Cheatsheet for YAGS 0.0.2

Graph definitions

Adjacency list

`g:=GraphByAdjacencies([[],[4],[1,2],[]])`

Adjacency matrix

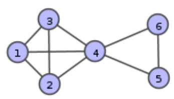
`M:=[[false, true, false], [true, false, true], [false, true, false]]; g:=GraphByAdjMatrix(M);`

List of edges

`g:=GraphByEdges([[1,2],[2,3],[3,4]]);`

Complete cover

`g:=GraphByCompleteCover([[1,2,3,4],[4,5,6]]);`

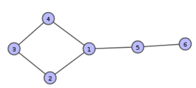


By relation

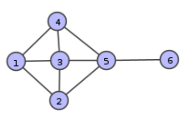
`f:=function(x,y) return Intersection(x,y)<>[]; end;;`
`g:=GraphByRelation([[1,2,3],[3,4,5],[5,6,7]],f);`

By walks

`g:=GraphByWalks([1,2,3,4,1],[1,5,6]);`



`g:=GraphByWalks([1,[2,3,4],5],[5,6]);`



As intersection graph

`g:=IntersectionGraph([[1,2,3],[3,4,5],[5,6,7]]);`

As a copy

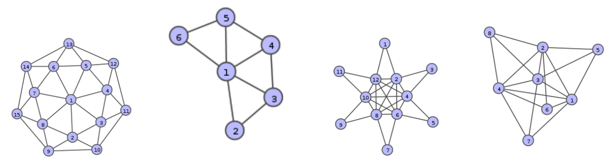
`h:=CopyGraph(g)`

As an induced subgraph

`h:=InducedSubgraph(g,[3,4,6]);`

Graph families (with parameters)

- `g:=DiscreteGraph(n)`
- `g:=CompleteGraph(n)`
- `g:=PathGraph(n)` n vertices.
- `g:=CycleGraph(n)`
- `g:=CubeGraph(n)`
- `g:=OctahedralGraph(n)`
- `g:=JohnsonGraph(n,r)` Vertices are subsets of $\{1, 2, \ldots, n\}$ with r elements, edges between subsets with intersection of $r - 1$ elements.
- `g:=Circulant(n,J)` Second paramenter is a list of jumps
- `g:=CompleteBipartiteGraph(n,m)`
- `g:=CompleteMultipartiteGraph(n1,n2[, n3 ...])`
- `g:=TorusGraph(n,m)`
- `g:=TreeGraph(L)` L is a list. Vertices at depth k have `L[k]` children.
- `g:=TreeGraph(n,k)` Same as `TreeGraph([n,n,..,n])` (the list has length k)
- `g:=WheelGraph(n)`
- `g:=WheelGraph(7,2)` Second optional parameter is the radius of the wheel.
- `g:=FanGraph(4);`
- `g:=SunGraph(6);`
- `g:=SpikyGraph(4);`
- Examples: Wheel, Fan, Sun, Spiky:



Named graphs

Platonic

`Tetrahedron`, `Octahedron`, `Cube`, `Dodecahedron`, `Icosahedron`.

Other

`TrivialGraph`, `DiamondGraph`, `ClawGraph`, `HouseGraph`, `BullGraph`, `AntennaGraph`, `KiteGraph`, `AGraph`, `ChairGraph`, `DartGraph`, `DominoGraph`, `FishGraph`, `GemGraph`, `HouseGraph`, `ParachuteGraph`, `ParapluieGraph`, `PawGraph`, `PetersenGraph`, `RGraph`, `SnubDisphenoid`.

Random graphs

- `g:=RandomGraph(n)`
- `g:=RandomGraph(n,p)` Graph with n vertices, each edge with probability p to appear.

New graphs from old

- `h:=RemoveVertices(g,[1,3]);`
- `h:=AddEdges(g,[[1,2]]);`
- `h:=RemoveEdges(g,[[1,2],[3,4]]);`

Parameters

- `Order(g)`
- `Size(g)`
- `CliqueNumber(g)`
- `VertexDegree(g,v)`
- `MaxDegree(g)`
- `MinDegree(g)`
- `Girth(g)`
- `NumberOfCliques(g)`
- `NumberOfConnectedComponents(g)`

Boolean tests

- `IsCompleteGraph(g)`
- `IsCliqueHelly(g)`
- `IsDiamondFree(g)`
- `IsEdge(g,x,y)` or `IsEdge(g,[x,y])`
- `IsIsomorphicGraph(g,h)`
- `IsCompactSurface(g)`
- `IsSurface(g)`
- `IsLocallyConstant(g)`
- `IsLocallyH(g,h)`
- `IsLoopless(g)`

Products

- `p=BoxProduct(g,h)`
- `p=TimesProduct(g,h)`
- `p=BoxTimesProduct(g,h)`
- `p=DisjointUnion(g,h)`
- `p=Join(g,h)`
- `p=GraphSum(g,l)` l is a list of graphs. Suppose that g has n vertices. In the disjoint union of the first n graphs of l (using `TrivialGraphs` if needed to fill n slots), add all edges between graphs corresponding to adjacent vertices in g.
- `p=Composition(g,h)` is the same as `GraphSum(g,l)`, where l is a list of length the order of g, with all components equal to h.

Operators

- `h:=CliqueGraph(g)`
- `h:=CliqueGraph(g,m)` Stops when a maximum of m cliques have been found.
- `h:=LineGraph(g)`
- `h:=ComplementGraph(g)`
- `h:=Cone(g)`
- `h:=Suspension(g)`
- `h:=ParedGraph(g)`
- `h:=CompletelyParedGraph(g)`
- `h:=QuotientGraph(g,p)` p is a partition of vertices. The vertices of h are the parts of p, with two vertices adjacent if there are two vertices adjacent in g in the corresponding parts. Singletons in p may be omitted.
- `h:=QuotientGraph(g,l1,l2)` $l1, l2$ are lists of vertices of the same length, with repetitions allowed. In h, each vertex of the first list is identified with the corresponding vertex in the second list.
- `h:=Link(g,x)` The subgraph of g induced by the neighbors of x.
- `h:=SpanningForest(g)`

Lists

- `VertexNames(g)`
- `Cliques(g)`
- `Cliques(g,m)` Stops if a maximum of m cliques have been found.
- `Basement(kng,kmg,x)` $n \leq m$
- `AdjMatrix(g)`
- `Adjaceny(g,v)`

- `Adjacencies(g)`
- `VertexDegrees(g)`
- `Edges(g)`
- `CompletesOfGivenOrder(g,o)`
- `ConnectedComponents(g)`
- `GraphAttributeStatistics(n,p,F)` Returns information about the parameter `F` for 100 random graphs of order n and edge probability p.
- `BoundaryVertices(g)` For g a triangulation of a compact surface, returns the list of vertices whose link is isomorphic to a path.
- `InteriorVertices(g)`
- `SpanningForestEdges(g)`

Distances

- `Distance(g,x,y)`
- `DistanceMatrix(g)`
- `Diameter(g)`
- `Eccentricity(g,x)`
- `Radius(g)`
- `Distances(g,a,b)` a, b are lists of vertices. Returns a list.
- `DistanceSet(g,a,b)` As before, but returns a set.
- `DistanceGraph(g,d)` The graph with vertex set the vertices of g, two vertices adjacent if their distance is in d.
- `PowerGraph(g,n)` Same as the distance graph with set of distance $\{1, \ldots, n\}$.

Graph morphisms

- `IsoMorphisms(g,h)`
- `AutomorphismGroup(g)`
- `Morphism(g,h)`, `Morphisms(g,h)`, `NextMorphism(g,h,f)`
- `MonoMorphism(g,h)`, `MonoMorphisms(g,h)`, `NextMonoMorphism(g,h,f)`
- `EpiMorphism(g,h)`, `EpiMorphisms(g,h)`, `NextEpiMorphism(g,h,f)`
- `WeakMorphism(g,h)`, `WeakMorphisms(g,h)`, `NextWeakMorphism(g,h,f)`, and more predefined classes of morphisms and the possibility to define new classes

Small Graphs

- `ConnectedGraphsOfGivenOrder(n)` Up to $n = 9$.
- `Graph6ToGraph(s)` `s` is a string.
- `GraphsOfGivenOrder(n)` Up to $n = 9$.
- `ImportGraph6(f)` `f` is a filename.

Graph categories

- `DefaultGraphCategory` A variable that holds the current graph category. Has to be set with, e.g. `SetDefaultCategory(OrientedGraphs)`

Graph categories:

`Graphs`, `UndirectedGraphs`, `LooplessGraphs`, `SimpleGraphs`, `OrientedGraphs`.

Digraphs

- `InNeigh(g,x)` List of in-neighbors of x in g.
- `IsTournament(g)`
- `IsTransitiveTournament(g)`
- `Orientations(g)` List of all oriented graphs that can be obtained from g

Draw

- `Draw(g)` Shows a window with a drawing of `g`. Commands in the `draw` window: `h`:help, `f`:fit graph, `l`: toggle labels, `d`: toggle dynamics, `r`: toggle repulsion, `s`: save & quit, `q`: quit without saving

Backtrack

Example: coloring with two colors:

```
g:=PathGraph(3);
chk:=function(L,g)
    local x,y;
    if L=[] then return true; fi;
    x:=Length(L);
    for y in [1..x-1] do
        if IsEdge(g,[x,y]) and L[x]=L[y] then
            return false;
        fi;
    od;
    return true;
end;
```

then `BacktrackBag([0,1],chk,Order(g),g);` returns `[ [ 0, 1, 0 ], [ 1, 0, 1 ] ]`.