First Written: March-May tested for Maple 2024
UNDER CONSTRUCTION
Version : May 4, 2025

Written by the Experimental Mathematics class taught by Dr. Z.
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This is AGT.txt, A Maple package to perform algorithms on graphs

The most current version is available on WWW at:
http://sites.math.rutgers.edu/~zeilberg/EM25/AGT.txt .
Please report all bugs to: DoronZeil at gmail dot com .

For general help, and a list of the MAIN functions,
type "Help();". For specific help type "Help(procedure_name);"
For a list of the supporting functions type: Help1();

These are the SUPPORTING procedures we added after instruction:
DegreeList(G), BFS(G,s,t), FindPath(G, neighborhood, n,
current, path, visited), SumEdgeWeights(G), OddVertices(G),
AllMatchings(L), MatchingPathsAndCost(matching, G),
BestMatchingAndPaths(odds, G), AddPathsToGraph(G, pathTable)

To access the list of newly added support procedures again,
type "Helpsupport()"

The ADDITIONAL procedures (added by Jeffrey Tang and Matthew
Esaia) are: DiracThm(G), isHamiltonian(G), isEulerian(G),
ChromaticPolynomial(G), FordFulkerson(G,s,t), PerfectMatching
(G), ColorGraph(G), ChinesePostman(G)

To access the list of newly added main procedures again, type
"Helpnew()"

Example test runs are on the following pages. Note for Ford-Fulkerson and Chinese Postman problem, there is only one example because these procedures require

"Generating random graph with n =", 4, ", p =", 1
"Here is the graph G:", [4, {{1, 2}, {1, 3}, {1, 4}, {2, 3}, {2, 4}, {3, 4}}]

"==== Dirac Theorem ===="
"DiracThm:", true

"==== Hamiltonian Path (if Dirac holds) ===="
"Hamiltonian path result:", true, [1, 2, 3, 4]

"==== Eulerian Circuit ===="
"Eulerian circuit result:", FAIL, "G has a vertex of odd degree!"

"==== Perfect Matching ===="
"Perfect matching:", {[1, 2], [3, 4]}

"==== Graph Coloring ===="
"Color assignment:", [1, 2, 3, 4]
"Number of colors used:", 4

"==== Chromatic Polynomial ===="
"Chromatic polynomial evaluated at k = 3:", 24

"Generating random graph with n =", 6, ", p =", 3/5
"Here is the graph G:", [6, {{1, 5}, {1, 6}, {2, 3}, {2, 4},
{3, 4}, {3, 6}, {4, 5}, {4, 6}, {5, 6}}]

"==== Dirac Theorem ===="
"DiracThm:", false

"==== Hamiltonian Path (if Dirac holds) ===="
"Hamiltonian path result:", FAIL, "Dirac's Theorem does not hold!"

"==== Eulerian Circuit ===="
"Eulerian circuit result:", FAIL, "G has a vertex of odd degree!"

"==== Perfect Matching ===="
"Perfect matching:", {[1, 5], [2, 3], [4, 6]}

"==== Graph Coloring ===="
"Color assignment:", [1, 1, 2, 3, 2, 4]
"Number of colors used:", 4

"==== Chromatic Polynomial ===="
"Chromatic polynomial evaluated at k = 2:", 0

"Generating random graph with n =", 12, ", p =", 3/7
"Here is the graph G:", [12, {{1, 2}, {1, 3}, {1, 7}, {1, 10},
{1, 12}, {2, 3}, {2, 5}, {2, 6}, {2, 8}, {3, 6}, {3, 7},
{3, 9}, {3, 10}, {4, 7}, {4, 8}, {4, 12}, {5, 6}, {5, 8},
{5, 10}, {5, 12}, {6, 8}, {6, 9}, {6, 10}, {7, 9}, {7, 11},
{8, 9}, {8, 10}, {8, 11}, {8, 12}, {9, 10}, {9, 11}, {10, 11}}]

"==== Dirac Theorem ===="
"DiracThm:", false

"==== Hamiltonian Path (if Dirac holds) ===="
"Hamiltonian path result:", FAIL, "Dirac's Theorem does not hold!"

"==== Eulerian Circuit ===="
"Eulerian circuit result:", FAIL, "G has a vertex of odd degree!"

"==== Perfect Matching ===="
"Perfect matching:", {[1, 2], [3, 6], [4, 7], [5, 8], [9, 10]}

"==== Graph Coloring ===="
"Color assignment:", [1, 2, 3, 1, 1, 4, 2, 3, 1, 2, 4, 2]
"Number of colors used:", 4

"==== Chromatic Polynomial ===="
"Chromatic polynomial evaluated at k = 2:", 0

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"==== Ford-Fulkerson Max Flow ===="

Gmat := [[ 0, 16, 13, 0, 0, 0 ], [ 0, 0, 10, 12, 0, 0 ],
         [ 0, 4, 0, 0, 14, 0 ],  [ 0, 0, 9, 0, 0, 20 ],
         [ 0, 0, 0, 7, 0, 4 ],   [ 0, 0, 0, 0, 0, 0 ] ]:
       "Max flow from", 1, "to", 6, ":", 23

"==== Chinese Postman Problem ===="

#Gweight := RWG(n, p, K):
Gweight := [ 5,
{ {1,2}, {2,3}, {3,4}, {1,4}, {1,5}, {3,5} },
table([
{1,2} = 3,
{2,3} = 4,
{3,4} = 5,
{1,4} = 6,
{1,5} = 2,
{3,5} = 1
  ])
 ]:
Graph is Eulerian. Eulerian circuit: "G has a vertex of odd degree!"

"Chinee Postman result:", 21
NULL;
```