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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

Section A: Test Questions (21 Marks)

Question 1 (5 marks)

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

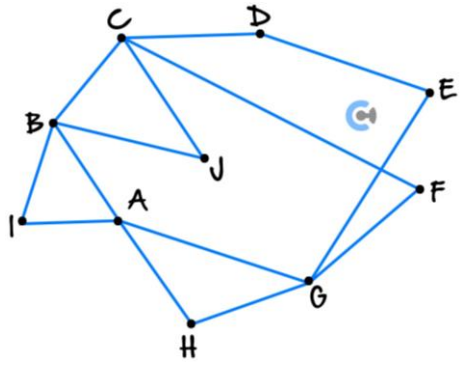
Statement	True	False
a. To find the number of possible walks with a length of 3, we consider A^3.		
b. Euler trail is a walk where we pass all the vertices exactly once.		
c. A graph where exactly one vertex has an odd degree contains an Euler trail.		
d. For Euler circuits, we can go through the vertices 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

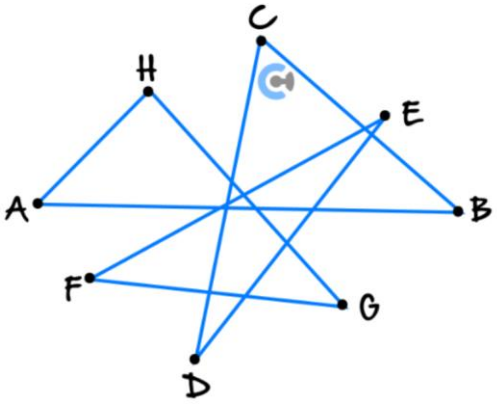
Question 2 (4 marks)

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

a. (2 marks)



b. (2 marks)



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)

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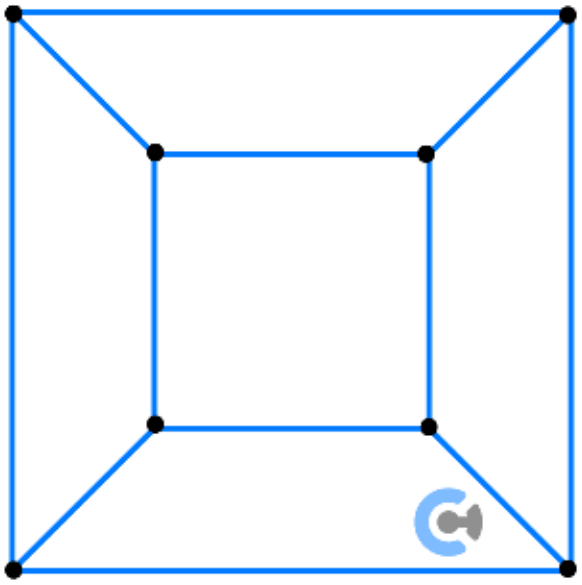
Question 4 (2 marks)

Find spanning trees of the following graph.



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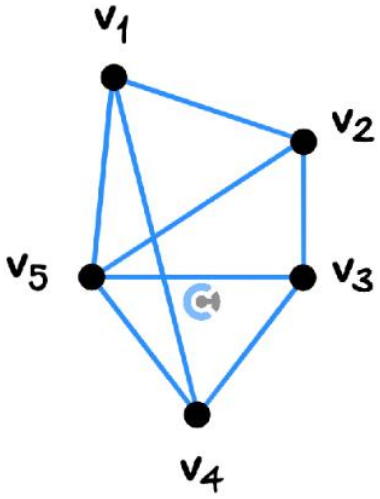
Question 5 (6 marks) **Tech-Active.**



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)

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