3128E+14	9,0051E+14	2,44785E+15	6,65395E+15	1,80873E+16	4,91664E+16	1,33648E+17	3,63293E+17	9,8753E+17
32	1,7026E+13	4,628E+13	1,258E+14	3,4197E+14	9,2956E+14	2,52681E+15	6,86859E+15	1,86708E+16	5,07524E+16	1,37959E+17	3,75013E+17	1,0194E+18
33	1,7558E+13	4,7726E+13	1,2973E+14	3,5265E+14	9,5861E+14	2,60578E+15	7,08324E+15	1,92542E+16	5,23384E+16	1,42271E+17	3,86732E+17	1,0512E+18
34	1,809E+13	4,9173E+13	1,3367E+14	3,6334E+14	9,8766E+14	2,68474E+15	7,29788E+15	1,98377E+16	5,39245E+16	1,46582E+17	3,98451E+17	1,0831E+18
35	1,8622E+13	5,0619E+13	1,376E+14	3,7403E+14	1,0167E+15	2,7637E+15	7,51253E+15	2,04212E+16	5,55105E+16	1,50893E+17	4,1017E+17	1,115E+18
36	1,9154E+13	5,2065E+13	1,4153E+14	3,8471E+14	1,0458E+15	2,84267E+15	7,72717E+15	2,10046E+16	5,70965E+16	1,55204E+17	4,21889E+17	1,1468E+18
37	1,9686E+13	5,3512E+13	1,4546E+14	3,954E+14	1,0748E+15	2,92163E+15	7,94181E+15	2,15881E+16	5,86825E+16	1,59516E+17	4,33608E+17	1,1787E+18
38	2,0218E+13	5,4958E+13	1,4939E+14	4,0609E+14	1,1039E+15	3,00059E+15	8,15646E+15	2,21715E+16	6,02685E+16	1,63827E+17	4,45327E+17	1,2105E+18
39	2,075E+13	5,6404E+13	1,5332E+14	4,1677E+14	1,1329E+15	3,07956E+15	8,3711E+15	2,2755E+16	6,18545E+16	1,68138E+17	4,57047E+17	1,2424E+18
40	2,1282E+13	5,785E+13	1,5725E+14	4,2746E+14	1,162E+15	3,15852E+15	8,58574E+15	2,33385E+16	6,34405E+16	1,72449E+17	4,68766E+17	1,2742E+18
41	2,1814E+13	5,9297E+13	1,6118E+14	4,3815E+14	1,191E+15	3,23748E+15	8,80039E+15	2,39219E+16	6,50266E+16	1,7676E+17	4,80485E+17	1,3061E+18

Values of file*e^{col}

f*e^c	27	28	29	30	31	32	33	34	35	36	37	38
42	2,2346E+13	6,0743E+13	1,6512E+14	4,4883E+14	1,2201E+15	3,31644E+15	9,01503E+15	2,45054E+16	6,66126E+16	1,81072E+17	4,92204E+17	1,3379E+18
43	2,2878E+13	6,2189E+13	1,6905E+14	4,5952E+14	1,2491E+15	3,39541E+15	9,22967E+15	2,50889E+16	6,81986E+16	1,85383E+17	5,03923E+17	1,3698E+18
44	2,341E+13	6,3635E+13	1,7298E+14	4,702E+14	1,2781E+15	3,47437E+15	9,44432E+15	2,56723E+16	6,97846E+16	1,89694E+17	5,15642E+17	1,4017E+18
45	2,3942E+13	6,5082E+13	1,7691E+14	4,8089E+14	1,3072E+15	3,55333E+15	9,65896E+15	2,62558E+16	7,13706E+16	1,94005E+17	5,27361E+17	1,4335E+18
46	2,4474E+13	6,6528E+13	1,8084E+14	4,9158E+14	1,3362E+15	3,6323E+15	9,8736E+15	2,68392E+16	7,29566E+16	1,98317E+17	5,39081E+17	1,4654E+18
47	2,5006E+13	6,7974E+13	1,8477E+14	5,0226E+14	1,3653E+15	3,71126E+15	1,00882E+16	2,74227E+16	7,45426E+16	2,02628E+17	5,508E+17	1,4972E+18
48	2,5538E+13	6,942E+13	1,887E+14	5,1295E+14	1,3943E+15	3,79022E+15	1,03029E+16	2,80062E+16	7,61286E+16	2,06939E+17	5,62519E+17	1,5291E+18
49	2,607E+13	7,0867E+13	1,9264E+14	5,2364E+14	1,4234E+15	3,86919E+15	1,05175E+16	2,85896E+16	7,77147E+16	2,1125E+17	5,74238E+17	1,5609E+18
50	2,6602E+13	7,2313E+13	1,9657E+14	5,3432E+14	1,4524E+15	3,94815E+15	1,07322E+16	2,91731E+16	7,93007E+16	2,15562E+17	5,85957E+17	1,5928E+18
51	2,7134E+13	7,3759E+13	2,005E+14	5,4501E+14	1,4815E+15	4,02711E+15	1,09468E+16	2,97565E+16	8,08867E+16	2,19873E+17	5,97676E+17	1,6247E+18
52	2,7667E+13	7,5205E+13	2,0443E+14	5,557E+14	1,5105E+15	4,10607E+15	1,11615E+16	3,034E+16	8,24727E+16	2,24184E+17	6,09395E+17	1,6565E+18
53	2,8199E+13	7,6652E+13	2,0836E+14	5,6638E+14	1,5396E+15	4,18504E+15	1,13761E+16	3,09235E+16	8,40587E+16	2,28495E+17	6,21115E+17	1,6884E+18
54	2,8731E+13	7,8098E+13	2,1229E+14	5,7707E+14	1,5686E+15	4,264E+15	1,15908E+16	3,15069E+16	8,56447E+16	2,32807E+17	6,32834E+17	1,7202E+18
55	2,9263E+13	7,9544E+13	2,1622E+14	5,8776E+14	1,5977E+15	4,34296E+15	1,18054E+16	3,20904E+16	8,72307E+16	2,37118E+17	6,44553E+17	1,7521E+18
56	2,9795E+13	8,099E+13	2,2015E+14	5,9844E+14	1,6267E+15	4,42193E+15	1,202E+16	3,26739E+16	8,88168E+16	2,41429E+17	6,56272E+17	1,7839E+18
57	3,0327E+13	8,2437E+13	2,2409E+14	6,0913E+14	1,6558E+15	4,50089E+15	1,22347E+16	3,32573E+16	9,04028E+16	2,4574E+17	6,67991E+17	1,8158E+18
58	3,0859E+13	8,3883E+13	2,2802E+14	6,1982E+14	1,6848E+15	4,57985E+15	1,24493E+16	3,38408E+16	9,19888E+16	2,50051E+17	6,7971E+17	1,8476E+18
59	3,1391E+13	8,5329E+13	2,3195E+14	6,305E+14	1,7139E+15	4,65881E+15	1,2664E+16	3,44242E+16	9,35748E+16	2,54363E+17	6,91429E+17	1,8795E+18
60	3,1923E+13	8,6775E+13	2,3588E+14	6,4119E+14	1,7429E+15	4,73778E+15	1,28786E+16	3,50077E+16	9,51608E+16	2,58674E+17	7,03149E+17	1,9114E+18
61	3,2455E+13	8,8222E+13	2,3981E+14	6,5187E+14	1,772E+15	4,81674E+15	1,30933E+16	3,55912E+16	9,67468E+16	2,62985E+17	7,14868E+17	1,9432E+18
62	3,2987E+13	8,9668E+13	2,4374E+14	6,6256E+14	1,801E+15	4,8957E+15	1,33079E+16	3,61746E+16	9,83328E+16	2,67296E+17	7,26587E+17	1,9751E+18
63	3,3519E+13	9,1114E+13	2,4767E+14	6,7325E+14	1,8301E+15	4,97467E+15	1,35225E+16	3,67581E+16	9,99188E+16	2,71608E+17	7,38306E+17	2,0069E+18
64	3,4051E+13	9,256E+13	2,5161E+14	6,8393E+14	1,8591E+15	5,05363E+15	1,37372E+16	3,73416E+16	1,01505E+17	2,75919E+17	7,50025E+17	2,0388E+18

Values of file*e^{col}

f*e^c	39	40	41	42	43	44	45	46	47	48	49	50
1	8,6593E+16	2,3539E+17	6,3984E+17	1,7393E+18	4,7278E+18	1,28516E+19	3,49343E+19	9,49612E+19	2,58131E+20	7,01674E+20	1,90735E+21	5,1847E+21
2	1,7319E+17	4,7077E+17	1,2797E+18	3,4785E+18	9,4557E+18	2,57032E+19	6,98685E+19	1,89922E+20	5,16263E+20	1,40335E+21	3,81469E+21	1,0369E+22
3	2,5978E+17	7,0616E+17	1,9195E+18	5,2178E+18	1,4184E+19	3,85548E+19	1,04803E+20	2,84884E+20	7,74394E+20	2,10502E+21	5,72204E+21	1,5554E+22
4	3,4637E+17	9,4154E+17	2,5594E+18	6,9571E+18	1,8911E+19	5,14064E+19	1,39737E+20	3,79845E+20	1,03253E+21	2,80669E+21	7,62939E+21	2,0739E+22
5	4,3297E+17	1,1769E+18	3,1992E+18	8,6964E+18	2,3639E+19	6,4258E+19	1,74671E+20	4,74806E+20	1,29066E+21	3,50837E+21	9,53673E+21	2,5924E+22
6	5,1956E+17	1,4123E+18	3,8391E+18	1,0436E+19	2,8367E+19	7,71096E+19	2,09606E+20	5,69767E+20	1,54879E+21	4,21004E+21	1,14441E+22	3,1108E+22
7	6,0615E+17	1,6477E+18	4,4789E+18	1,2175E+19	3,3095E+19	8,99612E+19	2,4454E+20	6,64728E+20	1,80692E+21	4,91172E+21	1,33514E+22	3,6293E+22
8	6,9275E+17	1,8831E+18	5,1187E+18	1,3914E+19	3,7823E+19	1,02813E+20	2,79474E+20	7,5969E+20	2,06505E+21	5,61339E+21	1,52588E+22	4,1478E+22
9	7,7934E+17	2,1185E+18	5,7586E+18	1,5653E+19	4,2551E+19	1,15664E+20	3,14408E+20	8,54651E+20	2,32318E+21	6,31506E+21	1,71661E+22	4,6662E+22
10	8,6593E+17	2,3539E+18	6,3984E+18	1,7393E+19	4,7278E+19	1,28516E+20	3,49343E+20	9,49612E+20	2,58131E+21	7,01674E+21	1,90735E+22	5,1847E+22
11	9,5253E+17	2,5892E+18	7,0383E+18	1,9132E+19	5,2006E+19	1,41368E+20	3,84277E+20	1,04457E+21	2,83944E+21	7,71841E+21	2,09808E+22	5,7032E+22
12	1,0391E+18	2,8246E+18	7,6781E+18	2,0871E+19	5,6734E+19	1,54219E+20	4,19211E+20	1,13953E+21	3,09758E+21	8,42008E+21	2,28882E+22	6,2216E+22
13	1,1257E+18	3,06E+18	8,318E+18	2,2611E+19	6,1462E+19	1,67071E+20	4,54146E+20	1,2345E+21	3,35571E+21	9,12176E+21	2,47955E+22	6,7401E+22
14	1,2123E+18	3,2954E+18	8,9578E+18	2,435E+19	6,619E+19	1,79922E+20	4,8908E+20	1,32946E+21	3,61384E+21	9,82343E+21	2,67029E+22	7,2586E+22
15	1,2989E+18	3,5308E+18	9,5977E+18	2,6089E+19	7,0918E+19	1,92774E+20	5,24014E+20	1,42442E+21	3,87197E+21	1,05251E+22	2,86102E+22	7,7771E+22
16	1,3855E+18	3,7662E+18	1,0237E+19	2,7828E+19	7,5645E+19	2,05626E+20	5,58948E+20	1,51938E+21	4,1301E+21	1,12268E+22	3,05175E+22	8,2955E+22
17	1,4721E+18	4,0015E+18	1,0877E+19	2,9568E+19	8,0373E+19	2,18477E+20	5,93883E+20	1,61434E+21	4,38823E+21	1,19285E+22	3,24249E+22	8,814E+22
18	1,5587E+18	4,2369E+18	1,1517E+19	3,1307E+19	8,5101E+19	2,31329E+20	6,28817E+20	1,7093E+21	4,64636E+21	1,26301E+22	3,43322E+22	9,3325E+22
19	1,6453E+18	4,4723E+18	1,2157E+19	3,3046E+19	8,9829E+19	2,4418E+20	6,63751E+20	1,80426E+21	4,90449E+21	1,33318E+22	3,62396E+22	9,8509E+22
20	1,7319E+18	4,7077E+18	1,2797E+19	3,4785E+19	9,4557E+19	2,57032E+20	6,98685E+20	1,89922E+21	5,16263E+21	1,40335E+22	3,81469E+22	1,0369E+23
21	1,8185E+18	4,9431E+18	1,3437E+19	3,6525E+19	9,9285E+19	2,69884E+20	7,3362E+20	1,99419E+21	5,42076E+21	1,47351E+22	4,00543E+22	1,0888E+23
22	1,9051E+18	5,1785E+18	1,4077E+19	3,8264E+19	1,0401E+20	2,82735E+20	7,68554E+20	2,08915E+21	5,67889E+21	1,54368E+22	4,19616E+22	1,1406E+23
23	1,9916E+18	5,4139E+18	1,4716E+19	4,0003E+19	1,0874E+20	2,95587E+20	8,03488E+20	2,18411E+21	5,93702E+21	1,61385E+22	4,3869E+22	1,1925E+23
24	2,0782E+18	5,6492E+18	1,5356E+19	4,1743E+19	1,1347E+20	3,08438E+20	8,38423E+20	2,27907E+21	6,19515E+21	1,68402E+22	4,57763E+22	1,2443E+23
25	2,1648E+18	5,8846E+18	1,5996E+19	4,3482E+19	1,182E+20	3,2129E+20	8,73357E+20	2,37403E+21	6,45328E+21	1,75418E+22	4,76837E+22	1,2962E+23
26	2,2514E+18	6,12E+18	1,6636E+19	4,5221E+19	1,2292E+20	3,34142E+20	9,08291E+20	2,46899E+21	6,71141E+21	1,82435E+22	4,9591E+22	1,348E+23
27	2,338E+18	6,3554E+18	1,7276E+19	4,696E+19	1,2765E+20	3,46993E+20	9,43225E+20	2,56395E+21	6,96954E+21	1,89452E+22	5,14984E+22	1,3999E+23
28	2,4246E+18	6,5908E+18	1,7916E+19	4,87E+19	1,3238E+20	3,59845E+20	9,7816E+20	2,65891E+21	7,22768E+21	1,96469E+22	5,34057E+22	1,4517E+23
29	2,5112E+18	6,8262E+18	1,8555E+19	5,0439E+19	1,3711E+20	3,72696E+20	1,01309E+21	2,75387E+21	7,48581E+21	2,03485E+22	5,53131E+22	1,5036E+23

Values of file*e^{col}

f*e^{c}	39	40	41	42	43	44	45	46	47	48	49	50
30	2,5978E+18	7,0616E+18	1,9195E+19	5,2178E+19	1,4184E+20	3,85548E+20	1,04803E+21	2,84884E+21	7,74394E+21	2,10502E+22	5,72204E+22	1,5554E+23
31	2,6844E+18	7,2969E+18	1,9835E+19	5,3918E+19	1,4656E+20	3,984E+20	1,08296E+21	2,9438E+21	8,00207E+21	2,17519E+22	5,91277E+22	1,6073E+23
32	2,771E+18	7,5323E+18	2,0475E+19	5,5657E+19	1,5129E+20	4,11251E+20	1,1179E+21	3,03876E+21	8,2602E+21	2,24536E+22	6,10351E+22	1,6591E+23
33	2,8576E+18	7,7677E+18	2,1115E+19	5,7396E+19	1,5602E+20	4,24103E+20	1,15283E+21	3,13372E+21	8,51833E+21	2,31552E+22	6,29424E+22	1,711E+23
34	2,9442E+18	8,0031E+18	2,1755E+19	5,9135E+19	1,6075E+20	4,36954E+20	1,18777E+21	3,22868E+21	8,77646E+21	2,38569E+22	6,48498E+22	1,7628E+23
35	3,0308E+18	8,2385E+18	2,2395E+19	6,0875E+19	1,6547E+20	4,49806E+20	1,2227E+21	3,32364E+21	9,0346E+21	2,45586E+22	6,67571E+22	1,8146E+23
36	3,1174E+18	8,4739E+18	2,3034E+19	6,2614E+19	1,702E+20	4,62658E+20	1,25763E+21	3,4186E+21	9,29273E+21	2,52602E+22	6,86645E+22	1,8665E+23
37	3,204E+18	8,7093E+18	2,3674E+19	6,4353E+19	1,7493E+20	4,75509E+20	1,29257E+21	3,51356E+21	9,55086E+21	2,59619E+22	7,05718E+22	1,9183E+23
38	3,2905E+18	8,9446E+18	2,4314E+19	6,6092E+19	1,7966E+20	4,88361E+20	1,3275E+21	3,60853E+21	9,80899E+21	2,66636E+22	7,24792E+22	1,9702E+23
39	3,3771E+18	9,18E+18	2,4954E+19	6,7832E+19	1,8439E+20	5,01212E+20	1,36244E+21	3,70349E+21	1,00671E+22	2,73653E+22	7,43865E+22	2,022E+23
40	3,4637E+18	9,4154E+18	2,5594E+19	6,9571E+19	1,8911E+20	5,14064E+20	1,39737E+21	3,79845E+21	1,03253E+22	2,80669E+22	7,62939E+22	2,0739E+23
41	3,5503E+18	9,6508E+18	2,6234E+19	7,131E+19	1,9384E+20	5,26916E+20	1,43231E+21	3,89341E+21	1,05834E+22	2,87686E+22	7,82012E+22	2,1257E+23
42	3,6369E+18	9,8862E+18	2,6873E+19	7,305E+19	1,9857E+20	5,39767E+20	1,46724E+21	3,98837E+21	1,08415E+22	2,94703E+22	8,01086E+22	2,1776E+23
43	3,7235E+18	1,0122E+19	2,7513E+19	7,4789E+19	2,033E+20	5,52619E+20	1,50217E+21	4,08333E+21	1,10996E+22	3,0172E+22	8,20159E+22	2,2294E+23
44	3,8101E+18	1,0357E+19	2,8153E+19	7,6528E+19	2,0802E+20	5,6547E+20	1,53711E+21	4,17829E+21	1,13578E+22	3,08736E+22	8,39232E+22	2,2813E+23
45	3,8967E+18	1,0592E+19	2,8793E+19	7,8267E+19	2,1275E+20	5,78322E+20	1,57204E+21	4,27325E+21	1,16159E+22	3,15753E+22	8,58306E+22	2,3331E+23
46	3,9833E+18	1,0828E+19	2,9433E+19	8,0007E+19	2,1748E+20	5,91174E+20	1,60698E+21	4,36821E+21	1,1874E+22	3,2277E+22	8,77379E+22	2,385E+23
47	4,0699E+18	1,1063E+19	3,0073E+19	8,1746E+19	2,2221E+20	6,04025E+20	1,64191E+21	4,46318E+21	1,21322E+22	3,29787E+22	8,96453E+22	2,4368E+23
48	4,1565E+18	1,1298E+19	3,0712E+19	8,3485E+19	2,2694E+20	6,16877E+20	1,67685E+21	4,55814E+21	1,23903E+22	3,36803E+22	9,15526E+22	2,4887E+23
49	4,2431E+18	1,1534E+19	3,1352E+19	8,5224E+19	2,3166E+20	6,29728E+20	1,71178E+21	4,6531E+21	1,26484E+22	3,4382E+22	9,346E+22	2,5405E+23
50	4,3297E+18	1,1769E+19	3,1992E+19	8,6964E+19	2,3639E+20	6,4258E+20	1,74671E+21	4,74806E+21	1,29066E+22	3,50837E+22	9,53673E+22	2,5924E+23
51	4,4163E+18	1,2005E+19	3,2632E+19	8,8703E+19	2,4112E+20	6,55432E+20	1,78165E+21	4,84302E+21	1,31647E+22	3,57854E+22	9,72747E+22	2,6442E+23
52	4,5029E+18	1,224E+19	3,3272E+19	9,0442E+19	2,4585E+20	6,68283E+20	1,81658E+21	4,93798E+21	1,34228E+22	3,6487E+22	9,9182E+22	2,696E+23
53	4,5895E+18	1,2475E+19	3,3912E+19	9,2182E+19	2,5058E+20	6,81135E+20	1,85152E+21	5,03294E+21	1,3681E+22	3,71887E+22	1,01089E+23	2,7479E+23
54	4,676E+18	1,2711E+19	3,4552E+19	9,3921E+19	2,553E+20	6,93986E+20	1,88645E+21	5,1279E+21	1,39391E+22	3,78904E+22	1,02997E+23	2,7997E+23
55	4,7626E+18	1,2946E+19	3,5191E+19	9,566E+19	2,6003E+20	7,06838E+20	1,92138E+21	5,22287E+21	1,41972E+22	3,8592E+22	1,04904E+23	2,8516E+23
56	4,8492E+18	1,3182E+19	3,5831E+19	9,7399E+19	2,6476E+20	7,1969E+20	1,95632E+21	5,31783E+21	1,44554E+22	3,92937E+22	1,06811E+23	2,9034E+23
57	4,9358E+18	1,3417E+19	3,6471E+19	9,9139E+19	2,6949E+20	7,32541E+20	1,99125E+21	5,41279E+21	1,47135E+22	3,99954E+22	1,08719E+23	2,9553E+23
58	5,0224E+18	1,3652E+19	3,7111E+19	1,0088E+20	2,7421E+20	7,45393E+20	2,02619E+21	5,50775E+21	1,49716E+22	4,06971E+22	1,10626E+23	3,0071E+23

Values of file*e^{col}

f*e^{c}	39	40	41	42	43	44	45	46	47	48	49	50
59	5,109E+18	1,3888E+19	3,7751E+19	1,0262E+20	2,7894E+20	7,58244E+20	2,06112E+21	5,60271E+21	1,52297E+22	4,13987E+22	1,12533E+23	3,059E+23
60	5,1956E+18	1,4123E+19	3,8391E+19	1,0436E+20	2,8367E+20	7,71096E+20	2,09606E+21	5,69767E+21	1,54879E+22	4,21004E+22	1,14441E+23	3,1108E+23
61	5,2822E+18	1,4359E+19	3,903E+19	1,061E+20	2,884E+20	7,83948E+20	2,13099E+21	5,79263E+21	1,5746E+22	4,28021E+22	1,16348E+23	3,1627E+23
62	5,3688E+18	1,4594E+19	3,967E+19	1,0784E+20	2,9313E+20	7,96799E+20	2,16592E+21	5,88759E+21	1,60041E+22	4,35038E+22	1,18255E+23	3,2145E+23
63	5,4554E+18	1,4829E+19	4,031E+19	1,0957E+20	2,9785E+20	8,09651E+20	2,20086E+21	5,98256E+21	1,62623E+22	4,42054E+22	1,20163E+23	3,2664E+23
64	5,542E+18	1,5065E+19	4,095E+19	1,1131E+20	3,0258E+20	8,22502E+20	2,23579E+21	6,07752E+21	1,65204E+22	4,49071E+22	1,2207E+23	3,3182E+23

Values of file*e^{col}

f*e^{c}	51	52	53	54	55	56	57	58
1	1,4093E+22	3,831E+22	1,0414E+23	2,8308E+23	7,6948E+23	2,09166E+24	5,68572E+24	1,54554E+25
2	2,8187E+22	7,662E+22	2,0828E+23	5,6615E+23	1,539E+24	4,18332E+24	1,13714E+25	3,09108E+25
3	4,228E+22	1,1493E+23	3,1241E+23	8,4923E+23	2,3084E+24	6,27498E+24	1,70572E+25	4,63662E+25
4	5,6374E+22	1,5324E+23	4,1655E+23	1,1323E+24	3,0779E+24	8,36664E+24	2,27429E+25	6,18216E+25
5	7,0467E+22	1,9155E+23	5,2069E+23	1,4154E+24	3,8474E+24	1,04583E+25	2,84286E+25	7,72769E+25
6	8,4561E+22	2,2986E+23	6,2483E+23	1,6985E+24	4,6169E+24	1,255E+25	3,41143E+25	9,27323E+25
7	9,8654E+22	2,6817E+23	7,2896E+23	1,9815E+24	5,3863E+24	1,46416E+25	3,98E+25	1,08188E+26
8	1,1275E+23	3,0648E+23	8,331E+23	2,2646E+24	6,1558E+24	1,67333E+25	4,54858E+25	1,23643E+26
9	1,2684E+23	3,4479E+23	9,3724E+23	2,5477E+24	6,9253E+24	1,88249E+25	5,11715E+25	1,39099E+26
10	1,4093E+23	3,831E+23	1,0414E+24	2,8308E+24	7,6948E+24	2,09166E+25	5,68572E+25	1,54554E+26
11	1,5503E+23	4,2141E+23	1,1455E+24	3,1138E+24	8,4643E+24	2,30083E+25	6,25429E+25	1,70009E+26
12	1,6912E+23	4,5972E+23	1,2497E+24	3,3969E+24	9,2337E+24	2,50999E+25	6,82286E+25	1,85465E+26
13	1,8322E+23	4,9803E+23	1,3538E+24	3,68E+24	1,0003E+25	2,71916E+25	7,39144E+25	2,0092E+26
14	1,9731E+23	5,3634E+23	1,4579E+24	3,9631E+24	1,0773E+25	2,92832E+25	7,96001E+25	2,16375E+26
15	2,114E+23	5,7465E+23	1,5621E+24	4,2461E+24	1,1542E+25	3,13749E+25	8,52858E+25	2,31831E+26
16	2,255E+23	6,1296E+23	1,6662E+24	4,5292E+24	1,2312E+25	3,34666E+25	9,09715E+25	2,47286E+26
17	2,3959E+23	6,5127E+23	1,7703E+24	4,8123E+24	1,3081E+25	3,55582E+25	9,66572E+25	2,62742E+26
18	2,5368E+23	6,8958E+23	1,8745E+24	5,0954E+24	1,3851E+25	3,76499E+25	1,02343E+26	2,78197E+26
19	2,6778E+23	7,2789E+23	1,9786E+24	5,3784E+24	1,462E+25	3,97415E+25	1,08029E+26	2,93652E+26
20	2,8187E+23	7,662E+23	2,0828E+24	5,6615E+24	1,539E+25	4,18332E+25	1,13714E+26	3,09108E+26
21	2,9596E+23	8,0451E+23	2,1869E+24	5,9446E+24	1,6159E+25	4,39248E+25	1,194E+26	3,24563E+26
22	3,1006E+23	8,4282E+23	2,291E+24	6,2277E+24	1,6929E+25	4,60165E+25	1,25086E+26	3,40019E+26
23	3,2415E+23	8,8113E+23	2,3952E+24	6,5107E+24	1,7698E+25	4,81082E+25	1,30772E+26	3,55474E+26
24	3,3824E+23	9,1944E+23	2,4993E+24	6,7938E+24	1,8467E+25	5,01998E+25	1,36457E+26	3,70929E+26
25	3,5234E+23	9,5775E+23	2,6034E+24	7,0769E+24	1,9237E+25	5,22915E+25	1,42143E+26	3,86385E+26
26	3,6643E+23	9,9606E+23	2,7076E+24	7,36E+24	2,0006E+25	5,43831E+25	1,47829E+26	4,0184E+26
27	3,8052E+23	1,0344E+24	2,8117E+24	7,643E+24	2,0776E+25	5,64748E+25	1,53514E+26	4,17296E+26
28	3,9462E+23	1,0727E+24	2,9159E+24	7,9261E+24	2,1545E+25	5,85665E+25	1,592E+26	4,32751E+26
29	4,0871E+23	1,111E+24	3,02E+24	8,2092E+24	2,2315E+25	6,06581E+25	1,64886E+26	4,48206E+26
30	4,228E+23	1,1493E+24	3,1241E+24	8,4923E+24	2,3084E+25	6,27498E+25	1,70572E+26	4,63662E+26
31	4,369E+23	1,1876E+24	3,2283E+24	8,7753E+24	2,3854E+25	6,48414E+25	1,76257E+26	4,79117E+26
32	4,5099E+23	1,2259E+24	3,3324E+24	9,0584E+24	2,4623E+25	6,69331E+25	1,81943E+26	4,94572E+26
33	4,6509E+23	1,2642E+24	3,4365E+24	9,3415E+24	2,5393E+25	6,90248E+25	1,87629E+26	5,10028E+26
34	4,7918E+23	1,3025E+24	3,5407E+24	9,6246E+24	2,6162E+25	7,11164E+25	1,93314E+26	5,25483E+26
35	4,9327E+23	1,3409E+24	3,6448E+24	9,9076E+24	2,6932E+25	7,32081E+25	1,99E+26	5,40939E+26
36	5,0737E+23	1,3792E+24	3,749E+24	1,0191E+25	2,7701E+25	7,52997E+25	2,04686E+26	5,56394E+26
37	5,2146E+23	1,4175E+24	3,8531E+24	1,0474E+25	2,8471E+25	7,73914E+25	2,10372E+26	5,71849E+26
38	5,3555E+23	1,4558E+24	3,9572E+24	1,0757E+25	2,924E+25	7,94831E+25	2,16057E+26	5,87305E+26
39	5,4965E+23	1,4941E+24	4,0614E+24	1,104E+25	3,001E+25	8,15747E+25	2,21743E+26	6,0276E+26
40	5,6374E+23	1,5324E+24	4,1655E+24	1,1323E+25	3,0779E+25	8,36664E+25	2,27429E+26	6,18216E+26
41	5,7783E+23	1,5707E+24	4,2696E+24	1,1606E+25	3,1549E+25	8,5758E+25	2,33115E+26	6,33671E+26
42	5,9193E+23	1,609E+24	4,3738E+24	1,1889E+25	3,2318E+25	8,78497E+25	2,388E+26	6,49126E+26
43	6,0602E+23	1,6473E+24	4,4779E+24	1,2172E+25	3,3088E+25	8,99414E+25	2,44486E+26	6,64582E+26
44	6,2011E+23	1,6856E+24	4,5821E+24	1,2455E+25	3,3857E+25	9,2033E+25	2,50172E+26	6,80037E+26
45	6,3421E+23	1,724E+24	4,6862E+24	1,2738E+25	3,4627E+25	9,41247E+25	2,55857E+26	6,95493E+26

Values of file*e^{col}

46	6,483E+23	1,7623E+24	4,7903E+24	1,3021E+25	3,5396E+25	9,62163E+25	2,61543E+26	7,10948E+26
f*e^{c}	51	52	53	54	55	56	57	58
47	6,6239E+23	1,8006E+24	4,8945E+24	1,3305E+25	3,6165E+25	9,8308E+25	2,67229E+26	7,26403E+26
48	6,7649E+23	1,8389E+24	4,9986E+24	1,3588E+25	3,6935E+25	1,004E+26	2,72915E+26	7,41859E+26
49	6,9058E+23	1,8772E+24	5,1027E+24	1,3871E+25	3,7704E+25	1,02491E+26	2,786E+26	7,57314E+26
50	7,0467E+23	1,9155E+24	5,2069E+24	1,4154E+25	3,8474E+25	1,04583E+26	2,84286E+26	7,72769E+26
51	7,1877E+23	1,9538E+24	5,311E+24	1,4437E+25	3,9243E+25	1,06675E+26	2,89972E+26	7,88225E+26
52	7,3286E+23	1,9921E+24	5,4152E+24	1,472E+25	4,0013E+25	1,08766E+26	2,95657E+26	8,0368E+26
53	7,4696E+23	2,0304E+24	5,5193E+24	1,5003E+25	4,0782E+25	1,10858E+26	3,01343E+26	8,19136E+26
54	7,6105E+23	2,0687E+24	5,6234E+24	1,5286E+25	4,1552E+25	1,1295E+26	3,07029E+26	8,34591E+26
55	7,7514E+23	2,1071E+24	5,7276E+24	1,5569E+25	4,2321E+25	1,15041E+26	3,12715E+26	8,50046E+26
56	7,8924E+23	2,1454E+24	5,8317E+24	1,5852E+25	4,3091E+25	1,17133E+26	3,184E+26	8,65502E+26
57	8,0333E+23	2,1837E+24	5,9358E+24	1,6135E+25	4,386E+25	1,19225E+26	3,24086E+26	8,80957E+26
58	8,1742E+23	2,222E+24	6,04E+24	1,6418E+25	4,463E+25	1,21316E+26	3,29772E+26	8,96413E+26
59	8,3152E+23	2,2603E+24	6,1441E+24	1,6701E+25	4,5399E+25	1,23408E+26	3,35457E+26	9,11868E+26
60	8,4561E+23	2,2986E+24	6,2483E+24	1,6985E+25	4,6169E+25	1,255E+26	3,41143E+26	9,27323E+26
61	8,597E+23	2,3369E+24	6,3524E+24	1,7268E+25	4,6938E+25	1,27591E+26	3,46829E+26	9,42779E+26
62	8,738E+23	2,3752E+24	6,4565E+24	1,7551E+25	4,7708E+25	1,29683E+26	3,52515E+26	9,58234E+26
63	8,8789E+23	2,4135E+24	6,5607E+24	1,7834E+25	4,8477E+25	1,31775E+26	3,582E+26	9,7369E+26
64	9,0198E+23	2,4518E+24	6,6648E+24	1,8117E+25	4,9247E+25	1,33866E+26	3,63886E+26	9,89145E+26

f*e^{c}	59	60	61	62	63	64	65
1	4,2012E+25	1,142E+26	3,1043E+26	8,4384E+26	2,2938E+27	6,23515E+27	1,69489E+28
2	8,4024E+25	2,284E+26	6,2086E+26	1,6877E+27	4,5876E+27	1,24703E+28	3,38978E+28
3	1,2604E+26	3,426E+26	9,3129E+26	2,5315E+27	6,8813E+27	1,87054E+28	5,08467E+28
4	1,6805E+26	4,568E+26	1,2417E+27	3,3753E+27	9,1751E+27	2,49406E+28	6,77956E+28
5	2,1006E+26	5,71E+26	1,5521E+27	4,2192E+27	1,1469E+28	3,11757E+28	8,47445E+28
6	2,5207E+26	6,852E+26	1,8626E+27	5,063E+27	1,3763E+28	3,74109E+28	1,01693E+29
7	2,9408E+26	7,9941E+26	2,173E+27	5,9068E+27	1,6056E+28	4,3646E+28	1,18642E+29
8	3,361E+26	9,1361E+26	2,4834E+27	6,7507E+27	1,835E+28	4,98812E+28	1,35591E+29
9	3,7811E+26	1,0278E+27	2,7939E+27	7,5945E+27	2,0644E+28	5,61163E+28	1,5254E+29
10	4,2012E+26	1,142E+27	3,1043E+27	8,4384E+27	2,2938E+28	6,23515E+28	1,69489E+29
11	4,6213E+26	1,2562E+27	3,4147E+27	9,2822E+27	2,5232E+28	6,85866E+28	1,86438E+29
12	5,0415E+26	1,3704E+27	3,7252E+27	1,0126E+28	2,7525E+28	7,48218E+28	2,03387E+29
13	5,4616E+26	1,4846E+27	4,0356E+27	1,097E+28	2,9819E+28	8,10569E+28	2,20336E+29
14	5,8817E+26	1,5988E+27	4,346E+27	1,1814E+28	3,2113E+28	8,72921E+28	2,37284E+29
15	6,3018E+26	1,713E+27	4,6564E+27	1,2658E+28	3,4407E+28	9,35272E+28	2,54233E+29
16	6,7219E+26	1,8272E+27	4,9669E+27	1,3501E+28	3,6701E+28	9,97624E+28	2,71182E+29
17	7,1421E+26	1,9414E+27	5,2773E+27	1,4345E+28	3,8994E+28	1,05998E+29	2,88131E+29
18	7,5622E+26	2,0556E+27	5,5877E+27	1,5189E+28	4,1288E+28	1,12233E+29	3,0508E+29
19	7,9823E+26	2,1698E+27	5,8982E+27	1,6033E+28	4,3582E+28	1,18468E+29	3,22029E+29
20	8,4024E+26	2,284E+27	6,2086E+27	1,6877E+28	4,5876E+28	1,24703E+29	3,38978E+29
21	8,8225E+26	2,3982E+27	6,519E+27	1,7721E+28	4,8169E+28	1,30938E+29	3,55927E+29
22	9,2427E+26	2,5124E+27	6,8295E+27	1,8564E+28	5,0463E+28	1,37173E+29	3,72876E+29
23	9,6628E+26	2,6266E+27	7,1399E+27	1,9408E+28	5,2757E+28	1,43408E+29	3,89825E+29
24	1,0083E+27	2,7408E+27	7,4503E+27	2,0252E+28	5,5051E+28	1,49644E+29	4,06773E+29
25	1,0503E+27	2,855E+27	7,7607E+27	2,1096E+28	5,7345E+28	1,55879E+29	4,23722E+29

Values of file*e^{col}

26	1,0923E+27	2,9692E+27	8,0712E+27	2,194E+28	5,9638E+28	1,62114E+29	4,40671E+29
27	1,1343E+27	3,0834E+27	8,3816E+27	2,2784E+28	6,1932E+28	1,68349E+29	4,5762E+29
f*e^c	59	60	61	62	63	64	65
28	1,1763E+27	3,1976E+27	8,692E+27	2,3627E+28	6,4226E+28	1,74584E+29	4,74569E+29
29	1,2184E+27	3,3118E+27	9,0025E+27	2,4471E+28	6,652E+28	1,80819E+29	4,91518E+29
30	1,2604E+27	3,426E+27	9,3129E+27	2,5315E+28	6,8813E+28	1,87054E+29	5,08467E+29
31	1,3024E+27	3,5402E+27	9,6233E+27	2,6159E+28	7,1107E+28	1,9329E+29	5,25416E+29
32	1,3444E+27	3,6544E+27	9,9338E+27	2,7003E+28	7,3401E+28	1,99525E+29	5,42365E+29
33	1,3864E+27	3,7686E+27	1,0244E+28	2,7847E+28	7,5695E+28	2,0576E+29	5,59313E+29
34	1,4284E+27	3,8828E+27	1,0555E+28	2,869E+28	7,7989E+28	2,11995E+29	5,76262E+29
35	1,4704E+27	3,997E+27	1,0865E+28	2,9534E+28	8,0282E+28	2,1823E+29	5,93211E+29
36	1,5124E+27	4,1112E+27	1,1175E+28	3,0378E+28	8,2576E+28	2,24465E+29	6,1016E+29
37	1,5544E+27	4,2254E+27	1,1486E+28	3,1222E+28	8,487E+28	2,30701E+29	6,27109E+29
38	1,5965E+27	4,3396E+27	1,1796E+28	3,2066E+28	8,7164E+28	2,36936E+29	6,44058E+29
39	1,6385E+27	4,4538E+27	1,2107E+28	3,291E+28	8,9458E+28	2,43171E+29	6,61007E+29
40	1,6805E+27	4,568E+27	1,2417E+28	3,3753E+28	9,1751E+28	2,49406E+29	6,77956E+29
41	1,7225E+27	4,6822E+27	1,2728E+28	3,4597E+28	9,4045E+28	2,55641E+29	6,94905E+29
42	1,7645E+27	4,7964E+27	1,3038E+28	3,5441E+28	9,6339E+28	2,61876E+29	7,11853E+29
43	1,8065E+27	4,9106E+27	1,3348E+28	3,6285E+28	9,8633E+28	2,68111E+29	7,28802E+29
44	1,8485E+27	5,0248E+27	1,3659E+28	3,7129E+28	1,0093E+29	2,74347E+29	7,45751E+29
45	1,8905E+27	5,139E+27	1,3969E+28	3,7973E+28	1,0322E+29	2,80582E+29	7,627E+29
46	1,9326E+27	5,2532E+27	1,428E+28	3,8816E+28	1,0551E+29	2,86817E+29	7,79649E+29
47	1,9746E+27	5,3674E+27	1,459E+28	3,966E+28	1,0781E+29	2,93052E+29	7,96598E+29
48	2,0166E+27	5,4816E+27	1,4901E+28	4,0504E+28	1,101E+29	2,99287E+29	8,13547E+29
49	2,0586E+27	5,5958E+27	1,5211E+28	4,1348E+28	1,124E+29	3,05522E+29	8,30496E+29
50	2,1006E+27	5,71E+27	1,5521E+28	4,2192E+28	1,1469E+29	3,11757E+29	8,47445E+29
51	2,1426E+27	5,8242E+27	1,5832E+28	4,3036E+28	1,1698E+29	3,17993E+29	8,64394E+29
52	2,1846E+27	5,9384E+27	1,6142E+28	4,3879E+28	1,1928E+29	3,24228E+29	8,81342E+29
53	2,2266E+27	6,0526E+27	1,6453E+28	4,4723E+28	1,2157E+29	3,30463E+29	8,98291E+29
54	2,2687E+27	6,1668E+27	1,6763E+28	4,5567E+28	1,2386E+29	3,36698E+29	9,1524E+29
55	2,3107E+27	6,281E+27	1,7074E+28	4,6411E+28	1,2616E+29	3,42933E+29	9,32189E+29
56	2,3527E+27	6,3952E+27	1,7384E+28	4,7255E+28	1,2845E+29	3,49168E+29	9,49138E+29
57	2,3947E+27	6,5094E+27	1,7694E+28	4,8099E+28	1,3075E+29	3,55403E+29	9,66087E+29
58	2,4367E+27	6,6236E+27	1,8005E+28	4,8942E+28	1,3304E+29	3,61639E+29	9,83036E+29
59	2,4787E+27	6,7378E+27	1,8315E+28	4,9786E+28	1,3533E+29	3,67874E+29	9,99985E+29
60	2,5207E+27	6,852E+27	1,8626E+28	5,063E+28	1,3763E+29	3,74109E+29	1,01693E+30
61	2,5627E+27	6,9662E+27	1,8936E+28	5,1474E+28	1,3992E+29	3,80344E+29	1,03388E+30
62	2,6048E+27	7,0804E+27	1,9247E+28	5,2318E+28	1,4221E+29	3,86579E+29	1,05083E+30
63	2,6468E+27	7,1946E+27	1,9557E+28	5,3162E+28	1,4451E+29	3,92814E+29	1,06778E+30
64	2,6888E+27	7,3088E+27	1,9868E+28	5,4005E+28	1,468E+29	3,9905E+29	1,08473E+30