FigurateNum

A Python library for generating infinite figurate number sequences across dimensions.

Installation

```
pip install figuratenum
```

Main Class

```
from figuratenum import FigurateNum as fgn
```

Classes

```
from figuratenum import PlaneFigurateNum as pfgn
from figuratenum import SpaceFigurateNum as sfgn
from figuratenum import MultidimensionalFigurateNum as mfgn
from figuratenum import ZooFigurateNum as zfgn
from figuratenum import NumCollector as nc
```

Generating FigurateNum Sequences Step by Step

```
>>> seq = fgn()
>>> hyperdodecahedral = seq.hyperdodecahedral()

>>> first = next(hyperdodecahedral)
>>> second = next(hyperdodecahedral)
>>> third = next(hyperdodecahedral)
>>> fourth = next(hyperdodecahedral)

>>> print(first, second, third, fourth)
1 600 4983 19468
```

Example Using a Specific Class with a Loop

```
>>> seq_loop = mfgn()
>>> k_dimensional_centered_hypertetrahedron =
    seq_loop.k_dimensional_centered_hypertetrahedron(21)
>>> figuratenum_arr = []
>>> for _ in range(1, 15):
>>>     next_num = next(k_dimensional_centered_hypertetrahedron)
>>>     figuratenum_arr.append(next_num)
>>> print(figuratenum_arr)
[1, 23, 276, 2300, 14950, 80730, 376740, 1560780, 5852925, 20160075,
    64512240, 193536720, 548354040, 1476337800]
```

NumberCollector Class: Method Summary

- take(n)
- take_to_list(stop, start, step)
- take_to_array(stop, start, step)
- take_to_tuple(stop, start, step)
- pick(n)

Working with the NumberCollector Class

```
>>> seq = fgn()
>>> pentatope = seq.pentatope()

>>> print(nc.take_to_list(pentatope, 10))
[1, 5, 15, 35, 70, 126, 210, 330, 495, 715]
```

Plane Figurate Numbers

- polygonal
- triangular
- square
- pentagonal
- hexagonal
- heptagonal
- octagonal
- nonagonal
- decagonal
- hendecagonal
- dodecagonal
- tridecagonal
- tetradecagonal
- pentadecagonal
- hexadecagonal
- heptadecagonal
- octadecagonal
- nonadecagonal
- icosagonal
- icosihenagonal
- icosidigonal
- icositrigonal
- icositetragonal
- icosipentagonal
- icosihexagonal
- icosiheptagonal
- icosioctagonal
- icosinonagonal
- triacontagonal
- centered_triangular
- centered_square = diamond
- centered_pentagonal
- centered_hexagonal
- centered_heptagonal
- centered_octagonal
- centered_nonagonal
- centered_decagonal
- centered_hendecagonal
- centered_dodecagonal = star
- centered_tridecagonal

Plane Figurate Numbers

- centered_tetradecagonal
- centered_pentadecagonal
- centered_hexadecagonal
- centered_heptadecagonal
- centered_octadecagonal
- centered_nonadecagonal
- centered_icosagonal
- centered_icosihenagonal
- centered_icosidigonal
- centered_icositrigonal
- centered_icositetragonal
- centered_icosipentagonal
- centered_icosihexagonal
- centered_icosiheptagonal
- centered_icosioctagonal
- centered_icosinonagonal
- centered_triacontagonal
- centered_mgonal(m)
- pronic = heteromecic = oblong
- polite
- impolite
- cross
- aztec_diamond
- polygram(m) = centered_star_polygonal(m)
- pentagram
- gnomic
- truncated_triangular
- truncated_square
- truncated_pronic
- truncated_centered_pol(m) = truncated_centered_mgonal(m)
- truncated_centered_triangular
- truncated_centered_square
- truncated_centered_pentagonal
- truncated_centered_hexagonal = truncated_hex
- generalized_mgonal(m, start_numb)
- generalized_pentagonal(start_numb)
- generalized_hexagonal(start_numb)
- generalized_centered_pol(m, start_numb)
- generalized_pronic(start_numb)

Space Figurate Numbers

- m_pyramidal(m)
- triangular_pyramidal
- square_pyramidal = pyramidal
- pentagonal_pyramidal
- hexagonal_pyramidal
- heptagonal_pyramidal
- octagonal_pyramidal
- nonagonal_pyramidal
- decagonal_pyramidal
- hendecagonal_pyramidal
- dodecagonal_pyramidal
- tridecagonal_pyramidal
- tetradecagonal_pyramidal
- pentadecagonal_pyramidal
- hexadecagonal_pyramidal
- heptadecagonal_pyramidal
- octadecagonal_pyramidal
- nonadecagonal_pyramidal
- icosagonal_pyramidal
- icosihenagonal_pyramidal
- icosidigonal_pyramidal
- icositrigonal_pyramidal
- icositetragonal_pyramidal
- icosipentagonal_pyramidal
- icosihexagonal_pyramidal
- icosiheptagonal_pyramidal
- icosioctagonal_pyramidal
- icosinonagonal_pyramidal
- triacontagonal_pyramidal
- triangular_tetrahedral[finite]
- triangular_square_pyramidal[finite]
- square_tetrahedral[finite]
- square_square_pyramidal[finite]
- tetrahedral_square_pyramidal[finite]
- cubic
- tetrahedral
- octahedral
- dodecahedral
- icosahedral
- truncated_tetrahedral

Space Figurate Numbers

- truncated_cubic
- truncated_octahedral
- stella_octangula
- centered_cube
- rhombic_dodecahedral
- hauy_rhombic_dodecahedral
- centered_tetrahedron = centered_tetrahedral
- centered_square_pyramid = centered_pyramid
- centered_mgonal_pyramid(m)
- centered_pentagonal_pyramid
- centered_hexagonal_pyramid
- centered_heptagonal_pyramid
- centered_octagonal_pyramid
- centered_octahedron
- centered_icosahedron = centered_cuboctahedron
- centered_dodecahedron
- centered_truncated_tetrahedron
- centered_truncated_cube
- centered_truncated_octahedron
- centered_mgonal_pyramidal(m)
- centered_triangular_pyramidal
- centered_square_pyramidal
- centered_pentagonal_pyramidal
- centered_heptagonal_pyramidal
- centered_octagonal_pyramidal
- centered_nonagonal_pyramidal
- centered_decagonal_pyramidal
- centered_hendecagonal_pyramidal
- centered_dodecagonal_pyramidal
- centered_hexagonal_pyramidal = hex_pyramidal
- hexagonal_prism
- mgonal_prism(m)
- generalized_mgonal_pyramidal(m, start_num)
- generalized_pentagonal_pyramidal(start_num)
- generalized_hexagonal_pyramidal(start_num)
- generalized_cubic(start_num)
- generalized_octahedral(start_num)

Space Figurate Numbers

- generalized_icosahedral(start_num)
- generalized_dodecahedral(start_num)
- generalized_centered_cube(start_num)
- generalized_centered_tetrahedron(start_num)
- generalized_centered_square_pyramid(start_num)
- generalized_rhombic_dodecahedral(start_num)
- generalized_centered_mgonal_pyramidal(m, start_num)
- generalized_mgonal_prism(m, start_num)
- generalized_hexagonal_prism(start_num)

Multidimensional Figurate Numbers

- k_dimensional_hypertetrahedron(k) = k_hypertetrahedron(k) = regular_k_polytopic(k) = figurate_of_order_k(k)
- five_dimensional_hypertetrahedron
- six_dimensional_hypertetrahedron
- k_dimensional_hypercube(k) = k_hypercube(k)
- five_dimensional_hypercube
- six_dimensional_hypercube
- hypertetrahedral = pentachoron = pentatope = triangulotriangular = cell_5
- hypercube = octachoron = tesseract = biquadratic = cell_8
- hyperoctahedral = hexadecachoron = four_cross_polytope = four_orthoplex = cell_16
- hypericosahedral = hexacosichoron = polytetrahedron = tetraplex = cell_600
- hyperdodecahedral = hecatonicosachoron = dodecaplex = polydodecahedron = cell_120
- polyoctahedral = icositetrachoron = octaplex = hyperdiamond = cell_24
- four_dimensional_hyperoctahedron
- five_dimensional_hyperoctahedron
- six_dimensional_hyperoctahedron
- seven_dimensional_hyperoctahedron
- eight_dimensional_hyperoctahedron
- nine_dimensional_hyperoctahedron
- ten_dimensional_hyperoctahedron
- k_dimensional_hyperoctahedron(k) = k_cross_polytope(k)
- four_dimensional_mgonal_pyramidal(m) = mgonal_pyramidal_of_the_second_order(m)
- four_dimensional_square_pyramidal
- four_dimensional_pentagonal_pyramidal
- four_dimensional_hexagonal_pyramidal
- four_dimensional_heptagonal_pyramidal
- four_dimensional_octagonal_pyramidal
- four_dimensional_nonagonal_pyramidal
- four_dimensional_decagonal_pyramidal
- four_dimensional_hendecagonal_pyramidal
- four_dimensional_dodecagonal_pyramidal
- k_dimensional_mgonal_pyramidal(k,m) = mgonal_pyramidal_of_the_k_2_th_order(k,m)
- five_dimensional_mgonal_pyramidal(m)
- five_dimensional_square_pyramidal
- five_dimensional_pentagonal_pyramidal
- five_dimensional_hexagonal_pyramidal
- five_dimensional_heptagonal_pyramidal
- five_dimensional_octagonal_pyramidal

Multidimensional Figurate Numbers

- six_dimensional_mgonal_pyramidal(m)
- six_dimensional_square_pyramidal
- six_dimensional_pentagonal_pyramidal
- six_dimensional_hexagonal_pyramidal
- six_dimensional_heptagonal_pyramidal
- six_dimensional_octagonal_pyramidal
- centered_biquadratic
- k_dimensional_centered_hypercube(k)
- five_dimensional_centered_hypercube
- six_dimensional_centered_hypercube
- centered_polytope
- k_dimensional_centered_hypertetrahedron(k)
- five_dimensional_centered_hypertetrahedron
- six_dimensional_centered_hypertetrahedron
- centered_hyperoctahedral
- nexus(k)
- k_dimensional_centered_hyperoctahedron(k)
- five_dimensional_centered_hyperoctahedron
- six_dimensional_centered_hyperoctahedron
- generalized_pentatope(start_num = 0)
- generalized_k_dimensional_hypertetrahedron(k = 5, start_num = 0)
- generalized_biquadratic(start_num = 0)
- generalized_k_dimensional_hypercube(k = 5, start_num = 0)
- generalized_hyperoctahedral(start_num = 0)
- generalized_k_dimensional_hyperoctahedron(k = 5, start_num = 0)
- generalized_hyperdodecahedral(start_num = 0)
- generalized_hypericosahedral(start_num = 0)
- generalized_polyoctahedral(start_num = 0)
- generalized_k_dimensional_mgonal_pyramidal(k, m, start_num = 0)
- generalized_k_dimensional_centered_hypercube(k, start_num = 0)
- generalized_nexus(k, start_num = 0)

Zoo Figurate Numbers

- cuban_prime
- pell