Algo-quiz 2

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1 Question1

Answer

2 Question2

Answer

(a) V = {A,B,C,D,F}
(b) E = {{A,B},{A,C},{B,C},{BF},{CF},{DF}}
(c) P = (A,B,F)
(d) C = (C,F,B,C)
(e) E' = {{A,B},{A,C},{B,C},{BF},{CF}}
(f) There is only 1 connected components
(g) 2 more which is {A,D} and {C,D}

3 Question3

Answer

(a) Euler Path: D,E,H,G,D,A,B,C,F,B,E,F,I,E,A
No Euler Circuit: There are odd vertices

(b) No Euler Path nor Euler circuit as it has more than 2 odd vertices which break both the Euler path and the Euler circuit rule.

(c) Euler circuit can only occurs if and only all the degree of the vertex are even number. Euler circuit should start and end with the same vertex and only uses every edge of the graph once.

4 Question4

Answer

We can prove via contradiction.
Assume G is not connected, so there will be at least two connecting components. Let the number of vertices be u and v.

The number of edges is at most $\frac{(u-1)(u-2)}{2} + \frac{(v-1)(v-2)}{2}$

Since u + v = n, We will have at most:
$\frac{n^2-(2u+3)n+(2u^2+4)}{2} = \frac{n^2-2u(n-u)-(3n-4)}{2}$ edges.

We can clearly see that $1 < u < n$ is smaller than $\frac{n^2}{2}$. In addition, if every vertex has degree of at least $\frac{n}{2}$, then then number of the edges must also be equal $\frac{n^2}{2}$.

Therefore, there must be a vertex with degree $< \frac{n}{2}$

5 Question5

Answer

We can use the dirichlet's principle

Every vertex in the graph has degree in 0,1,....n-1. There are n possibilities for no vertices. But either we have vertex with 0 degree or n-1 degree. So we have n-1 possible degree for no vertices.

6 Question6

Answer

(a) Red = {A,H,J,C,F}
Blue = {B,D,I,G,E}

(b) A,B,E,C,F,H,D,G,I,J

(c) A,B,C,D,J,G,F,E,H,I

7 Question7

Answer

(a) A,D,G,F

(b) $L_0 = \{D\}$
$L_1 = \{A, C, E, G, F\}$
$L_2 = \{B, H, I, J\}$
$L_3 = \{\}$

$(c) BE = \{\{D, F\}, \{D, G\}\}$

8 Question8

Answer

(a) No, because a DAG should never be a cycle

(b) No, because for topological order to happen the graph should not have cycle which mean there should be a node with in-degree of zero

(c) Yes, G is strongly connected. As all the path exists between all the vertices. We can use DFS or BFS on the graph starting from any node. If DFS or BFS could visit other vertex in the graph then it is strongly connected.

9 Question9

Answer

(a) Python, Data Science, System skills, DSOOP, Machine learning, SSC, Algorithms

(b)

(c)

10 Question10

Answer