



**ABELIUM**  
Research & Development



# **“GreGAS Atlas”**

## **Encyclopedia of Graphs**

**(and graph-like structures)**

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## Motivation

- PhD research
- The On-Line Encyclopedia of Integer Sequences
  - <http://oeis.org>
- Project GReGAS
  - <http://gregas.eu>
  - “Geometric representations and symmetries of graphs, maps and other discrete structures and applications in science”

## Encyclopedia of Graphs

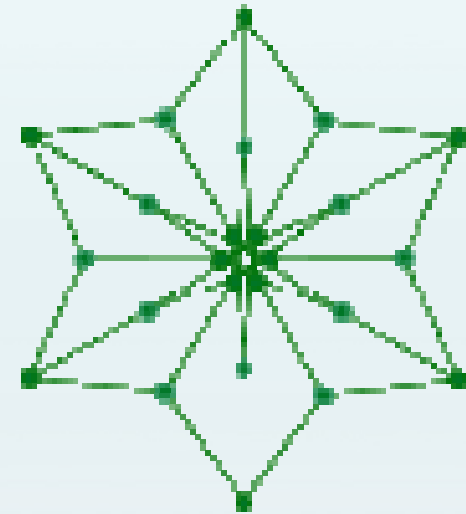
<http://atlas.gregas.eu>

- Online encyclopedia of graph collections aiming to help researchers find and use data about different families of graphs
- Created as a part of the ESF funded GreGAS project
- **Goal:**  
To become a reference repository for graphs and graph-like structures (maps, configurations, networks)



## Logo

- Generalized Petersen graph  $G(12, 5)$ , also known as Nauru graph
- The drawing is a unit-distance representation of the Nauru graph



ŽITNIK, Arjana, HORVAT, Boris, PISANSKI, Tomaž. All generalized Petersen graphs are unit-distance graphs. J. Korean Math. Soc., 2012, vol. 49, no. 3, pp. 475-491.



## The Concept

- Storing graphs in the form of collections
  - subsets of graphs with specific properties (e.g. symmetric, vertex-transitive)
- Why not all (connected) graphs?
  - 10 vertices: 12 M
  - 11 vertices: 1 B
  - 15 vertices:  $10^{20}$
- We store the data needed to construct the graph and the known properties

## Graph data

- Stored in “canonical” sparse6 format
  - Brendan D. McKay: nauty User's Guide
  - sparse6 vs. graph6 ( $\text{edges} < n^2 / 32$ )
- Procedure:



## Graph properties

- Types: integer, string, boolean
- Can be added later
- Currently some 35 properties

UGI	Entry name	Graph name	Order	Diameter	Girth	Bipartite	Distance-regular	Transitivity	Group order	Har
G-1	F004A	Tetrahedral graph	4	1	3	false	true	2	24	
G-2	F006A	Utility graph	6	2	4	true	true	3	72	
G-3	F008A	Cubical graph	8	3	4	true	true	2	48	
G-4	F010A	Petersen graph	10	2	5	false	true	3	120	
G-5	F014A	Heawood graph	14	3	6	true	true	4	336	
G-6	F016A	Möbius-Kantor graph	16	4	6	true	false	2	96	
G-7	F018A	Pappus graph	18	4	6	true	true	3	216	
G-8	F020A	Dodecahedral graph	20	5	5	false	true	2	120	

## Front page: functionality

- Search by: graph name, collection name, description & UGI or “Browse all collections”
- UGI: Universal Graph Identifier
  - UNIQUE for nonisomorphic graphs
  - G-“graph internal id in base 31” (no vowels)
    - e.g. G-R8, G-CSD6 etc.
  - Prepended letter (G) for further uses: maps (M), configurations (C), etc.





## Collection functionality

- Filter results
- Comment
- See specific graph
- Export data & properties of filtered graphs

Update collection view

You can use logical expressions to narrow down the list of graphs in a collection. [Examples](#)

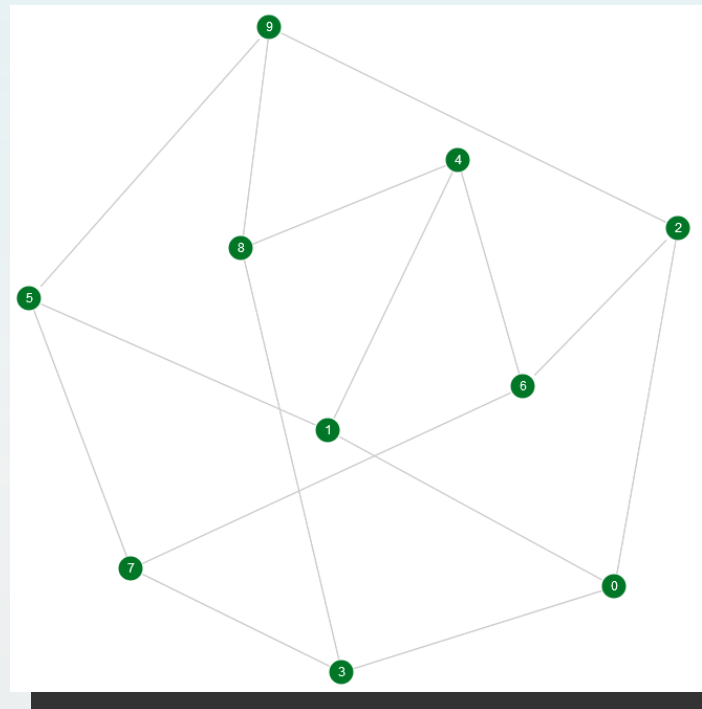
- Using AND: `girth >= 3 distance-regular = true "hamiltonian cycle" = false`
- Using OR: `order != 6 and (bipartite = true or diameter < 3)`
- Similar match: `"group order" ~ 2^10`
- Existence: `set? "graph name"`

Select properties:

- |  |   |   |
|--|---|---|
| <input checked="" type="checkbox"/> Order    | <input checked="" type="checkbox"/> Group order | <input checked="" type="checkbox"/> Transitivity      |
| <input checked="" type="checkbox"/> Diameter | <input checked="" type="checkbox"/> Bipartite   | <input checked="" type="checkbox"/> Hamiltonian cycle |

## Graph functionality

- See all known properties
- Download data
- Edit description (wiki + version control)
- Visualization



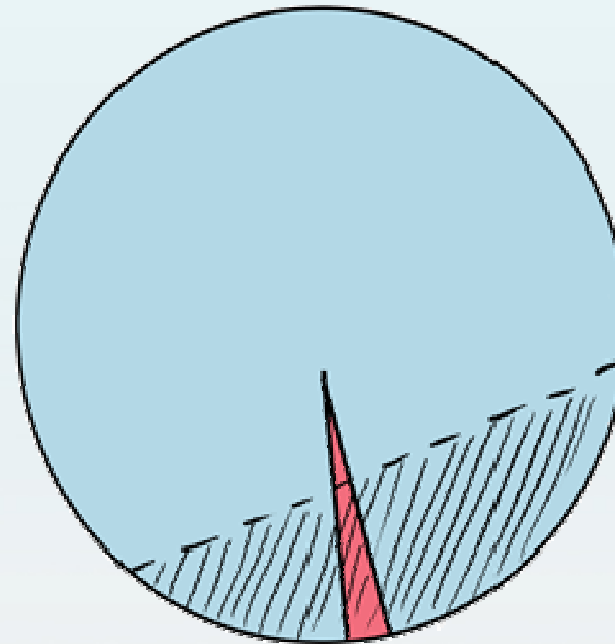
## Further work


- Master search independent of collections
- Automatic generation of graph families
- Calculation of unknown graph parameters
- Inclusion of other graph-like structures
  - maps, configurations, networks
- House of Graphs (<http://hog.grinvin.org>)





# Thank you CSD6!

A graph on math jokes



 Math jokes that are funny

 Math jokes that are not funny

 math jokes that you could actually understand

 a spider

I ONLY PLAY  
ROULETTE ON DAYS  
THAT END IN "Y"

