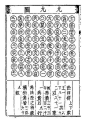
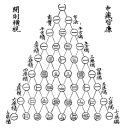
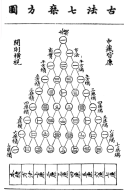


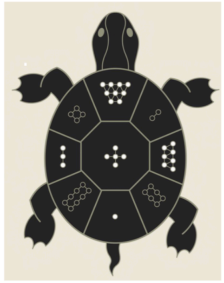
Ancient Chinese Mathematics- Magic Squares

https://www.dkfindout.com/us/history/ancient-china/chinese-paper-making/

Computation of π



Yang Hui triangle (Pascal's triangle) using rod numerals, as depicted in a publication of Zhu Shijie in 1303 AD



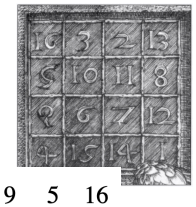
Lo Shu from "The Astronomical Phenomena" (*Tien Yuan Fa Wei*). Compiled by Bao Yunlong in 13th century, published during the Ming dynasty, 1457–1463.

4	9	2
3	5	7
8	1	6

A magic square is an nxn matrix, such that

1. The entries are the numbers 1,2, …, n^2.
2. The sum of columns, rows and diagonals is constant.

2	7	6	→15
9	5	1	→15
4	3	8	→15
↓15	↓15	↓15	↓15 ↘15



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

The sum of the rows (or columns, or diagonals) of a magic square is called the **magic constant**.

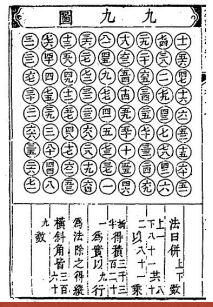
Compute the magic constant of a magic square of the following magic squares, and the magic constant of a nxn magic square

4	9	2
3	5	7
8	1	6

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

Homework problem 1.
Can you construct a magic square of size 3x3 with a number ≠ 5 in the center?
Justify your answer

4	9	2
3	5	7
8	1	6



A page displaying 9×9 magic square from Cheng Dawei's Suanfa tongzong (1593).

Melencolia I
1514
Albrecht Dürer German

https://www.metmuseum.org/en/art/collection/search/336228

It is an unsolved problem to determine the number of magic squares of an arbitrary order, but the number of distinct magic squares (excluding those obtained by rotation and reflection)

Order	Number of magic squares
1	1
2	0
3	1
4	880
5	275305224
6	?

$\sim 1.775399 \cdot 10^{19}$

A recipe for generating magic squares of odd size:

Step 1: Write down 1 in the middle of the top row.
Step k+1: Write down the number k+1 on the closest entry to the right and above the entry k, "pac-man" maner. If that entry is already filled, write down k+1 directly below k.

Extra Credit Homework problem 2: Find a "your own" magic square of size 4x4 or larger (different from the ones we saw in class, and not constructed with the above algorithm

Homework problem 2: Construct a magic square of order 7. Find its magic number.

17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9