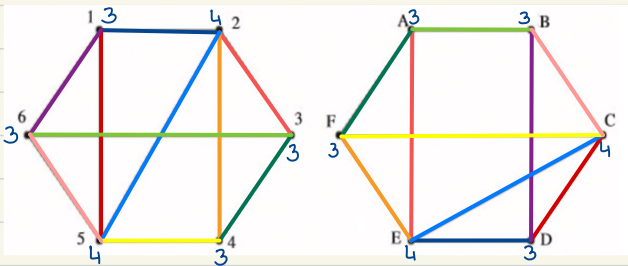


Homework 3

Name: Chhay Lay Heng

Net ID: cxh220032

Q.1- Determine whether the following graphs are isomorphic.

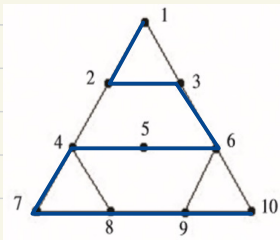


- | | G_1 | G_2 |
|---------------------|--|-------|
| 1) Vertice | 6 | 6 |
| 2) Edge | 10 | 10 |
| 3) Edge of Vertice: | 12-DE, 15-DC, 16-DB, 23-EA, 24-EF, 25-EC, 34-AF, 36-AB, 45-FC, 56-CB | |

$$f(1)=D, \quad f(2)=E, \quad f(3)=A, \quad f(4)=F, \quad f(5)=C, \quad f(6)=B$$

\therefore The graphs are isomorphic

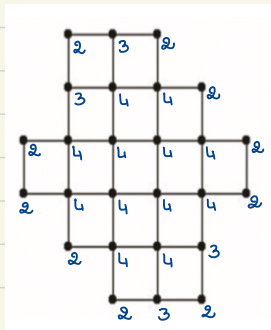
Q.2 - Determine whether the following graph has a Hamilton circuit or Hamilton path.



HP - $\{1, 2, 3, 6, 5, 4, 7, 8, 9, 10\}$

HC - No

Q.3 - Determine whether the following graph has an Euler circuit or Euler path.



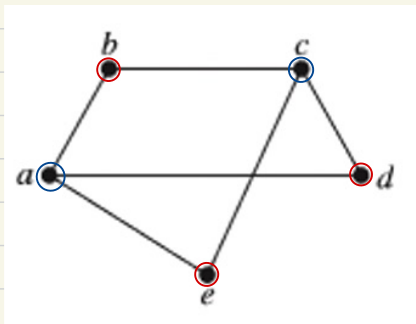
EC - No

Not every vertices are even.

EP - No

There are more than 2 vertices with odd degree.

Q.4 - Determine whether the following graph is bipartite.



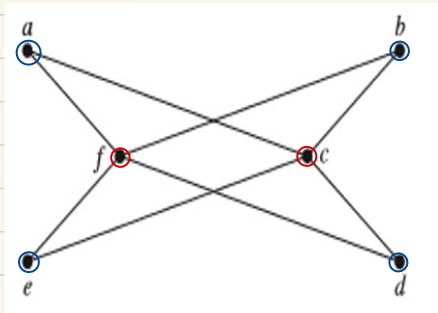
$V = \{a, b, c, d, e\}$

$V_1 = \{a, c\}$

$V_2 = \{b, d, e\}$

\therefore The graph is bipartite

Q.5 - Determine whether the following graph is bipartite.



$$V = \{a, b, c, d, e, f\}$$

$$V_1 = \{a, b, d, e\}$$

$$V_2 = \{c, f\}$$

\therefore The graph is bipartite

Q.6 - For which values of n are these graphs bipartite?

a) K_n : A complete graph K_n is bipartite for even values of n , and non-partite for odd values of n .

Because a complete graph K_n with n vertices can be divided into two subset of $n/2$ vertices each, and all the edges of the graph connect vertices from different subset.

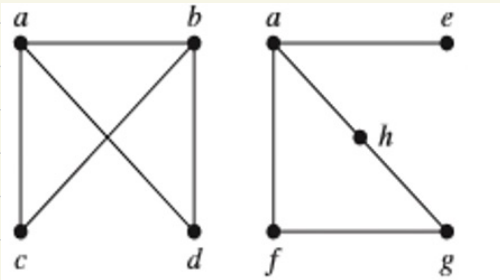
b) C_n : A cycle graph C_n is bipartite for even values of n , and non-bipartite for odd values of n . Because a cycle graph C_n can be divided into two sets of vertices, with each set containing alternate vertices on the cycle.

Q.7 - For which values of n are these graphs bipartite?

a) W_n : The wheel graph W_n is bipartite for all values of $n \geq 4$. Because a wheel graph consist of a cycle graph with one additional vertex connected to all vertices on the cycle.

b) Q_n : The hypercube graph Q_n is bipartite for all value of n . Because a hypercube graph can be constructed recursively, by taking two copies of a hypercube graph of one dimension lower and connecting corresponding vertices between the two copies.

Q.8 - Find the union of the given pair of sample graphs.



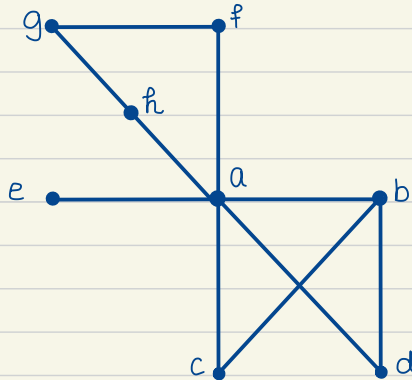
$$V_1 = \{a, b, c, d\}$$

$$E_1 = \{(a,b), (a,c), (a,d), (b,c), (b,d)\}$$

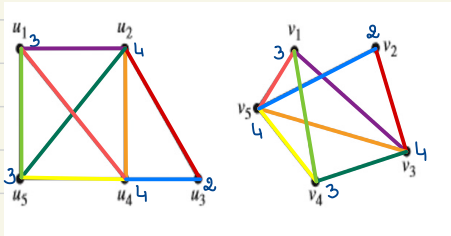
$$V_2 = \{a, e, f, g, h\}$$

$$E_2 = \{(a,e), (a,f), (a,h), (f,g), (g,h)\}$$

$$G_1 \cup G_2 = \{(a,b), (a,c), (a,d), (a,e), (a,f), (a,h), (b,c), (b,d), (f,g), (g,h)\}$$



Q.9 - Determine if the following graphs are isomorphic.

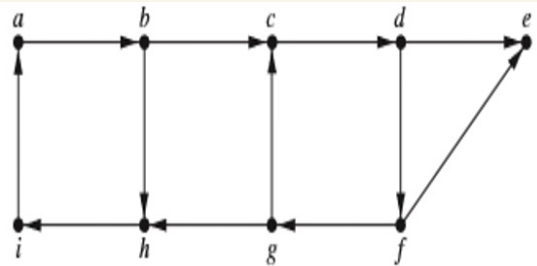


- | | G_1 | G_2 |
|--------------------|---|-------|
| 1) Vertices | 5 | 5 |
| 2) Edges | 8 | 8 |
| 3) Edge of Vertex: | $u_1u_2-v_1v_3, u_1u_4-v_1v_5, u_1u_5-v_1v_4, u_2u_3-v_2v_3, u_2u_4-v_2v_5, u_2u_5-v_2v_4,$
$u_3u_4-v_3v_5, u_4u_5-v_3v_4$ | |

$$f(u_1)=v_1, f(u_2)=v_3, f(u_3)=v_2, f(u_4)=v_5, f(u_5)=v_4$$

\therefore The graphs are isomorphic.

Q.10 - Find the strongly connected components of following graph.



ab - ab	ac - abc
ad - abcd	ae - abcde
af - abcdf	ag - abcdfg
ah - abh	ai - abhi

ba - bhia	bc - bc	bd - bcd	be - bcde
bf - bcdf	bg - bcdfg	bh - bh	bi - bhi
ca - cdfghia	cb - cdfghiab	cd - cd	ce - cde
cf - cdf	cg - cdfg	ch - cdfgh	ci - cdfghi

da - dfg^hia

df - df

fa - fghⁱa

fe - fgcd^e

ga - ghⁱa

ge - gcd^e

ia - ia

ie - iabcde

db - dfg^hiab

dg - dfg

fb - fghⁱab

fg - fg

gb - ghⁱab

gf - gcd^f

ib - iab

if - iabcd^f

dc - dfg^c

dh - dfg^h

fc - fgc

fh - fgh

gc - gc

gh - gh

ic - iabc

ig - iabcd^fg

de - de

di - dfg^hi

fd - fgc^d

fi - fghⁱ

gd - gcd

gi - ghⁱ

id - iabcd

ih - iabh