11. A *magic square* is a two-dimensional array with n rows and n columns in which each of the integers 1, 2, 3, …, n^2 appears exactly once **and** all column sums, row sums and diagonal sums are equal.

The array A is a 7×7 magic square in which all rows, columns and the two main diagonals add up to 175.

A

	[0]	[1]	[2]	[3]	[4]	[5]	[6]
[0]	30	39	48	1	10	19	28
[1]	38	47	7	9	18	27	29
[2]	46	6	8	17	26	35	37
[3]	5	14	16	25	34	36	45
[4]	13	15	24	33	42	44	4
[5]	21	23	32	41	43	3	12
[6]	22	31	40	49	2	11	20

(a) Construct an algorithm to calculate the sum of all elements on the main diagonal, from A[0, 0] to A[6, 6]. *[2]*

(b) An array with n rows and n columns holds every number from 1 to n^2. Construct an algorithm that checks whether the $n \times n$ array is a magic square. *[8]*

The following is the algorithm for constructing a magic square with n rows and n columns for any odd integer n.

- Z = 1
- Place Z in the middle of top row
- Loop until all integers 1, 2, 3, …, n^2 are placed in the array
  - Z = Z + 1
  - Move one row up and one column to the right to place the integer Z, unless one of the following occurs
    - If a move takes you above the top row in the j^{th} column, move to the bottom of the j^{th} column and place the integer Z there
    - If a move takes you outside to the right of the square in the i^{th} row, place the integer Z in the i^{th} row at the left side
    - If a move takes you to an already filled square or if you move out of the square at the upper-right corner, place Z immediately below Z – 1.

(c) By applying this algorithm, **copy** and complete the 5×5 magic square, which has been started below. Do **not** write solutions on this page. *[5]*

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