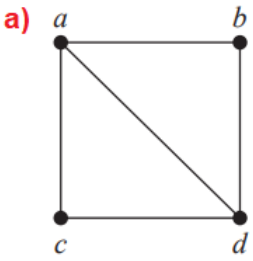
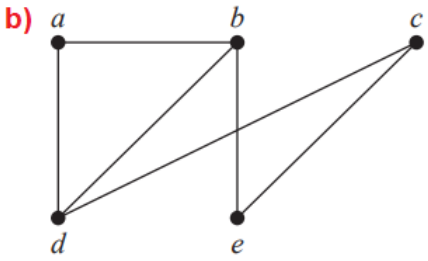
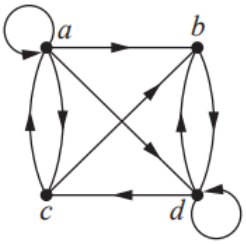
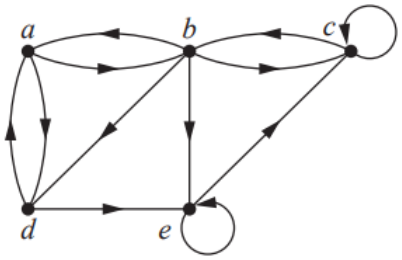
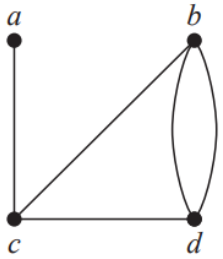
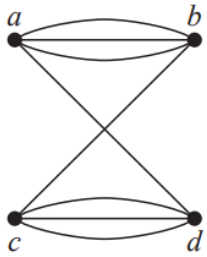
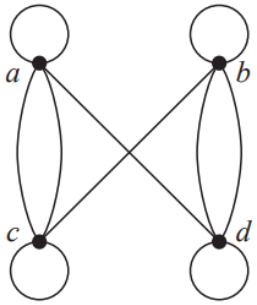
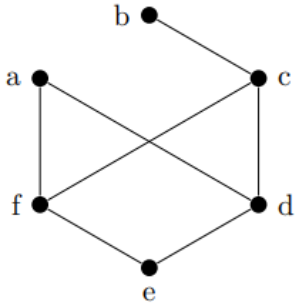
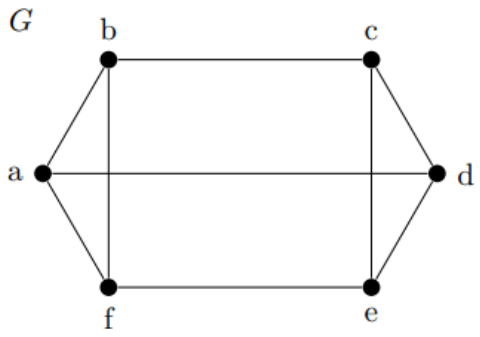
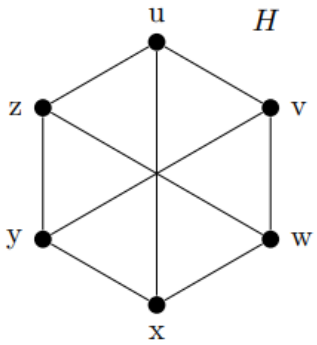
CS 3653 – Discrete Mathematics for Computer Science

Assignment # 13	Due – Apr 25, 2022, 11:59pm (CST)
Chapter # 10	Max. Points # 25

SN	QUESTION	Pts
1	Draw graph models, stating the type of graph used, to represent airline routes where every day there are four flights from Boston to Newark, two flights from Newark to Boston, three flights from Newark to Miami, two flights from Miami to Newark, one flight from Newark to Detroit, two flights from Detroit to Newark, three flights from Newark to Washington, two flights from Washington to Newark, and one flight from Washington to Miami, with a) an edge between vertices representing cities that have a flight between them (in either direction). b) an edge between vertices representing cities for each flight that operates between them (in either direction). c) an edge between vertices representing cities for each flight that operates between them (in either direction), plus a loop for a special sightseeing trip that takes off and lands in Miami. d) an edge from a vertex representing a city where a flight starts to the vertex representing the city where it ends. e) an edge for each flight from a vertex representing a city where the flight begins to the vertex representing the city where the flight ends.	5
2	Construct the call graph for a set of seven telephone numbers 555-0011, 555-1221, 555-1333, 555-8888, 555-2222, 555-0091, and 555-1200 if there were 3 calls from 555-0011 to 555-8888 and 2 calls from 555-8888 to 555-0011, 2 calls from 555-2222 to 555-0091, 2 calls from 555-1221 to each of the other numbers, and 1 call from 555-1333 to each of 555-0011, 555-1221, and 555-1200.	1.5
3	For each of the following sequences determine whether there is a simple graph whose vertices have these degrees. Draw such a graph if it exists. a) 0, 1, 1, 2 b) 2, 2, 2, 2 c) 1, 2, 3, 4, 5	1.5
4	How many vertices and how many edges do each of the following graphs have? a) K_5 b) C_4 c) W_5 d) $K_{2,5}$	2
5	Draw these graphs. a) K_7 b) $K_{1,8}$ c) $K_{4,4}$ d) C_7 e) W_7 f) Q_4	3

6	Use an adjacency list to represent the following graph. a)  b)  c)  d)  	4
7	Draw an undirected graph represented by the given adjacency matrix: a) $\begin{bmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \\ 2 & 4 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 0 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 1 & 3 & 0 & 4 \\ 1 & 2 & 1 & 3 & 0 \\ 3 & 1 & 1 & 0 & 1 \\ 0 & 3 & 0 & 0 & 2 \\ 4 & 0 & 1 & 2 & 3 \end{bmatrix}$	3
8	Use an incidence matrix to represent the following graphs.  a)  b)  c)	3
9	Is the following graph bipartite? Justify your answer.  	1

10	Decide whether the graphs G and H are isomorphic. Prove that your answer is correct.  	1

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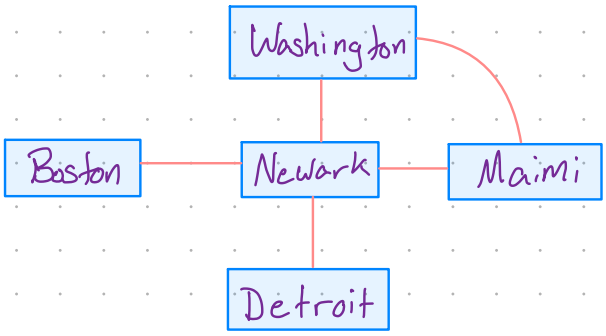
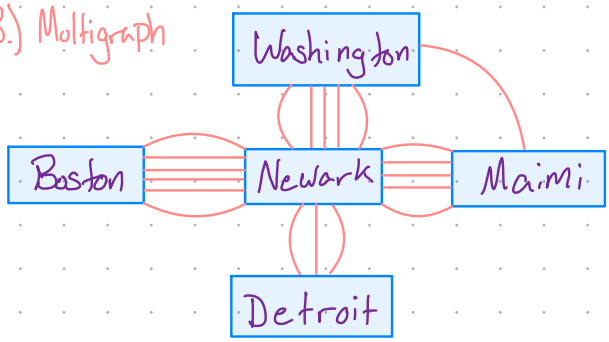
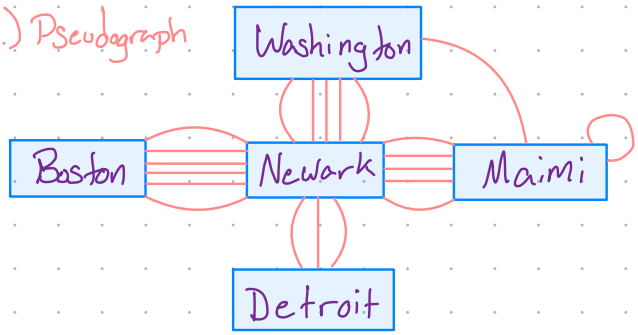
A.) Simple Graph



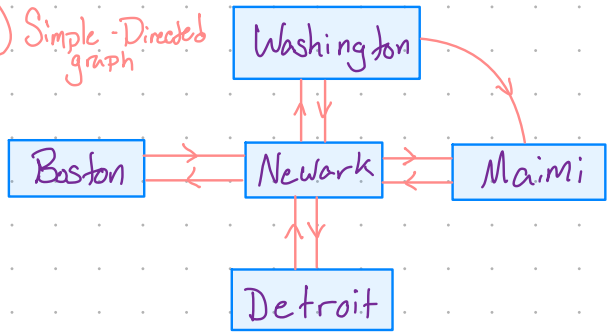
B.) Multigraph



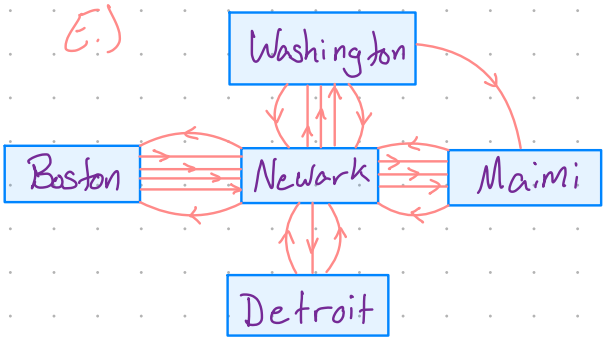
C.) Pseudograph



D.) Simple - Directed graph



E.)



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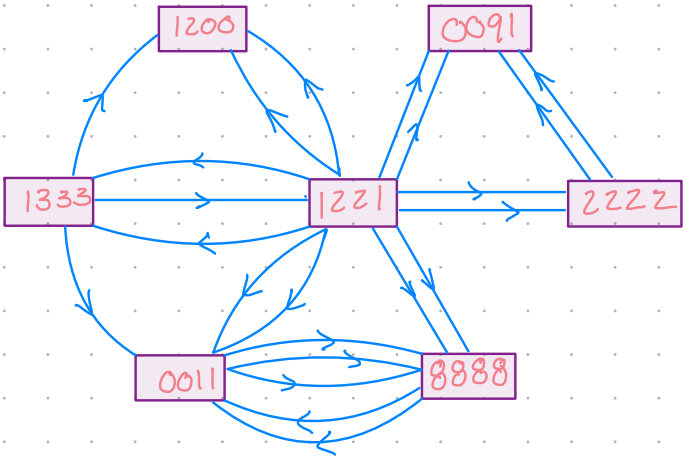

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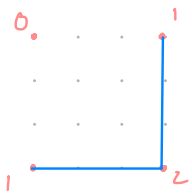
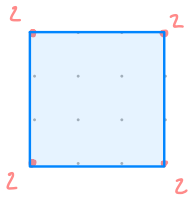
A.)



C.) DNE

B.)



4	How many vertices and how many edges do each of the following graphs have? a) K_5 b) C_4 c) W_5 d) $K_{2,5}$	2

A.) K_5 = Complete graphs

5 vertices

Edges = $n \cdot (n+1)/2 = 5 \cdot 6/2 = 15$ Edges

B.) C_4 = Circle Graph

4 vertices

4 Edges

C.) W_5 = Wheel Graph

5 Vertices

Edges = $2(n-1) = 2(5-1) = 2(4) = 8$ Edges

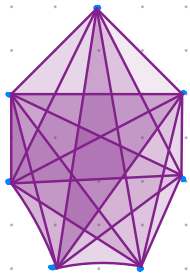
D.) $K_{2,5}$ = bipartite Graph

Vertices = $(5+2) = 7$ vertices

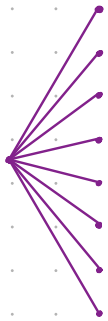
Edges = $(5 \cdot 2) = 10$ Edges

5	Draw these graphs. a) K_7 b) $K_{1,8}$ c) $K_{4,4}$ d) C_7 e) W_7 f) Q_4	3

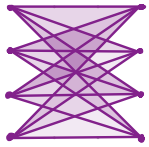
A.)



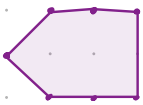
B.)



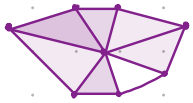
C.)



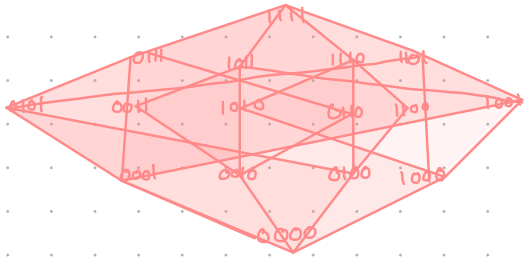
D.)

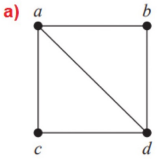
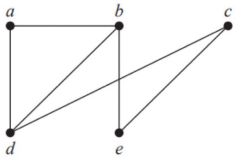
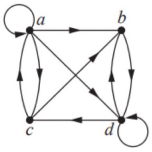
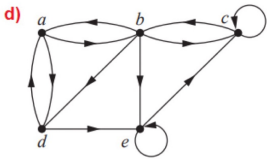


E.)



F.)



6	Use an adjacency list to represent the following graph. **a)**  **b)**  **c)**  **d)** 	4

A.)

	a	b	c	d
a	0	1	1	1
b	1	0	0	1
c	1	0	0	1
d	1	1	1	0

B.)

	a	b	c	d	e
a	0	1	0	1	0
b	1	0	0	1	1
c	0	0	0	1	1
d	1	1	1	0	0
e	0	1	1	0	0

C.)

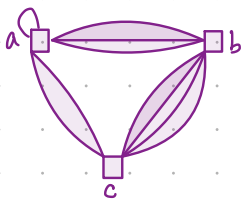
	a	b	c	d
a	1	1	1	1
b	0	0	0	1
c	1	1	0	1
d	0	1	1	1

D.)

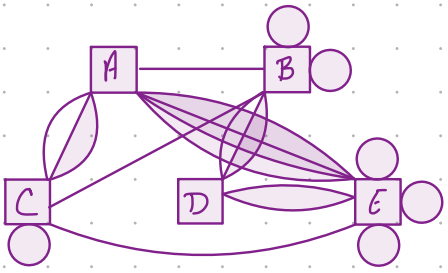
	a	b	c	d	e
a	0	1	0	1	0
b	1	0	1	1	1
c	0	1	1	0	0
d	1	0	0	0	1
e	0	0	1	0	1

7	Draw an undirected graph represented by the given adjacency matrix: **a)** 		a	b	c
---	---	---	---
a	1	3	2
b	3	0	4
c	2	4	0	 **b)** 		a	b	c	d
---	---	---	---	---
a	1	2	0	1
b	2	0	3	0
c	0	3	1	1
d	1	0	1	0 | **c)** |	a	b	c	d	e
---	---	---	---	---	---
a	0	1	3	0	4
b	1	2	1	3	0
c	3	1	1	0	1
d	0	3	0	0	2
e	4	0	1	2	3		3

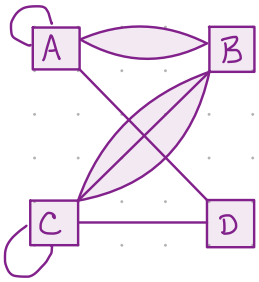
A.)

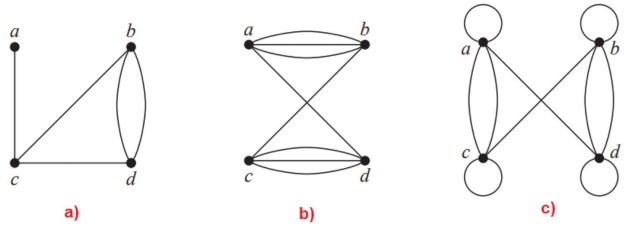


C.)



B.)



8	Use an incidence matrix to represent the following graphs.  	3

A.)

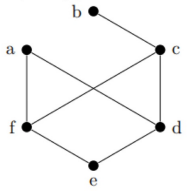
	a	b	c	d
a	0	0	1	0
b	0	0	1	2
c	1	1	0	1
d	0	2	1	0

B.)

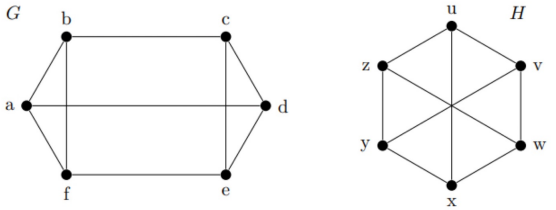
	a	b	c	d
a	0	3	0	1
b	3	0	1	0
c	0	1	0	3
d	1	0	3	0

C.)

	a	b	c	d
a	1	0	2	1
b	0	1	1	2
c	2	1	1	0
d	1	2	0	1

9	Is the following graph bipartite? Justify your answer.  	1

Yes, because a Bipartite Graphs Vertex Set Can be Partitioned into two non-empty Sets With no edges joining Vertices in Same Set

10	Decide whether the graphs G and H are isomorphic. Prove that your answer is correct.  	1

$G_1 = (V_1, E_1)$ & $G_2 = (V_2, E_2)$ Yes, they are Isomorphic

a b c d e f
↓ ↓ ↓ ↓ ↓ ↓
u v w x y z

$(a,b) = (u,v)$ $(b,c) = (v,w)$
$(a,f) = (u,z)$ $(f,e) = (z,y)$
$(c,d) = (w,x)$ $(a,d) = (u,x)$
$(d,c) = (x,y)$