

Practice 1 : Magic Square

A magic square of degree n , where n is an odd number greater than 3, is an $n \times n$ integer square matrix; the element values of this magic square are $1, 2, 3, \dots, n^2$, and the sums of all rows, all columns, the diagonal, and the anti-diagonal are the same, i.e. $(1+n^2)n/2$.

For example, the following are magic squares for $n=3$ and $n=5$.

$n=3$	6	1	8
	7	5	3
	2	9	4

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

Write a Java program that reads in an odd integer n from 3 to 19 and constructs a magic square of degree n . The algorithm for constructing a magic square of degree n is as below:

- Fill 1 into the top middle cell,
- After filling in k , fill in $k+1$ according to the following steps until n^2 cells are filled ,
- Meanwhile, the $n \times n$ square matrix is a cyclic structure connected as a torus in the horizontal and vertical directions,
 - If there is no integer in the upper left cell of k , then fill that cell with $k+1$;
 - If the top left cell is occupied, then fill $k+1$ into the cell below k .
- Also, add up the sum of each row, each column, the diagonal and the anti-diagonal to verify that the result is a magic square.

Practice 2 : Matrix Class

Write a Java program that defines an $m \times n$ matrix, and addition, subtraction, and multiplication operations of two matrices. To add ($A+B$) and subtract ($A-B$) two matrices A and B , A and B must have the same number of rows and columns. To multiply two matrices ($A \times B$), the number of columns of A must equal to the number of rows of B .

Assuming the values of the matrix elements are between -50 and 50, use a random number generator to generate the values of the matrix elements.

Define A , B , C , D , and E to be five matrices of 5×4 , 5×4 , 5×4 , 4×6 , and 5×6 , respectively.

Test the following matrix expressions:

- ✓ $A + B - C$
- ✓ $B \times D + E$
- ✓ $E - A \times D$

In package **Matrix** program source code: **Matrix.Java** and application class **MatrixAPP.Java**.