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On Left Slides (Upper or Lower) in *e*-Abacus Diagram

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Abstract

There has been an upsurge in interest in studying different (movements) on the e-abacus diagram in recent years in an effort to ascertain how these movements affect the design's origin as a type of coding. In this paper, we will present a technique that s being utilized for the first time, but from a single diagram, we will produce numerous diagrams that are distinct from one another save for some areas of the diagram, making it nearly impossible to identify the original. It will begin exclusively on the bottom left side of the picture, move in a manner akin to slides from top to bottom and from bottom to top, then exclusively on the top left side of the diagram, move in the direction up at the bottom, and eventually go downward to the top. We will present four new types in this research and in the upper or lower directions by dividing the diagram into slides merely from the left side of the diagram, namely LSUUL, LSULU, LSLUL, and LSLLU.

Keywords: Partition, e-abacus diagram, coding theory.

حول المقاطع اليسرى (العليا او السفلى) للمخطط المعداد من النمط – *e*

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المستخلص

في السنوات الاخيرة زاد الاهتمام بالحركات التي تحدث على المخطط المعداد من النمط – *e* حيث تناولت دراسات عدة هذا النوع بشكل مفصل واثر هذه الحركات على مفهوم الترميز. في هذا البحث تم اعتماد ولأول مرة اسلوب جديد; مع التأكيد انه من الممكن ان نأخذ الاتجاه الايمن ولكنه سيكون بنفس الالية ; ولهذا لم نحاول ان نعتمده هنا بحيث يخرج لدينا من المخطط الواحد عدة مخططات, مما يصعب كشف اصل المخطط واطلقنا هنا اسم المقاطع لأنها فعليا ستكون بهذا الشكل لتكون على المخططات المعداد من خلال اتخاذ الجهة اليسرى حصريا ومن ثم اعتماد مفهوم المقاطع التي ومن خلال اربع انواع (اسفل المخطط كليا وبالاتجاه (اعلى الى الاسفل) هذا اولا ومن ثم (اسفل الى الاعلى) وهذا ثاني نوع من المقاطع المستحدثة) لننتقل بعدها من (اعلى المخطط كليا ودائما بالاتجاه الايسر من (اعلى الى الاسفل) ليكون ثالث المقاطع الجديدة ويبقى لدينا اخر المقاطع الذي سيكون من (اسفل الى الاعلى)) وبالتالي سنرمز عليهم كل من LSUUL, LSULU, LSLUL , LSLLU.

الكلمات المفتاحية : التجزئة, المخطط المعداد من النمط – e و نظرية الترميز.

1. Introduction

As for the non-negative integers $\tau_1, \tau_2, \dots, \tau_n$ whose total equals the value r. A partition $\tau = (\tau_1, \tau_2, \dots, \tau_n)$ is an arrangement of these numbers that takes advantage of the fact that they are either equal or decreasing. For example, (5, 5, 4, 4, 4, 4, 1) is a partition of 27, but (5, 4, 4, 4, 4, 5, 1) is not. Defining $\beta_j = \tau_j + b - j$, $1 \le j \le b$. The set $\{\beta_1, \beta_2, \cdots \beta_b\}$ is said to be the set of β - number for τ, see [1]. Let *e* be a positive integer number greater than or equal to 2, we can represent numbers by a diagram called *e*-abacus diagram, see [2], as shown in Table 1:

Table 1. *e*-Abacus Diagram

runner – 1	runner - 2	…	runner - *e*
0	1	…	*e* – 1
e	*e* + 1	…	2*e* -1
2*e*	2*e* + 1	…	3*e* -1
⋮	⋮	⋮	⋮

Where every β – number will be represented by (▪) which takes its location in the *e*-abacus diagram and in case of the nonexistence of β - numbers, then it will be represented by (-). From the above example (5, 5, 4, 4, 4, 4, 1):

(5, 5, 4, 4, 4, 4, 1)

2-abacus

-	▪
-	-
-	▪
▪	▪
▪	-
▪	▪

3-abacus

-	▪	-
-	-	▪
▪	▪	▪
-	▪	▪

4-abacus

-	▪	-	-
-	▪	▪	▪
▪	-	▪	▪

5-abacus

-	▪	-	-	-
▪	▪	▪	▪	-
▪	▪	-	-	-

Figure 2: Abacus for (5, 5, 4, 4, 4, 4, 1)

1. LS Methods:

This paper will shed lights on the four four types of Left Slides (LS), and we will explain the differences between them that made us study these possibilities carefully because of their importance later on in the new coding process.

1.1 LSUUL-Method:

The following steps are the basis of this approach:

1. Consider the *e*-abacus diagram designated for the initial retail.
2. suppose that this image is an array with *t* rows and *c* columns.
3. Slide S_1 will be in position (*t* x 1).

4. Slide S_2 will have the positions {(t-1 x 1) - (t x 2)} take note that the direction of this slide is upper-to-lower, which is why is referred to as UL.
5.slide S_3 will be the sites {(t-2 x 1) – (t-1 x 2) – (t x 3)} and always go in the up-to-down direction.
6. We keep going until we get to the final slide, which only has site (1 x c).
Simply stating that the launch direction at this location always upwards explains why this kind is known as LSUUL.

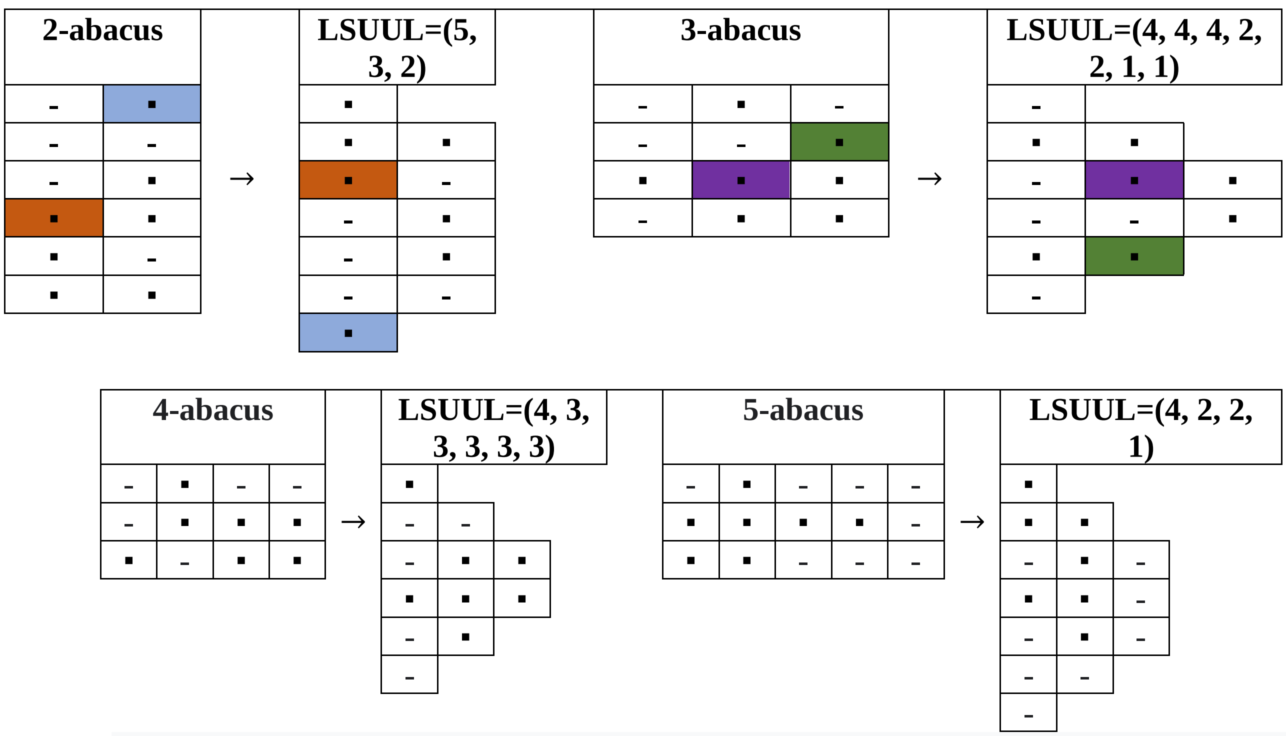

Figure 3: **LSUUL of (5, 5, 4, 4, 4, 4, 1)**

1.2 LSULU-Method:

The following steps are the basis of of this approach:
1. Consider the e-abacus diagram designated for the initial retail.
2. suppose that this image is an array with t rows and c columns.
3. Slide S_1 will be in position (t x 1).
4. Slide S_2 will have the positions { (t x 2) - (t-1 x 1) } take note that the direction of this slide is lower-to-upper, which is why it is referred to as LU.
5.slide S_3 will be the sites {(t x 3) – (t-1 x 2) – (t-2 x 1) } and always go in the lower-to-upper direction.
6. We keep going until we get to the final slide, which only has site (1 x c).
Simply stating that the launch direction at this location always upwards explains why this kind is known as LSULU.

(5, 5, 4, 4, 4, 4, 1)		
-	▪	-
-	-	▪
▪	▪	▪
-	▪	▪

LSUUL = (4, 4, 4, 2, 2, 1, 1)		
-		
▪	▪	
-	▪	▪
-	-	▪
▪	▪	
-		

LSULU = (4, 4, 3, 1, 1, 1, 1)		
-		
▪	▪	
▪	▪	-
▪	-	-
▪	▪	
-		

Figure 4: LSUUL and LSULU of (5, 5, 4, 4, 4, 4, 1) where *e*=3

According to the following, we will now present the third and fourth types:

1.3 LSLUL-Method:

1. Consider the *e*-abacus diagram designated for the initial retail.
2. suppose that this image is an array with *t* rows and *c* columns.
3. Slide S_1 will be in position (1 x 1).
4. Slide S_2 will have the positions { (1 x 2) - (2 x 1) } take note that the direction of this slide is upper-to-lower, which is why it is referred to as UL.
5. slide S_3 will be the sites {(1 x 3) – (2 x 2) – (3 x 1) } and always go in the upper-to-lower direction.
6. We keep going until we get to the final slide, which only has site (*t* x *c*).

Simply stating that the launch direction at this location always lower words explains why this kind is known as LSLUL.

(5, 5, 4, 4, 4, 4, 1)		
-	▪	-
-	-	▪
▪	▪	▪
-	▪	▪

LSUUL = (4, 4, 4, 2, 2, 1, 1)		
-		
▪	▪	
-	▪	▪
-	-	▪
▪	▪	
-		

LSULU = (4, 4, 3, 1, 1, 1, 1)		
-		
▪	▪	
▪	▪	-
▪	-	-
▪	▪	
-		

LSLUL= (5, 5, 5, 4, 4, 4, 1)		
-		
▪	-	
-	-	▪
▪	▪	-
▪	▪	
▪		

Figure 5: LSUUL, LSULU, and LSLUL of (5, 5, 4, 4, 4, 4, 1) where *e*=3

1.4 LSLLU-Method:

1. Consider the *e*-abacus diagram designated for the initial retail.
2. suppose that this image is an array with *t* rows and *c* columns.
3. Slide S_1 will be in position (1 x 1).
4. Slide S_2 will have the positions {(2 x 1) - (1 x 2) } take note that the direction of this slide is lower-to-upper, which is why it is referred to as LU.
5. slide S_3 will be the sites {(3 x 1) - (2 x 2) - (1 x 3) } and always go in the lower-to-upper direction.
6. We keep going until we get to the final slide, which only has site (*t* x *c*).

Simply stating that the launch direction at this location always lowers explains why this kind is known as LSLLU.

(5, 5, 4, 4, 4, 4, 1)		
-	▪	-
-	-	▪
▪	▪	▪
-	▪	▪

LSUUL		
-		
▪	▪	
-	▪	▪
-	-	▪
▪	▪	
-		

LSULU		
-		
▪	▪	
▪	▪	-
▪	-	-
▪	▪	
-		

LSLUL		
-		
▪	-	
-	-	▪
▪	▪	-
▪	▪	
▪		

LSLLU		
-		
-	▪	
▪	-	-
-	▪	▪
▪	▪	
▪		

.

(5, 5, 4, 4, 4, 1)		
a_{11}	a_{12}	a_{13}
a_{21}	a_{22}	a_{23}
a_{31}	a_{32}	a_{33}
a_{41}	a_{42}	a_{43}

LSUUL		
a_{41}		
a_{31}	a_{42}	
a_{21}	a_{32}	a_{43}
a_{11}	a_{22}	a_{33}
a_{12}	a_{23}	
a_{13}		

LSULU		
a_{41}		
a_{42}	a_{31}	
a_{43}	a_{32}	a_{21}
a_{33}	a_{22}	a_{11}
a_{23}	a_{12}	
a_{13}		

LSLUL		
a_{11}		
a_{12}	a_{21}	
a_{13}	a_{22}	a_{31}
a_{23}	a_{32}	a_{41}
a_{33}	a_{42}	
a_{43}		

LSLLU		
a_{11}		
a_{21}	a_{12}	
a_{31}	a_{22}	a_{13}
a_{41}	a_{32}	a_{23}
a_{42}	a_{33}	
a_{43}		

Figure 6: LSUUL, LSULU, LSLUL and LSLLU of (5, 5, 4, 4, 4, 4, 1) where *e*=3

<u>Rule 2.5</u>: For any partition τ of r, with t rows and c columns in the e-abacus diagram related to it, the number of the left slides in every four types is $\big(t + (e - 1)\big)$.

<u>Rule 2.6</u>: The lengths of slides in (Rule 2.5) are

$$\begin{cases} (2\sum_{k=1}^{e-1} k) + (t - e + 1)e & if\ \ t \geq e, \\ (2\sum_{g=1}^{t-1} g) + (e - t + 1)t & if\ t < e. \end{cases}$$

<u>Note 2.7</u>: With all the changes that occurred in the diagram, it is completely possible to use of the observations received by Mahmood and Al-Hussaini in [3] to calculate the new partition, which enabled us to find it smoothly in the four patterns as shown here.

From the above-mentioned example, if we take (5, 5, 4, 4, 4, 4, 1) the four methods are:

S_1	{-}
S_2	{1, 1}
S_3	{-, 2, 2}
S_4	{-, -, 4}
S_5	{4,4}
S_6	No effect
LSUUL	**(4, 4, 4, 2, 2, 1, 1)**

S_1	{-}
S_2	{1, 1}
S_3	{1, 1, -}
S_4	{2, -, -}
S_5	{4, 4}
S_6	No effect
LSULU	**(4, 4, 2, 1, 1, 1, 1)**

S_1	{-}
S_2	{1, -}
S_3	{-, -, 4}
S_4	{4, 4, -}
S_5	{5, 5}
S_6	{5}
LSLUL	**(5, 5, 5, 4, 4, 4, 1)**

S_1	{-}
S_2	{-, 2}
S_3	{2, -, -}
S_4	{-, 5, 5}
S_5	{5, 5}
S_6	{5}
LSLLU	**(5, 5, 5, 5, 5, 2, 2)**

2. An Application of Coding Theory:

It follows that we will benefit from the use of these new patterns to understand how any word can be conveyed to a specific location and arrive there conveniently and securely. These four patterns will be useful in the coding of the English letters used by Mahmood and Mahmood [4–5], who adopted a unique form for each letter based solely on the 5-abacus diagram.

Table 2: The value of partition for each letter after using LS-Methods

Letters	Partition	LSUUL	LSULU	LSLUL	LSLLU
A	(11, 8, 8, 5, 5, 5, 5, 5, 5, 5, 2, 1 , 1, 1)	(10, 10, 10, 9, 9, 9, 8, 8, 7, 3, 3, 1)	(10, 10, 10, 9, 9, 8, 8, 6, 5, 5, 5, 3, 1)	(11, 10, 8, 6, 6, 6, 5, 3, 3, 2, 2, 1, 1, 1)	(11, 11, 10, 8, 8, 4, 3, 3, 2, 2, 2, 1, 1, 1)
B	(11, 11, 11, 10, 8, 6, 6, 6, 5, 3, 1, 1, 1)	(11, 11, 9, 9, 9, 8, 6, 6, 5, 4, 3, 3, 2)	(11, 11, 11, 9, 8, 8, 7, 7, 4, 3, 2, 2, 1)	(11, 11, 11, 9, 8, 8, 7, 7, 4, 3, 2, 2, 1)	(11, 11, 9, 9, 9, 8, 6, 6, 5, 4, 3, 3, 2)
C	(13, 13, 13, 12, 9, 5, 5, 2, 1, 1, 1)	(13, 13, 11, 11, 9, 4, 2, 2, 1, 1, 1)	(13, 13, 13 ,11, 9, 4, 2, 2, 1, 1, 1)	(13, 13, 13, 11, 9, 4, 2, 2, 1, 1, 1)	(13, 13, 11, 11, 9, 4, 2, 2, 1, 1, 1)
D	(12, 12, 12, 11, 9, 8, 6, 5, 3, 1, 1, 1)	(12, 12, 12, 11, 11, 9, 6, 5, 4, 3, 3, 2)	(12, 12, 12, 11, 11, 9, 8, 4, 3, 2, 2, 1)	(12, 12, 12, 11, 11, 9, 8, 4, 3, 2, 2, 1)	(12, 12, 12, 11, 11, 9, 6, 5, 4, 3, 3, 2)
E	(12, 12, 12, 12, 8, 6, 6, 6, 2, 1, 1, 1, 1)	(12, 11, 9, 8, 7, 7, 6, 6, 5, 4, 3, 3, 2)	(12, 12, 11, 9, 8, 6, 6, 5, 4, 3, 2, 2, 1)	(12, 12, 11, 9, 8, 6, 6, 5, 4, 3, 2, 2, 1)	(12, 11, 9, 8, 7, 7, 6, 6, 5, 4, 3, 3, 2)
F	(12, 8, 6, 6, 6, 2, 1, 1, 1, 1)	(15, 14, 12, 11, 10, 8, 8, 5, 3, 2)	(15, 15, 14, 12, 11, 9, 9, 6, 3, 1)	(9, 8, 6, 6, 5, 4, 3, 2, 2, 1)	(8, 7, 7, 6, 6, 5, 4, 3, 3, 2)
G	(11, 11, 11, 10, 7, 7, 7, 7, 6, 2, 1, 1, 1)	(10, 10, 9, 9, 9, 8, 6, 4, 2, 2, 1, 1, 1)	(11, 10, 9, 9, 8, 8, 6, 4, 2, 2, 1, 1, 1)	(11, 11, 11, 10, 10, 9, 6, 4, 2, 2, 1, 1, 1)	(11, 11, 11, 10, 9, 8, 6, 4, 2, 2, 1, 1, 1)
H	(13, 11, 10, 8, 7, 7, 7, 7, 6, 4, 3, 1)	(13, 13, 12, 10, 10, 9, 9, 8, 8, 5, 3, 2)	(13, 12, 10, 10, 9, 9, 8, 8, 7, 6, 3, 1)	(13, 12, 10, 10, 9, 9, 8, 8, 6, 3, 1)	(13, 13, 12, 10, 10, 9, 9, 8, 8, 5, 3, 2)
I	(15, 15, 15, 12, 8, 4, 1, 1, 1)	(14, 12, 10, 10, 8, 6, 6, 4,	(15, 14, 12, 12, 8, 4, 4, 2,	(15, 14, 12, 12, 8, 4, 4, 2,	(14, 12, 10, 10, 8, 6, 6, 4,

		2)	1)	1)	2)
J	(14, 11, 10, 8, 4, 1 ,1 ,1)	(15, 13, 11, 11, 9, 6, 1, 1)	(16, 15, 13, 13, 9, 5, 1, 1)	(11, 11, 7, 5, 4, 4, 2, 1)	(9, 9, 7, 5, 5, 4, 4, 2)
K	(15, 13, 11, 10, 7, 7, 5, 4, 3, 1)	(15, 12, 8, 8, 8, 8, 8, 5, 3, 2)	(15, 12, 11, 7, 7, 7, 7, 6, 3, 1)	(15, 12, 11, 7, 7, 7, 7, 6, 3, 1)	(15, 12, 8, 8, 8, 8, 8, 5, 3, 2)
L	(17, 17, 17, 17, 13, 9, 5, 1)	(8, 8, 6, 5, 4, 3, 3, 2)	(11, 7, 5,4, 3, 2, 2, 1)	(17, 17, 16, 14, 10, 6, 3, 1)	(17, 16, 14, 11, 8, 5, 3, 2)
M	(12, 9, 9, 8, 7, 7, 6, 5, 5, 4, 3, 2, 1)	(11, 11, 11, 9, 8, 8, 8, 7, 4, 3, 1)	(11, 11, 9, 9, 9, 8, 6, 5, 5, 4, 3, 1)	(12, 11, 9, 8, 7, 7, 6, 4, 3, 3, 3, 1, 1)	(12, 12, 11, 9, 8, 5, 4, 4, 4, 3, 1, 1, 1)
N	(11, 9, 8, 8, 7, 6, 6, 6, 6, 5, 4, 4, 3, 1)	(11, 11, 10, 8, 8, 8, 8, 8, 8, 8, 8, 5, 3, 2)	(11, 10, 8, 8, 8, 8, 8, 7, 7, 7, 7, 6, 3, 1)	(11, 10, 9, 9, 8, 8, 7, 7, 6, 3, 1)	(11, 11, 10, 10, 9, 9, 8, 8, 7, 7, 5, 5, 3, 2)
O	(12, 12, 12, 11, 8, 8, 5, 5, 2, 1, 1, 1)	(12, 12, 12, 11, 11, 9, 4, 2, 2, 1, 1, 1)	(12, 12, 12, 11, 11, 9, 4, 2, 2, 1, 1, 1)	(12, 12, 12, 11, 11, 9, 4, 2, 2, 1, 1, 1)	(12, 12, 12, 11, 11, 9, 4, 2, 2, 1, 1, 1)
P	(11, 11, 11, 8, 6, 6, 6, 5, 3, 1, 1, 1)	(12, 12, 10, 9, 8, 6, 6, 3, 2, 2, 1)	(12, 12, 12, 10, 9, 7, 7, 4, 1, 1)	(10, 8, 7, 7, 7, 7, 7, 4, 3, 2, 2, 1)	(8, 8, 8, 7, 5, 5, 5, 5, 4, 3, 3, 2)
Q	(11, 11, 11, 11, 10, 10, 8, 8, 5, 5, 2, 1, 1, 1)	(10, 10, 10, 9, 9, 7, 7, 7, 4, 2, 2, 1, 1, 1)	(10, 10, 10, 9, 9, 7, 4, 4, 4, 2, 2, 1, 1, 1)	(11, 11, 11, 11, 11, 11, 11, 9, 4, 2, 2, 1, 1, 1)	(11, 11, 11, 11, 11, 11, 11, 9, 4, 2, 2, 1, 1, 1)
R	(13, 11, 10, 8, 6, 6, 6, 5, 3, 1, 1, 1)	(12, 12, 10, 10, 10, 9, 9, 8, 8, 5, 3, 2)	(12, 12, 12, 10, 9, 9, 8, 8, 7, 6, 3, 1)	(13, 12, 9, 8, 8, 7, 7, 4, 3, 2, 2, 1)	(13, 13, 9, 9, 8, 6, 6, 5, 4, 3, 3, 2)
S	(13, 13, 13, 12, 7, 7, 2, 1, 1, 1)	(13, 11, 8, 7, 7, 3, 3, 3, 1)	(14, 13, 11, 6, 6, 5, 5, 1)	(12, 12, 11, 8, 7, 4, 3, 1, 1, 1)	(11, 11, 8, 6, 5, 5, 4, 3, 1, 1)
T	(14, 10, 6, 2, 1, 1, 1, 1, 1)	(16, 15, 13, 11, 11, 9, 6, 5, 5)	(16, 16, 15, 13, 13, 9, 7, 6, 3)	(13, 10, 6, 5, 3, 3, 1, 1, 1)	(11, 9, 8, 7, 5, 5, 3, 1, 1)
U	(14, 14, 12, 10, 9, 7, 6, 4, 3, 1)	(15, 15, 14, 12, 10, 7, 6, 5, 4, 4)	(15, 14, 12, 12, 10, 9, 5, 4, 3, 3)	(14, 14, 14, 13, 10, 9, 7, 6, 3, 1)	(14, 14, 14, 13, 13, 10, 8, 5, 3, 2)
V	(16, 13, 12, 11, 8, 8, 5)	(17, 16, 9, 3, 3, 3, 3)	(16, 14, 7, 6, 3, 3, 3)	(15, 15, 15, 12, 11, 4, 2)	(15, 15, 15, 15, 9, 2, 1)
W	(14, 13, 12, 11, 10, 10, 9, 8, 8, 5)	(14, 13, 11, 6, 4, 4, 3, 1, 1, 1)	(13, 11, 8, 6, 4, 3, 3, 3, 1, 1)	(14, 14, 12, 12, 12, 11, 9, 7, 4, 2)	(14, 14, 14, 12, 11, 11, 9, 4, 2, 1)
X	(13, 10, 9, 8, 5, 2, 1)	(16, 13, 13, 13, 13, 6, 1)	(17, 13, 13, 13, 13, 7, 2)	(16, 11, 5, 5, 5, 5, 1)	(17, 12, 5, 5, 5, 5, 2)
Y	(16, 12, 9, 9, 9, 8, 5)	(17, 12, 8, 5, 5, 5, 5)	(16, 11, 8, 6, 6, 6, 3)	(15, 12, 12, 12, 10, 7, 2)	(13, 13, 13, 13, 10, 6, 1)
Z	(13, 13, 13, 13, 13, 10, 7, 4, 1, 1, 1, 1)	(13, 12, 11, 11, 8, 8, 7, 5, 2, 2, 1)	(13, 13, 12, 12, 11, 6, 5, 2, 1, 1)	(13, 13, 12, 10, 7, 7, 7, 7, 7, 4, 2, 1)	(13, 12, 10, 7, 7, 7, 7, 7, 7, 7, 4, 2)

If we take any letter as an example, let it be P, then what has been calculated will be:

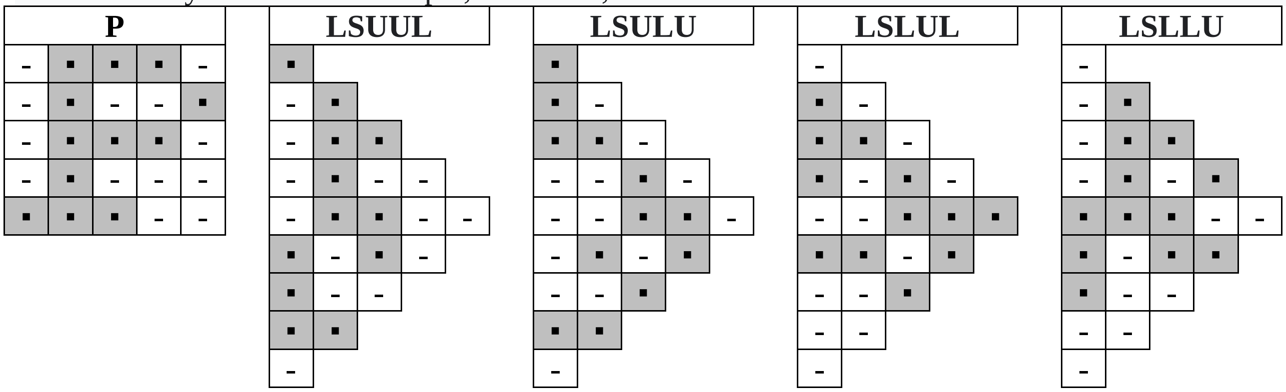

Figure 7: **LSUUL, LSULU, LSLUL and LSLLU of Letter P**

Now, if we used all methods for any word, except for a program that removes the influence on it, it will be quite difficult to notice the distortion process that is obtained because of how enormous it is. We may see this by looking at words like "HOPE,"; Where we will rely on the pink color of the beads of H, the green color of the beads of O, the gray color of the beads of P, and the blue color of the beads of E to determine their new locations, where we will see the following:

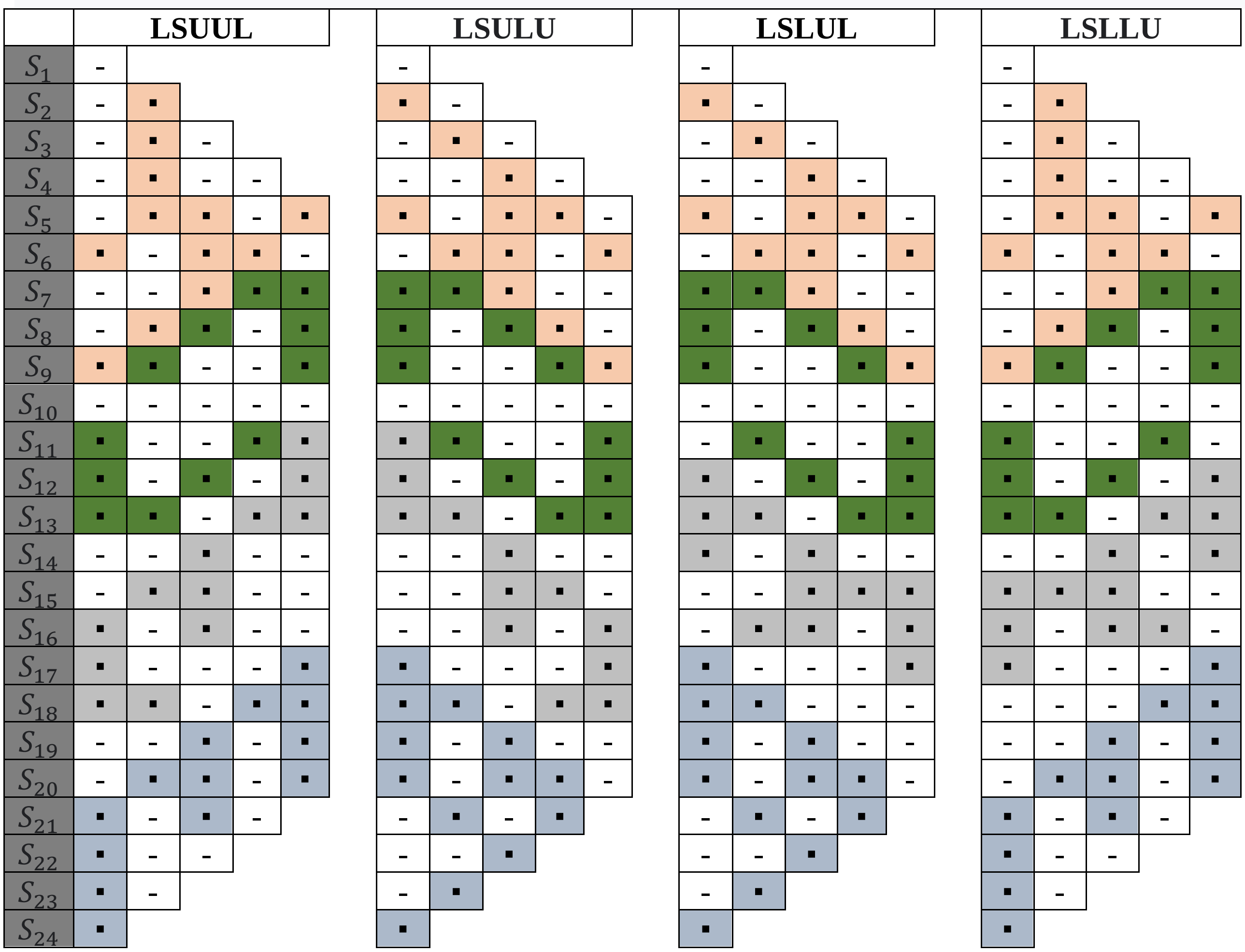

Figure 8: LSUUL, LSULU, LSLUL and LSLLU of (HOPE)

Because of its difficulty on the one hand and the large number of cases that are bathed at the same time, which will make it difficult to detect, the coding process will become safer in sending anything to the other party where we notice the severity of the change in the features of the letter through the use of these four techniques. A very basic observation is that, unlike the letter in the word, where we sort of saw a quasi-symmetry between each independently, we did not obtain a similarity or symmetry between any of the four situations when employing a single letter. The depth of benefit from this issue has been demonstrated by modern practical applications, particularly industrial ones, especially since opening production lines through (several designs derived from the basic design will give a greater profit to any company). The most well-known research that addressed this issue are maybe [8–10].

3. Conclusion

Any of the four slide applications will increase the security of the encoding of any sentence, especially when sending a very sensitive or significant sentence to a party that represents the government and trying to ensure that it reaches the recipient without being easily identified. Through these slides, the possibility of applying the ideas contained in each of [6-10] will be more effective and make it safer, which will make us to transfer the information under confidential conditions with ease.

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5. References

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