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Secret-Text by e-Abacus Diagram II

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Abstract
In this work, there will be upgraded on the work of (Mahmood and Mahmood , 2018) by finding a general rule of the code for any text made from any number of words by using James e-Abacus Diagram in partition theory

Keywords: Partition Number, Abacus James Diagram.

الجملة السرية بأستخدام مخطط اباكس جيمس e

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الخلاصة
في هذا العمل، سيكون هناك تحديث على آعمال محمود ومحمود في عام ٢٠١٨ من خلال إيجاد قاعدة عامة لتشفير آي نص مصنوع من آي عدد من الكلمات باستخدام مخطط جيمس آباكس في نظرية التقسيم.

1. Introduction

Let n be a positive integer. A composition of n is a sequence $\mu = (\mu_1, \mu_2, \dots)$ of non-negative integers such that $|\mu| = \sum_i \mu_i = n$. The integers μ_i for $i \geq 1$are the parts of μ if $\mu_i = 0$ for $i > r$, we identify μ with $(\mu_1, \mu_2, \dots, \mu_r)$. A composition μ is a partition if $\mu_j \geq \mu_{j+1}$, for all $j \geq 1$. We write $\mu \vDash n$ and $\mu \vdash n$ if μ is a composition and μ is a partition of n respectively, [1]. Let σ be the number of redundant part of the partition μ of n , then we have $\mu = (\mu_1, \mu_2, \mu_3, \dots, \mu_r) = (\lambda_1^{\sigma_1}, \lambda_2^{\sigma_2}, \dots, \lambda_m^{\sigma_m})$such that $|\mu| = n = \sum_{i=1}^{r} \mu_i = \sum_{k=1}^{m} \lambda_k^{\sigma_k}$,[2]. An e-Abacus is a Chinese abacus withe vertical runners, labeled $0, 1, 2, 3, \dots, e-1$ from left to right. We label the positions on the abacus $0, 1, 2, \dots$ from left to right, top to bottom.

run.1	run.2	run.3	…	run.e
0	1	2	…	$e-1$
e	$e+1$	$e+2$	…	$2e-1$
2e	$2e+1$	$2e+2$	…	$3e-1$
.	.	.	…	.

James in [3], defined β-numbers by fix μ as a partition of n, choose an integer b greater than or

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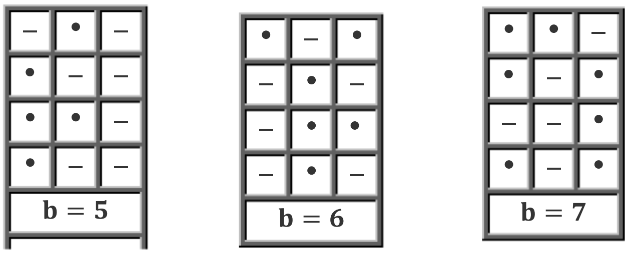
equal to the number of parts r of μ and define $\beta_i = \mu_i + b - i, 1 \le i \le b$.The set $\beta_1, \beta_2, \ldots, \beta_b$ is said to be a set of β-numbers for μ. He will represent β-numbers by □ and any number does not appear by – in each any runners depending on e.

Example: if $\mu = (5, 4, 4, 2, 1)$, then $n = 16$, $r = 5$ and we can take $b \ge 5$. If $b = 5, 6$ and 7, then β-numbers are $\{9, 7, 6, 3, 1\}$, $\{10, 8, 7, 4, 2, 0\}$ and $\{11, 9, 8, 5, 3, 1, 0\}$ respectively. If $e = 3$ then we have:



Mahmood in [4] defined the following: For any Abacus James diagram and β-numbers, the values of $b = r, r + 1, \ldots, r + (e - 1)$, are called the "guides" where r is the number of parts of the partition μ of n. We will define any Abacus James diagram that corresponds to any b guide, as a "Main diagram" or "Guide diagram".

In this paper, we should find partition number for a text depended on partition number for the design of each letter that fit the standard of the main Diagram found before and based on the table we previously found. After the results of Mahmood and Mahmood [2] we have the following partition for any letter:

Letters	Partition	Letters	Partition
A	$(11,8^2,5^7,2,1^3)$	B	$(11^3,10,8,6^3,5,3,1^3)$
C	$(13^3,12,9,5^2,2,1^3)$	D	$(12^3,11,9,8,6,5,3,1^3)$
E	$(11^5,7, 5^3, 1^5)$	F	$(6,10,6, 5^4, 1^5)$
G	$(11^3,10,7^4,6,2,1^3)$	H	$(13,11,10,8,7^4,6,4,3,1)$
I	$(15^3,12,8,4,1^3)$	J	$(14,11,10,8,4,1^3)$
K	$(15,13,11,10,7^2,5,4,3,1)$	L	$(17^4,13,9,5,1)$
M	$(12,9^2,8,7^2,6,5^2,4,3,2,1)$	N	$(11,9,8^2,7,6^4,5,4^2,3,1)$
O	$(12^3,11,8^2,5^2,2,1^3)$	P	$(11^3,8,6^3,5,3,1^3)$
Q	$(11^4,10^2,8^2,5^2,2,1^3)$	R	$(13,11,10,8,6^3,5,3,1^3)$
S	$(13^3,12,7^2,2,1^3)$	T	$(14,10,6,2,1^5)$
U	$(14^2,12,10,9,7,6,4,3,1)$	V	$(16,13,12,11,8^2,5)$
W	$(14,13,12,11,10^2,9,8^2,5)$	X	$(13,10,9,8,5,2,1)$
Y	$(16,12,9^3,8,5)$	Z	$(13^5,10,7,4,1^4)$

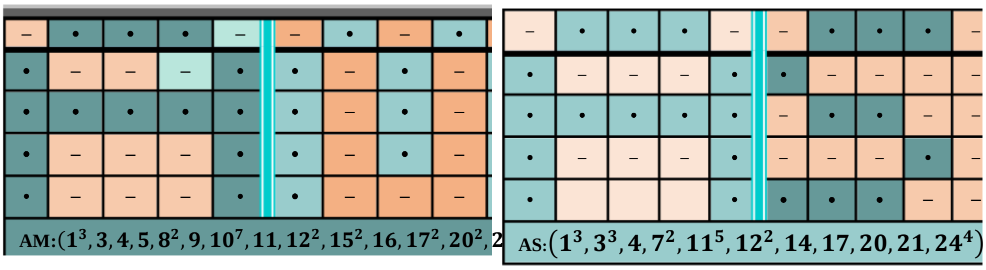
Figure 1.1

2. Creation a Text Consists of at Least Two Words

In this section, we take the partition of any text made from any number of words. That shown in the table above. The only difference between this paper and the one before it is the presence of space between each word in the same text, so what is the size of this space? For that, we will suggest the space as the same chart, which has five rows and columns without any bead. As this diagram:

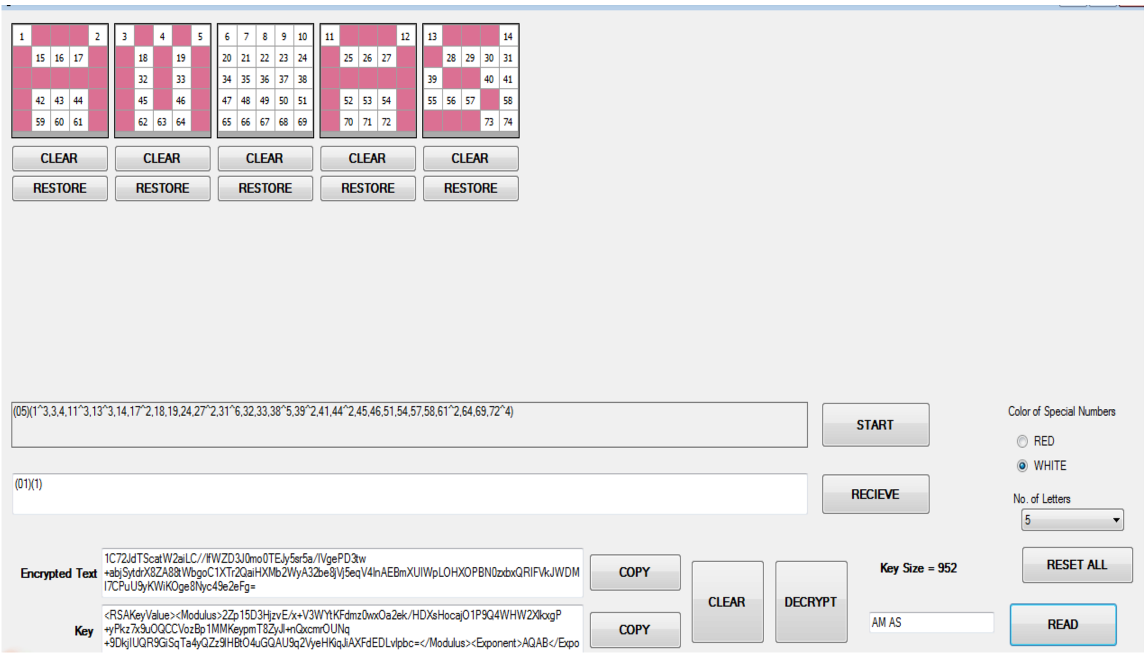
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Take the text: **AM AS**



Then the secret –text of AM AS is:

R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u	R u		R u	R u	R u	R u	R u	R u
1				2	3		4		5	6	7	8	9	10	11				12	13				14
	15	16	17			18		19		20	21	22	23	24		25	26	27			28	29	30	31
						32		33		34	35	36	37	38						39			40	41
	42	43	44			45		46		47	48	49	50	51		52	53	54		55	56	57		58
	59	60	61			62	63	64		65	66	67	68	69		70	71	72					73	74
AM AS: $(1^3, 3, 4, 11^3, 13^3, 14, 17^2, 18, 19, 24, 27^2, 31^6, 32, 33, 38^5, 39^2, 41, 44^2, 45, 46, 51, 54, 57, 58, 61^2, 64, 69, 72^4)$																								



Let $PW^*(w)_k$ be a partition of word **w** to with respect $(*)$ the condition of five positions in each row k, also $b^\#$ is the sum of all beads that come before it unless it's the same column and $i = 0, 1, 2, ...$if $w = 2, 3, 4, ...$respectively.

<u>Rule (2.1)</u>: The general rule of the secret -text with two words is defined by:

	Word(1) with τ_1 letters	Word(2) with τ_2 letters
(1)	$PW^*(1)_1 \Rightarrow [PW^*(\tau_1)_1 + (5(\tau_1 - 1) - b^\#)]$	$[PW^*(2)_1 + (5(\tau_1 + 1) - b^\#)] \Rightarrow [PW^*(\tau_2)_1 + (5(\tau_1 + \tau_2) - b^\#)]$
(2)	$[PW^*(1)_2 + (5(\tau_1 + \tau_2) - b^\#)] \Rightarrow [PW^*(\tau_1)_2 + (5((2\tau_1 + \tau_2) - 1) - b^\#)]$	$[PW^*(2)_2 + (5((2\tau_1 + \tau_2) + 1) - b^\#)] \Rightarrow [PW^*(\tau_2)_2 + (5(2\tau_1 + 2\tau_2) - b^\#)]$
(3)	$[PW^*(1)_3 + (5(\sum_{t=1}^{2} 2\tau_t) - b^\#)] \Rightarrow [PW^*(\tau_1)_3 + (5((3\tau_1 + 2\tau_2) - 1) - b^\#)]$	$[PW^*(2)_3 + (5((3\tau_1 + 2\tau_2) + 1) - b^\#)] \Rightarrow [PW^*(\tau_2)_3 + (5(\sum_{t=1}^{2} 3\tau_t) - b^\#)]$
(4)	$[PW^*(1)_4 + (5(\sum_{t=1}^{2} 3\tau_t) - b^\#)] \Rightarrow [PW^*(\tau_1)_4 + (5((4\tau_1 + 3\tau_2) - 1) - b^\#)]$	$[PW^*(2)_4 + (5((4\tau_1 + 3\tau_2) + 1) - b^\#)] \Rightarrow [PW^*(\tau_2)_4 + (5(\sum_{t=1}^{2} 4\tau_t) - b^\#)]$
(5)	$[PW^*(1)_5 + (5(\sum_{t=1}^{2} 4\tau_t) - b^\#)] \Rightarrow [PW^*(\tau_1)_5 + (5((5\tau_1 + 4\tau_2) - 1) - b^\#)]$	$[PW^*(2)_5 + (5((5\tau_1 + 4\tau_2) + 1) - b^\#)] \Rightarrow [PW^*(\tau_2)_5 + (5(\sum_{t=1}^{2} 5\tau_t) - b^\#)]$

Figure 2.2

Proof:

By using the same system in Rule (2.1) and the idea of (space) in (the introduction of this section), we have the result in each (rectangular) between each row and any letters. In fact, (Arrow⟹) refer to (the start of operation for the 1st Letter in each word and the end of the operation for the last letter in the same word).

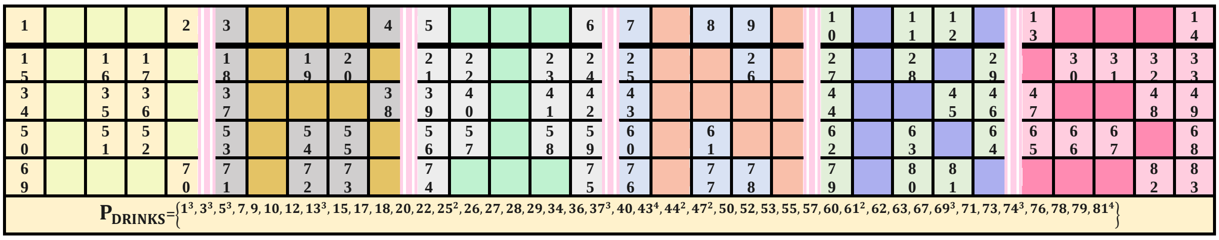
Rule (2.2): The general rule of the secret –text with three words is defined by:

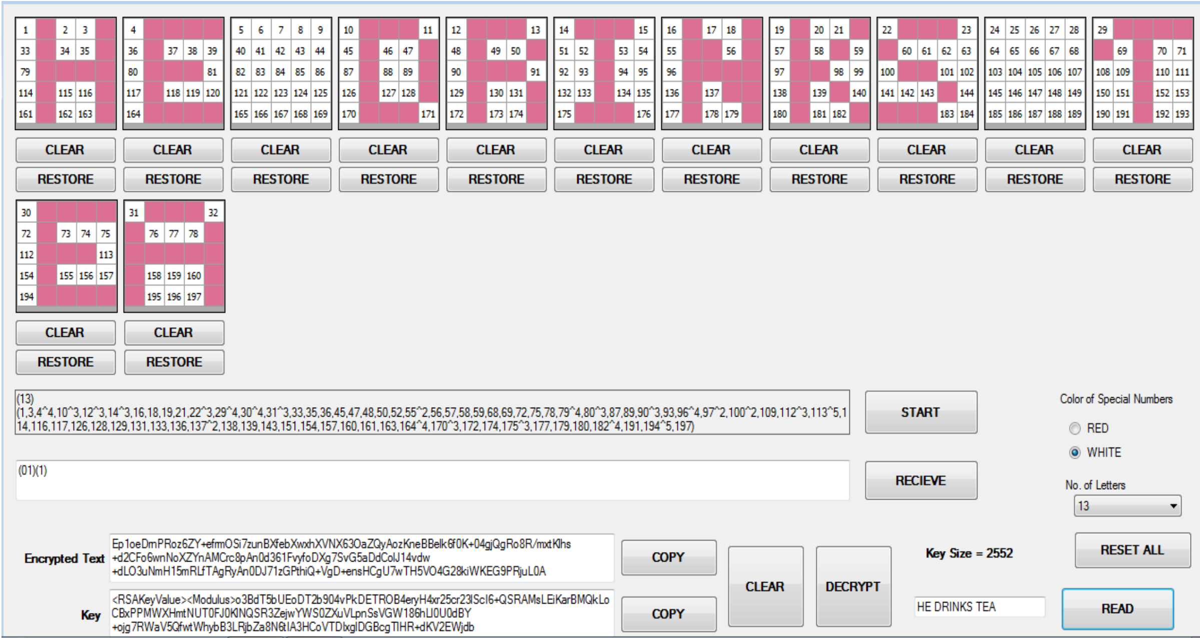
	Word(1) with τ_1	Word(2) with τ_2	Word(3) with τ_3
(1)	$PW^{*}(1)_1 \Rightarrow$ $[PW^{*}(\tau_1)_1 + (5(\tau_1 - 1) - b^{*})]$	$[PW^{*}(2)_1 + (5(\tau_1 - 1) - b^{*})] \Rightarrow$ $[PW^{*}(\tau_2)_1 + (5(\tau_1 - \tau_2) - b^{*})]$	$[PW^{*}(3)_1 + (5(\tau_1 - \tau_2 + 2) - b^{*})]$ $\Rightarrow$ $[PW^{*}(\tau_3)_1 + (5(\tau_1 - \tau_2 + \tau_3 + 1) - b$
(2)	$\lvert PW^{*}(1)_2 + (5(\sum_{i=1}^{t} \tau_i - 1) - b^{*})\rvert \Rightarrow$ $\lvert PW^{*}(\tau_1)_2 + (5(2\tau_1 + \sum_{i=2}^{t} \tau_i) - b^{*})\rvert$	$\lvert PW^{*}(2)_2 + \left(5\left((2\tau_1 + \sum_{i=2}^{t} \tau_i) + 2\right) - b^{*}\right)\rvert$ $\lvert PW^{*}(\tau_2)_2 + \left(5\left((\sum_{i=1}^{t} 2\tau_i - \tau_2) + 1\right) - b^{*}\right)\rvert$	$\left[PW^{*}(3)_2 + \left(5\left((\sum_{i=1}^{t} 2\tau_i - \tau_3) +\right.\right.\right.$ $\left[PW^{*}(\tau_3)_2 + \left(5\left((\sum_{i=1}^{s} 2\tau_i) + 2\right)\right.\right.$
(3)	$\lvert PW^{*}(1)_3 + \left(5\left((\sum_{i=1}^{t} 2\tau_i) - 2\right) - b^{*}\right)\rvert \Rightarrow$ $\lvert PW^{*}(\tau_1)_3 + \left(5\left((3\tau_1 - \sum_{i=2}^{t} 2\tau_i) + 1\right) - b^{*}\right)$	$\lvert PW^{*}(2)_3 + \left(5\left((3\tau_1 + \sum_{i=2}^{t} \tau_i) + 3\right) - b^{*}\right)\rvert$ $\lvert PW^{*}(\tau_2)_3 + \left(5\left((\sum_{i=1}^{t} 3\tau_i - 2\tau_2) + 2\right) - b^{*}\right)$	$\left[PW^{*}(3)_3 + \left(5\left((\sum_{i=1}^{t} 3\tau_i - 2\tau_3)\right.\right.\right.$ $\Rightarrow$ $\left[PW^{*}(\tau_3)_3 + \left(5\left((\sum_{i=1}^{s} 3\tau_i) + 3\right)\right.\right.$
(4)	$\lvert PW^{*}(1)_4 + \left(5\left((\sum_{i=1}^{t} 3\tau_i) - 3\right) - b^{*}\right)\rvert \Rightarrow$ $\lvert PW^{*}(\tau_1)_4 + \left(5\left((4\tau_1 - \sum_{i=2}^{t} 2\tau_i) + 2\right) - b^{*}\right)$	$\lvert PW^{*}(2)_4 + \left(5\left((4\tau_1 + \sum_{i=2}^{t} 3\tau_i) - 4\right) - b^{*}\right)$ $\lvert PW^{*}(\tau_2)_4 + \left(5\left((\sum_{i=1}^{t} 4\tau_i - 3\tau_2) + 3\right) - b^{*}\right)$	$\left[PW^{*}(3)_4 + \left(5\left((\sum_{i=1}^{t} 4\tau_i - 3\tau_3)\right.\right.\right.$ $\Rightarrow$ $\left[PW^{*}(\tau_3)_4 + \left(5\left((\sum_{i=1}^{s} 4\tau_i) + 4\right)\right.\right.$
(5)	$\lvert PW^{*}(1)_5 + \left(5\left((\sum_{i=1}^{t} 4\tau_i) - 4\right) - b^{*}\right)\rvert \Rightarrow$ $\lvert PW^{*}(\tau_1)_5 + \left(5\left((5\tau_1 - \sum_{i=2}^{t} 4\tau_i) + 3\right) - b^{*}\right)$	$\lvert PW^{*}(2)_5 + \left(5\left((5\tau_1 + \sum_{i=2}^{t} 4\tau_i) - 5\right) - b^{*}\right)$ $\lvert PW^{*}(\tau_2)_5 + \left(5\left((\sum_{i=1}^{t} 5\tau_i - 4\tau_2) + 4\right) - b^{*}\right)$	$\left[PW^{*}(3)_5 + \left(5\left((\sum_{i=1}^{t} 5\tau_i - 4\tau_3)\right.\right.\right.$ $\Rightarrow$ $\left[PW^{*}(\tau_3)_5 + \left(5\left((\sum_{i=1}^{s} 5\tau_i) + 5\right)\right.\right.$

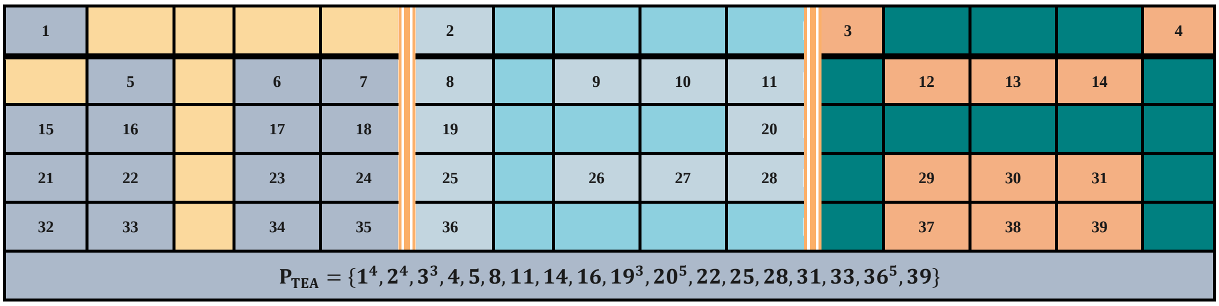
Figure 2.3

Proof:
By using the same system in Rule (2. 2) and the idea of (space) in (the introduction of this section), we have the results in each (rectangular) between each row and any letters.
For example, **(HE DRINKS TEA)**

1		2	3		4				
5		6	7		8		9	10	11
12					13				14
15		16	17		18		19	20	21
22		23	24		25				
HE: $\{1,3,4^4,5,7,8,12^4,13^3,15,17,18,22,24,25^4\}$									







Now, after the **Rule (2. 1)** and **Rule (2.2),** we can find the general rule of the partition of text for any number the words, as follows:

	Word(1) with τ_1	Word(2) with τ_2	$\cdots$	Word(ω) with τ_ω
(1)	$PW^*(1)_1 \Rightarrow [PW^*(\tau_1)_1 + (5(\tau_1 - 1) - b^{\#})]$	$[PW^*(2)_1 + (5(\tau_1 + 1) - b^{\#})] \Rightarrow [PW^*(\tau_2)_1 + (5(\sum_{t=1}^{2} \tau_t) - b^{\#})]$		$[PW^*(\omega)_1 + (5(\sum_{t=1}^{\omega-1} \tau_t + (i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_\omega)_1 + (5\sum_{t=1}^{\omega}(\tau_t + i) - b^{\#})]$
(2)	$[PW^*(1)_2 + (5(\sum_{t=1}^{\omega} \tau_t + i) - b^{\#})] \Rightarrow [PW^*(\tau_1)_2 + (5((2\tau_1 + \sum_{t=2}^{\omega} \tau_t) + (i-1)) - b^{\#})]$	$[PW^*(2)_2 + (5((2\tau_1 + \sum_{t=2}^{\omega} 2\tau_t) + (i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_2)_2 + (5((\sum_{t=1}^{2} 2\tau_t + \sum_{t=3}^{\omega} \tau_t) + (i)) - b^{\#})]$		$[PW^*(\omega)_2 + (5((\sum_{t=1}^{\omega-1} 2\tau_t + \tau_\omega) + (2i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_\omega)_2 + (5((\sum_{t=1}^{\omega} 3\tau_t) + 3i) - b^{\#})]$
(3)	$[PW^*(1)_3 + (5((\sum_{t=1}^{\omega} 2\tau_t) + 2i) - b^{\#})] \Rightarrow [PW^*(\tau_1)_3 + (5((3\tau_1 + \sum_{t=2}^{\omega} 2\tau_t) + (2i-1)) - b^{\#})]$	$[PW^*(2)_3 + (5((3\tau_1 + \sum_{t=2}^{\omega} 2\tau_t) + (2i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_2)_3 + (5((\sum_{t=1}^{2} 3\tau_t + \sum_{t=3}^{\omega} 2\tau_t) + (2i)) - b^{\#})]$		$[PW^*(\omega)_3 + (5((\sum_{t=1}^{\omega-1} 3\tau_t + 2\tau_\omega) + (3i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_\omega)_3 + (5((\sum_{t=1}^{\omega} 3\tau_t) + 3i) - b^{\#})]$
(4)	$[PW^*(1)_4 + (5((\sum_{t=1}^{\omega} 3\tau_t) + 3i) - b^{\#})] \Rightarrow [PW^*(\tau_1)_4 + (5((4\tau_1 + \sum_{t=2}^{\omega} 3\tau_t) + (3i-1)) - b^{\#})]$	$[PW^*(2)_4 + (5((4\tau_1 + \sum_{t=2}^{\omega} 3\tau_t) + (3i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_2)_4 + (5((\sum_{t=1}^{2} 4\tau_t + \sum_{t=3}^{\omega} 3\tau_t) + (3i)) - b^{\#})]$		$[PW^*(\omega)_4 + (5((\sum_{t=1}^{\omega-1} 4\tau_t + 3\tau_\omega) + (4i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_\omega)_4 + (5((\sum_{t=1}^{\omega} 4\tau_t) + 4i) - b^{\#})]$
(5)	$[PW^*(1)_5 + (5((\sum_{t=1}^{\omega} 4\tau_t) + 4i) - b^{\#})] \Rightarrow [PW^*(\tau_1)_5 + (5((5\tau_1 + \sum_{t=2}^{\omega} 4\tau_t) + (4i-1)) - b^{\#})]$	$[PW^*(2)_4 + (5((5\tau_1 + \sum_{t=2}^{\omega} 4\tau_t) + (4i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_2)_4 + (5((\sum_{t=1}^{2} 5\tau_t + \sum_{t=3}^{\omega} 4\tau_t) + (4i)) - b^{\#})]$		$[PW^*(\omega)_5 + (5((\sum_{t=1}^{\omega-1} 5\tau_t + 4\tau_\omega) + (5i+1)) - b^{\#})] \Rightarrow [PW^*(\tau_\omega)_5 + (5((\sum_{t=1}^{\omega} 5\tau_t) + 5i) - b^{\#})]$

References

1. Mathas, **1999**. Iwahori-Hecke Algebras and Schur Algebras of the Symmetric Group. Amer. Math. Soc., University Lecture Series,Vol. 15.
2. Awreng, B., Mahmood and Ammar S. Mahmood, **2018**. *Secret-Word by e-Abacus Diagram I, Iraqi Journal of Science,* **60**(3): 638-646.
3. James, G. **1978**. Some combinatorial results involving Young diagrams, *Math. Proc. Cambridge Phil. Soc*., **83**: 1-10.
4. Ammar S. Mahmood, **2011**. On the introduction of young Diagram core, *J. Educ. and Sci*. (Mosul University), **24**(3): 143-159.