

Le carré super magique

C'est un carré magique où, en plus des lignes, colonnes et diagonales ayant une somme de 34, on trouve bien d'autres regroupements de cellules ayant ce total de 34.

Un exemple parmi d'autres :

	A	B	C	D
1	14	11	5	4
2	1	8	10	15
3	12	13	3	6
4	7	2	16	9

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	A	B	C	D	A	B	C	D																																						
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TRANSFORMATIONS

Toutes les transformations ci-dessous conservent au carré magique (super) toutes ses propriétés.

1) Déplacements

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	A	B	C	D																						
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A partir d'un même carré magique on peut générer jusqu'à 12 carrés par le jeu de ces différents déplacements.

2) Rotations

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3) Permutations

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2	1	8	10	15	
1	14	11	5	4	
4	7	2	16	9	
	A	D	C	B	
1	14	4	5	11	Permutation des colonnes paires
2	1	15	10	8	
3	12	6	3	13	
4	7	9	16	2	
	C	B	A	D	
1	5	11	14	4	Permutation des colonnes impaires
2	10	8	1	15	
3	3	13	12	6	
4	16	2	7	9	

4) Symétries

	A	B	C	D	
4	7	2	16	9	Symétrie autour de l'axe horizontal
3	12	13	3	6	
2	1	8	10	15	
1	14	11	5	4	
	D	C	B	A	
1	4	5	11	14	Symétrie autour de l'axe vertical
2	15	10	8	1	
3	6	3	13	12	
4	9	16	2	7	
	A	B	C	D	
1	14	1	12	7	Symétrie autour de la 1ère diagonale.
2	11	8	13	15	
3	5	10	3	16	
4	4	15	6	9	
	A	B	C	D	
1	14	11	5	4	Symétrie autour de la 2e diagonale.
2	1	8	10	15	
3	12	13	3	6	
4	7	2	16	9	

La question que je me pose : existe-t-il qu'un seul schéma de carré magique, tous les autres étant issus de différentes transformations ?

SYMÉTRIES

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Il y a 86 combinaisons de chiffres 1 à 16 formant une somme de 34.

Voici ces combinaisons et les figures qu'elles forment :

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Fréquence de chaque nombre dans les 86 combinaisons

Nombres	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fréquences	19	20	21	22	22	23	23	22	22	23	23	22	22	21	20	19

On remarquera la symétrie des fréquences.

On peut se poser la question pourquoi une somme de 34 ?

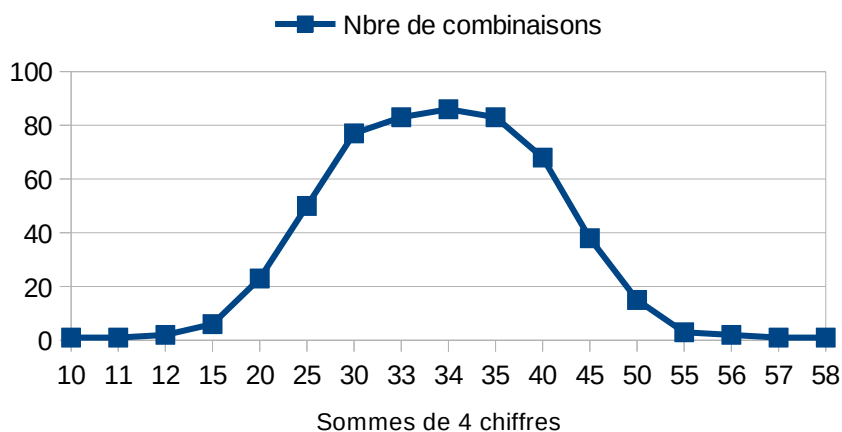
C'est la somme que l'on peut obtenir avec le plus grand nombre de combinaisons (86)

Si l'on cherchait à obtenir une somme de 10, il n'y aurait qu'une seule combinaison ($1+2+3+4 = 10$)

La plus grande somme de 4 nombres (de 1 à 16) est 58 ($13+14+15+16 = 58$) il n'y a aussi qu'une seule combinaison.

Voici un tableau avec quelques exemples de valeurs

Somme demandée	Nbre de combinaisons de 4 nombres de 1 à 16
10	1
11	1
12	2
15	6
20	23
25	50
30	77
33	83
34	86
35	83
40	68
45	38
50	15
55	3
56	2
57	1
58	1



Les différents essais que j'ai effectués montrent qu'il n'est pas possible de construire un carré super-magique avec une somme différente de 34.

34 est le double de la somme des extrêmes de la série de 1 à 16 soit
 $(1 + 16) * 2 = 34$

On peut construire un carré super-magique en commençant avec un autre chiffre. Par exemple :
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
la somme est donc $(3 + 18) * 2 = 42$

La série initiale pour bâtir un carré super magique (de 1 à 16) est une série à progression arithmétique de raison 1.

On peut construire des carré super-magique avec une progression différente de 1.
Par exemple, une série commençant par 2 avec un pas de 2 :

2 4 6 8 10 12 14 16 20 22 24 26 28 30 32
et la somme sera $(2 + 32) * 2 = 68$

	A	B	C	D
1	2	16	20	30
2	24	26	6	12
3	14	4	32	18
4	28	22	10	8

Autre exemple, une série commençant par 3 avec un pas de 3 :

3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48
et sa somme $(3 + 48) * 2 = 102$

	A	B	C	D
1	3	24	30	45
2	36	39	9	18
3	21	6	48	27
4	42	33	15	12