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VCE Specialist Mathematics ½

Graph Theory II [5.4]

Test

21 Marks. 1 Minute Reading. 17 Minutes Writing.

Results:

Test Questions	_____ / 21

Q1 – 4

Section A: Test Questions (21 Marks)

Question 1 (5 marks)

Tick whether the following statements are **true** or **false**.

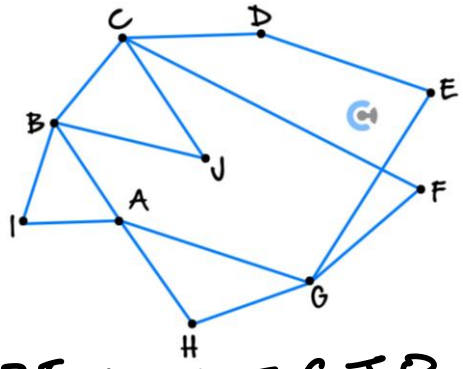
Statement	True	False
a. To find the number of possible walks with a length of 3, we consider A^3.		
b. Euler trail is a walk where we pass all the vertices exactly once.		
c. A graph where exactly one vertex has an odd degree contains an Euler trail.		
d. For Euler circuits, we can go through the vertices multiple times.		
e. A graph where all vertices have an even degree always contains an Euler circuit.		
f. Hamiltonian path is a walk where we pass all the vertices exactly once.		
g. Hamiltonian cycle does not have to use all the edges.		
h. Trees must have a path that can visit all the vertices.		
i. Trees must not have a cycle, meaning they cannot go through all the edges and come back to the original edge.		
j. Spanning tree cannot be a subgraph of a graph that is not a tree.		

Space for Personal Notes

Question 2 (4 marks)

Identify an Eulerian trail and a Hamiltonian cycle in each of the following graphs (if they exist).

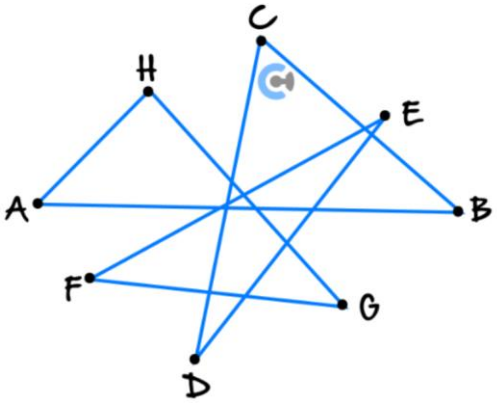
a. (2 marks)



Euler: EDCBIAHGFCJBAGE

Hamiltonian: Doesn't exist

b. (2 marks)



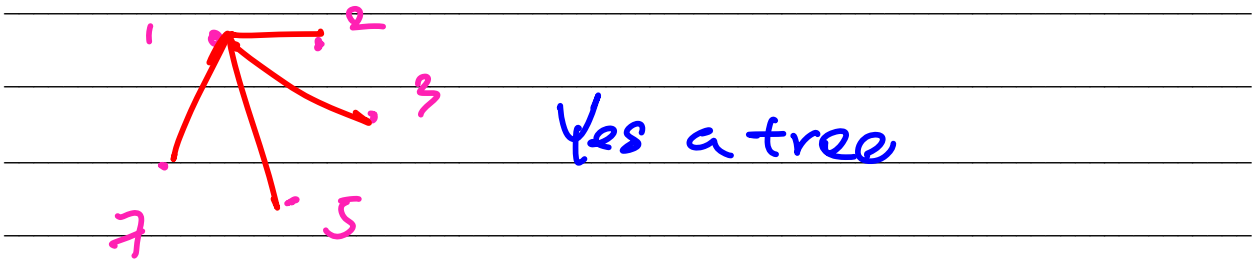
Euler Trail
ABCDEFGHA

Hamiltonian cycle

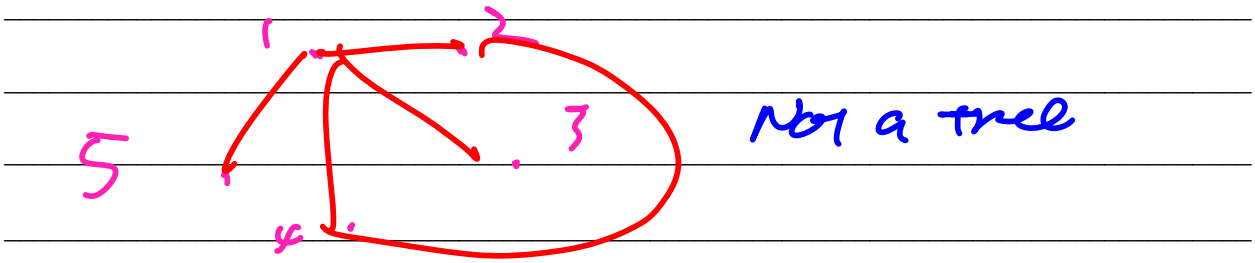
Question 3 (4 marks)

Which of the following graphs are trees? In each case, we insist that $m \neq n$.

a. Vertex set $\{1, 2, 3, 5, 7\}$ and an edge between m and n if m divides n or n divides m. (2 marks)



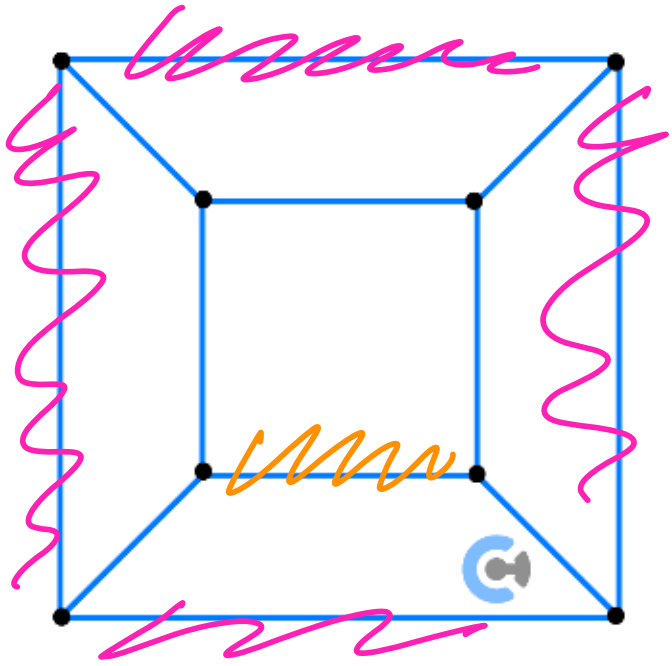
b. Vertex set $\{1, 2, 3, 4, 5\}$ and an edge between m and n if m divides n or n divides m. (2 marks)

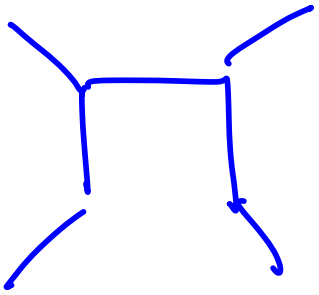


Space for Personal Notes

Question 4 (2 marks)

Find spanning trees of the following graph.





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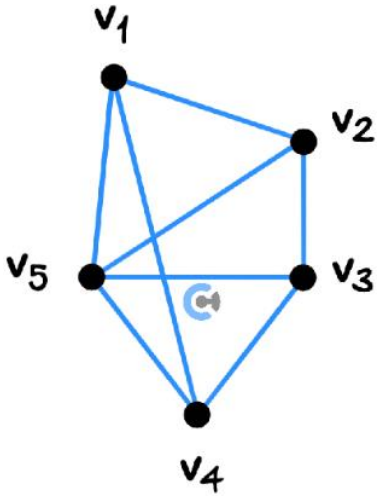
Question 5 (6 marks) **Tech-Active.**



a. Write down the adjacency matrix, A, for this graph. (2 marks)

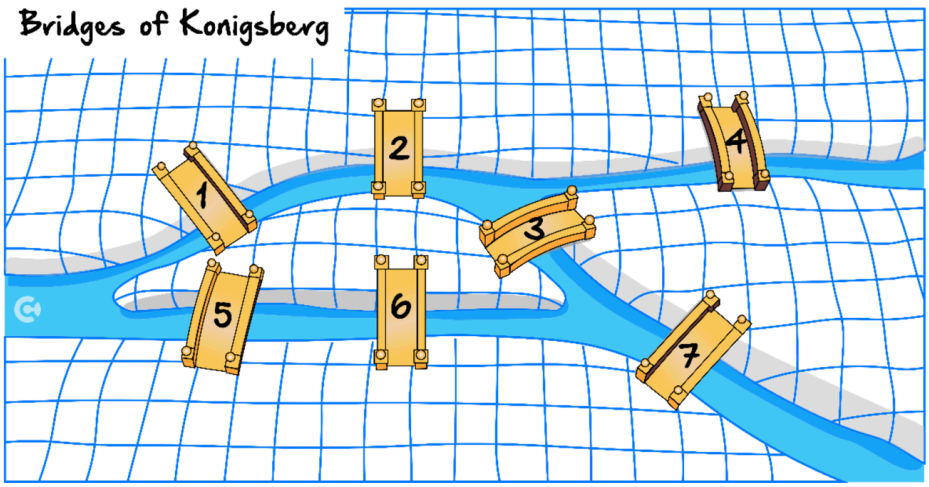
b. Evaluate A^4. (1 mark)

c. Find the number of different walks of length 4 from v_5 to v_5. (1 mark)

d. Verify that the trace of A^3 is 6 times the number of triangles in the graph. (2 marks)

Space for Personal Notes

In the town of Koningsberg, there are seven bridges. People of the town were questioning if it is possible to walk through all the bridges in such a way that each bridge would only be crossed once.



a. Draw the graph that represents the different sections of the town connected by the bridges. (3 marks)

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