

Depth-First Search and Breadth-First Search

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import GRAPH

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-- dfs g begin : a list of the nodes in graph 'g' reachable from node 'begin'
dfs :: Graph -> Node -> [ Node ]

dfs g begin = dfs' g [ begin ] [ ]

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-- dfs' g next seen : a list of the nodes in graph 'g' reachable from nodes in
-- the list 'next', but excluding nodes in the list 'seen'

dfs' :: Graph -> [ Node ] -> [ Node ] -> [ Node ]

dfs' _ [ ] _ = [ ]

dfs' g ( n : ns ) seen = if elem n seen then
                        dfs' g ns seen
                        else
                            n : dfs' g ( outNeighbours n g ++ ns ) ( n : seen )

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-- bfs g begin : a list of the nodes in graph 'g' reachable from node 'begin'
bfs :: Graph -> Node -> [ Node ]

bfs g begin = bfs' g [ begin ] [ ]

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-- bfs' g next seen : a list of the nodes in graph 'g' reachable from nodes in
-- the list 'next', but excluding nodes in the list 'seen'

bfs' :: Graph -> [ Node ] -> [ Node ] -> [ Node ]

bfs' _ [ ] _ = [ ]

bfs' g ( n : ns ) seen = if elem n seen then
                        bfs' g ns seen
                        else
                            n : bfs' g ( ns ++ outNeighbours n g ) ( n : seen )

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-- doSearch search graph begin : the list of labels of nodes generated
-- by performing 'search' on graph 'graph',
-- starting at the node with label 'begin'

doSearch :: ( Graph -> Node -> [ Node ] ) -> Graph -> String -> [ String ]

doSearch search graph begin = map n2s ( search graph ( s2n begin ) )

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g1 = ugraph [ "A", "B", "C", "D", "E", "F", "G", "H" ]
      [ ( "A", "B" ), ( "A", "C" ), ( "A", "E" ),
        ( "B", "D" ), ( "B", "E" ),
        ( "C", "F" ), ( "C", "G" ),
        ( "D", "E" ),
        ( "F", "G" ) ]
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g2 = graph [ "0", "+1", "-1", "+2", "-2", "+3", "-3", "+4", "-4" ]
      [ ( "0", "+1" ), ( "+1", "+2" ), ( "+2", "+3" ), ( "+3", "+4" ),
        ( "0", "-1" ), ( "-1", "-2" ), ( "-2", "-3" ), ( "-3", "-4" ) ]
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> doSearch dfs g1 "A"
["A","B","D","E","C","F","G"]

> doSearch bfs g1 "A"
["A","B","C","E","D","F","G"]

> doSearch dfs g1 "B"
["B","A","C","F","G","E","D"]

> doSearch bfs g1 "B"
["B","A","D","E","C","F","G"]

> doSearch dfs g1 "F"
["F","C","A","B","D","E","G"]

> doSearch bfs g1 "F"
["F","C","G","A","B","E","D"]
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> doSearch dfs g2 "0"
["0","+1","+2","+3","+4","-1","-2","-3","-4"]

> doSearch bfs g2 "0"
["0","+1","-1","+2","-2","+3","-3","+4","-4"]

> doSearch dfs g2 "+2"
["+2","+3","+4"]

> doSearch bfs g2 "+2"
["+2","+3","+4"]
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