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Faculty of Mathematics and Computer Science
Department: Computer Science
Subject Responsible : Dr. Said GADRI
Subject: Graph Theory/L2-LMD

TUTORIALS - SERIES NO. 02 (CORRECTION)

EXERCISE N° 01

Study of connectivity in the following graphs:

(a) A connected graph
(b) An unconnected graph (contains 02 blocks)
(c) A connected component, the entire graph is not connected (composed of 2 blocks)
(d) A connected component, the graph is not connected (for the same reason)
(e) The two components delimited by the dotted lines are connected, the entire graph is also connected.

EXERCISE N° 02

Study of the strong connectivity in the following graphs:

(a) A strongly connected graph
(b) Is not strongly connected (contains a source vertex and a sink vertex)
(c) Is a strongly connected component, the graph is not strongly connected (there is a source vertex)
(d) Is not a strongly connected component (there is a sink), the graph is not strongly connected (for the same reason)
(e) Not a strongly connected graph, the graph is not strongly connected.

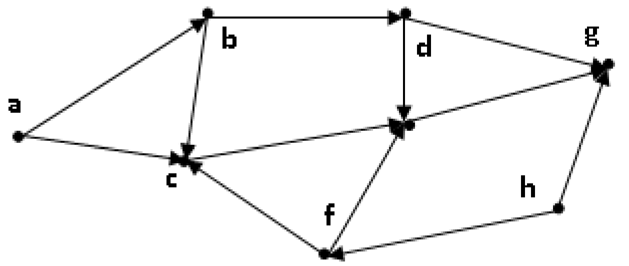
EXERCISE N° 03

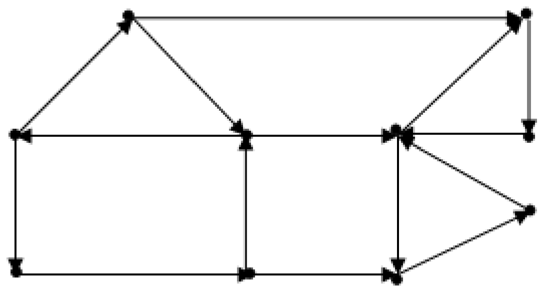
Study of connectivity and strong connectivity in the graphs below:

(a) The graph is not connected, but contains 2 simply connected components ==> is not strongly connected (2 blocks: triangle + square)
(b) Not connected and not strongly connected (contains 2 SCC/2 Str.CC)
(c) Connected, strongly Connected
(d) Connected, but not strongly connected (contains 2 source vertices)

EXERCISE N° 04

G1(X1,U1), G1(X1,U1) two directed graphs

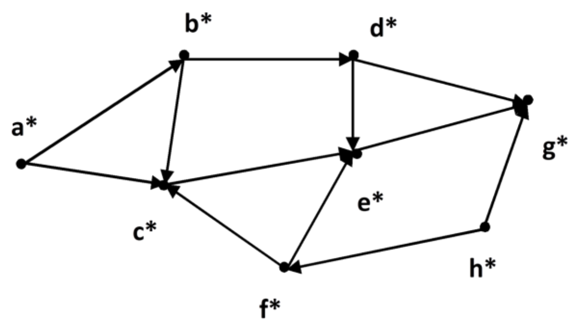




(a) Application of the SCC search algorithm to find: SCC(a), SCC(d), SCC(g)

SCC(a) = {a, b, c, d, e, f, g}==> i.e. the whole graph
==> the graph G1 is simply connected,

==> It froms it itself a single SCC
which contains all the vertices
==> SCC(d) = SCC(g) = SCC (a)
= the graph G1



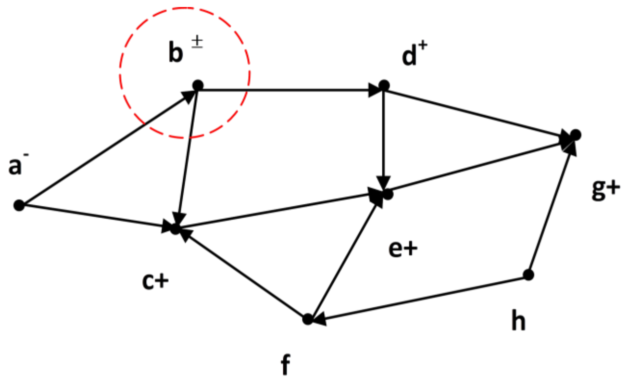
(b) – Application of the strongly connected component search algorithm to find:

Str.CC(b), Str.CC(c), Str.CC(f)

Str.CC(b) = {b}

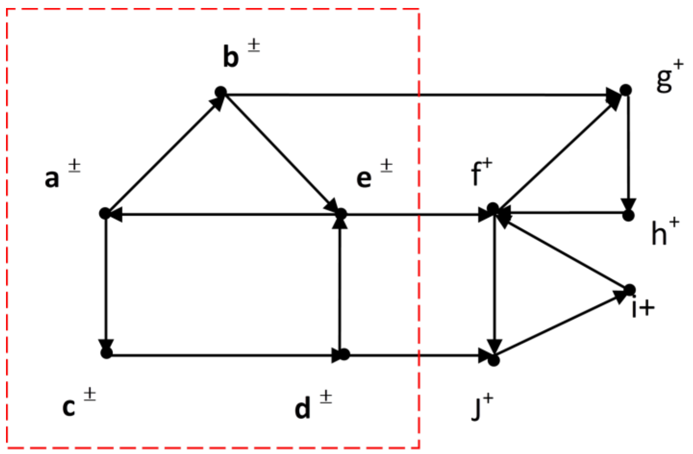
Similarly, we find that:

Str.CC(c) = {c}, Str.CC(f) = {f}

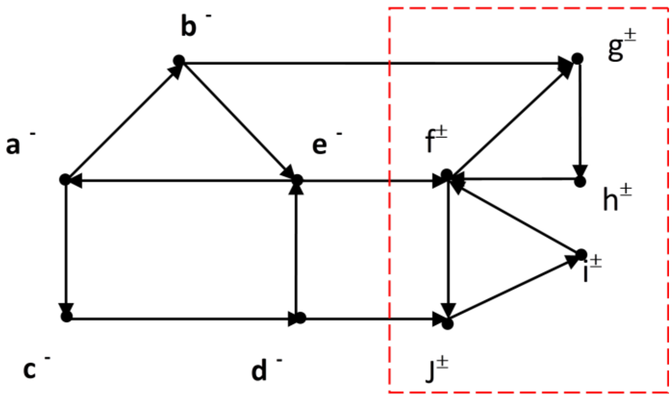


(c) Let's apply the algorithm on G2 to find:
Str.CC(e), Str.CC(g), Str.CC(i)

Str.CC(e) = {a, b, c, d}

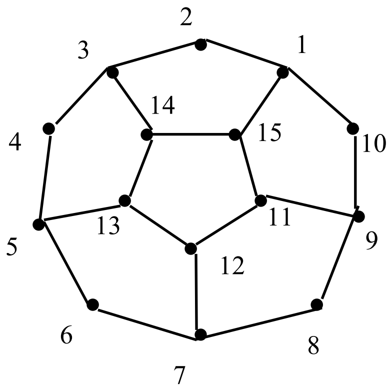


Str.CC(g) = {g, f, h, i, j} = Str.CC(i)

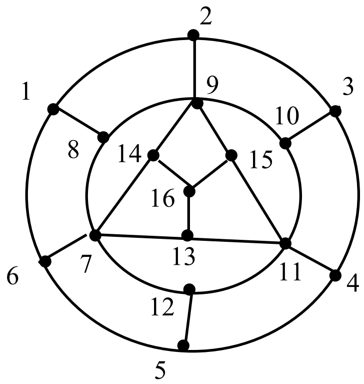


Exercise 05

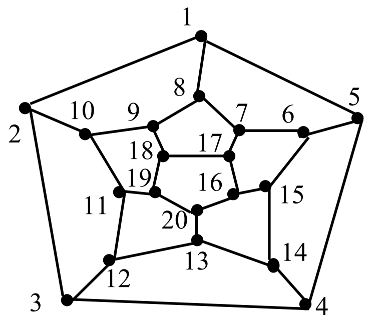
Among the figures below, give the one which represents a Hamiltonian graph?



G1



G2



G3

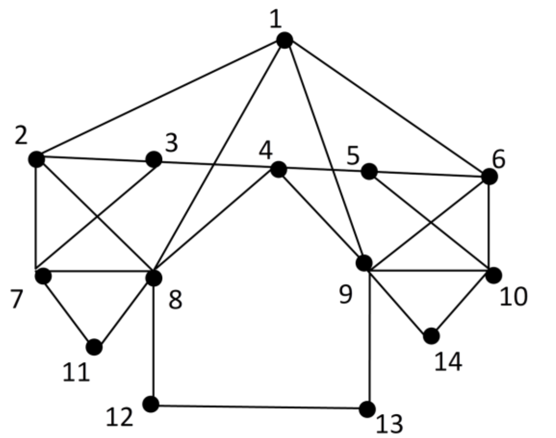
G1 is a Hamiltonian graph, because there exists a hamiltonian chain in the graph, it is:
C = (2, 3, 14, 13, 12, 11, 15, 1, 10, 9, 8, 7, 6, 5, 4)

G2 is not a Hamiltonian graph, because there is no hamiltonian chain

G3 is a Hamiltonian graph, because there exists a Hamiltonian chain which is:
C = (1, 8, 9, 18, 19, 20, 16, 17, 7, 6, 15, 14, 13, 12, 11, 10, 2, 3, 4, 5}

<u>EXERCISE N° 06</u>

Find in the graph below:



a) A hamiltonian chain

C = (1, 2, 3, 7, 11, 8, 12, 13, 9, 4, 5, 6, 10, 14)

b) A hamiltonian cycle

There is no hamiltonian cycle

c) A Eulerian chain

We note that the number of vertices of odd degree is 2 ==> there exists at least one Eulerian chain

C1 = (5, 6, 1, 2, 7, 11, 8, 7, 3, 2, 8, 1, 9, 4, 8, 12, 13, 9, 14, 10, 9, 6, 10, 5 , 4, 3)

C2 = (3, 2, 1, 6, 10, 14, 9, 10, 5, 6, 9, 1, 8, 4, 9, 13, 12, 8, 11, 7, 8, 2, 7, 3 , 4, 5)

C3 = (5, 4, 3, 7, 11, 8, 7, 8, 7, 2, 8, 1, 9, 4, 8, 12, 13, 9, 14, 10, 9, 6, 10, 5 , 6, 1, 2, 3)

d) An eulerian cycle

There is no eulerian cycle