Student Information

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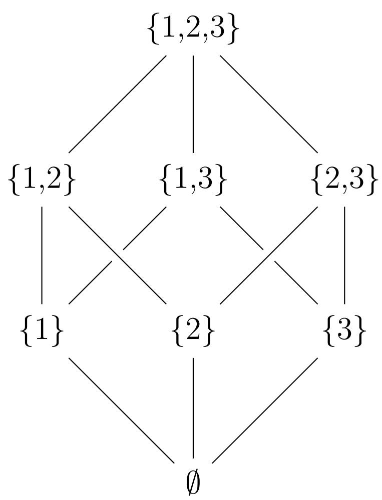
Answer 1

a)



b) Yes, it is lattice, because it is a partially ordered set, and each pair of elements has a least upper bound (LUB) and a greatest lower bound (GLB).
c) $\{\{1,2,3\}\}$
d) $\{\emptyset\}$
e) Yes, since it is unique element in the maximal elements, $\{1,2,3\}$ is the greatest element.
f) Yes, since it is unique element in the minimal elements, $\emptyset$ is the least element.
g) $\{1,3\}$

Answer 2

a)
$deg(a) = 2$, $deg(b) = 4$, $deg(c) = 2$, $deg(d) = 3$, $deg(e) = 3$
the sum is 14.
b)

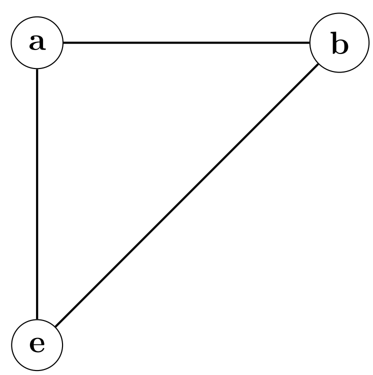
	a	b	c	d	e
a	0	1	0	0	1
b	1	0	1	1	1
c	0	1	0	1	0
d	0	1	1	0	1
e	1	1	0	1	0

The number of nonzero entries is 14.

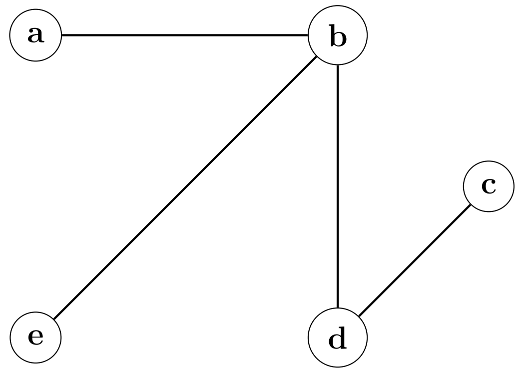
c)

	e_1	e_2	e_3	e_4	e_5	e_6	e_7
a	1	1	0	0	0	0	0
b	1	0	1	0	1	1	0
c	0	0	0	0	0	1	1
d	0	0	0	1	1	0	1
e	0	1	1	1	0	0	0

The number of nonzero entries is 14.
d) Yes, it does.



e) G is not a bipartite graph.If we remove three edges we can partition its vertex set into two disjoint sets as $V_1 = \{a, e, d\}$ and $V_2 = \{b, c\}$ such that every edge in the subgraph of G connects a vertex in V_1 and a vertex in V_2, and becomes bipartite.



f) Every edge can have 2 different directions, and makes a different graph every time a direction changes. Therefore, for 7 edges there are 2^7 possible graphs, which is 128.

g)The length of the simple longest path in G is 7. Without passing through the same edge we can go $d \longrightarrow e \longrightarrow a \longrightarrow b \longrightarrow c \longrightarrow d \longrightarrow b \longrightarrow e$
h) It is 1, because there is only one connected component of a graph G is a connected subgraph of G that is not a proper sub-graph of another connected subgraph of G.
i)No, there is not an Euler circuit in G, because there is not a circuit that contains every edge of a graph exactly once.
j)Yes, there in an Euler path in G. $d \longrightarrow e \longrightarrow a \longrightarrow b \longrightarrow c \longrightarrow d \longrightarrow b \longrightarrow e$ is the Euler path in G that contains every edge of G exactly once.
k)Yes, G has a Hamilton circuit.$a \longrightarrow b \longrightarrow c \longrightarrow d \longrightarrow e \longrightarrow a$ is the Hamilton circuit in G that passes through each vertex exactly once.
l)Yes, G has a Hamilton path. $a \longrightarrow b \longrightarrow c \longrightarrow d \longrightarrow e$ is the Hamilton path in G that passes through each vertex exactly once.

Answer 3

The graphs G and H both have 8 vertices and 16 edges. They also both have eight vertices of degree four. Because G and H agree with respect to these invariants, it is reasonable to try to find an isomorphism f . Let f be a function one to one and onto function from G to H; $f(a) = a'$,$f(b) = c'$,$f(c) = e'$,$f(d) = g'$, $f(e) = b'$,$f(f) = h'$,$f(g) = d'$,$f(h) = f'$
the adjacency matrix of G,

	a	b	c	d	e	f	g	h
a	0	1	0	1	1	1	0	0
b	1	0	1	0	1	0	1	0
c	0	1	0	1	0	0	1	1
d	1	0	1	0	0	1	0	1
e	1	1	0	0	0	1	0	1
f	1	0	0	1	1	0	1	0
g	0	1	1	0	0	1	0	1
h	0	0	1	1	1	0	1	0

and the adjacency matrix of H with the rows and columns labeled by the images of the corresponding vertices in G,

	a'	c'	e'	g'	b'	h'	d'	f'
a'	0	1	0	1	1	1	0	0
c'	1	0	1	0	1	0	1	0
e'	0	1	0	1	0	0	1	1
g'	1	0	1	0	0	1	0	1
b'	1	1	0	0	0	1	0	1
h'	1	0	0	1	1	0	1	0
d'	0	1	1	0	0	1	0	1
f'	0	0	1	1	1	0	1	0

Because AG = AH , it follows that f preserves edges. We conclude that f is an isomorphism, so G and H are isomorphic.

Answer 4

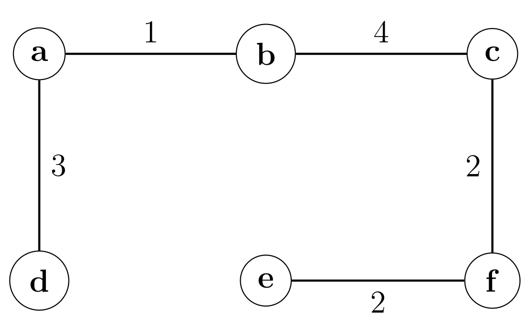
1- consider a
$a = 0,\ b = \infty,\ c = \infty,\ d = \infty,\ e = \infty,\ f = \infty,\ g = \infty,\ h = \infty,\ i = \infty,\ j = \infty,\ k = \infty$
2-consider b
$a = 0,\ b = 3(a),\ c = \infty,\ d = \infty,\ e = 5(a),\ f = \infty,\ g = \infty,\ h = 4(a),\ i = \infty,\ j = \infty,\ k = \infty$
3-consider h
$a = 0,\ b = 3(a),\ c = 5(a, b),\ d = \infty,\ e = 5(a),\ f = 10(a, b),\ g = \infty,\ h = 4(a),\ i = \infty,\ j = \infty,\ k = \infty$
4-consider c
$a = 0,\ b = 3(a),\ c = 5(a, b),\ d = \infty,\ e = 5(a),\ f = 9(a, h),\ g = \infty,\ h = 4(a),\ i = 6(a, h),\ j = \infty,\ k = \infty$
5-consider e
$a = 0,\ b = 3(a),\ c = 5(a, b),\ d = 8(a, b, c),\ e = 5(a),\ f = 7(a, b, c),\ g = 11(a, b, c),\ h = 4(a),\ i = 6(a, h),\ j = \infty,\ k = \infty$
6-consider i
$a = 0,\ b = 3(a),\ c = 5(a, b),\ d = 8(a, b, c),\ e = 5(a),\ f = 7(a, b, c),\ g = 11(a, b, c),\ h = 4(a),$

$i = 6(a, h)$, $j = \infty$, $k = \infty$
7-consider f
$a = 0$, $b = 3(a)$, $c = 5(a, b)$, $d = 8(a, b, c)$, $e = 5(a)$, $f = 7(a, b, c)$, $g = 11(a, b, c)$, $h = 4(a)$, $i = 6(a, h)$, $j = 12(a, h, e)$, $k = \infty$
8-consider d
$a = 0$, $b = 3(a)$, $c = 5(a, b)$, $d = 8(a, b, c)$, $e = 5(a)$, $f = 7(a, b, c)$, $g = 11(a, b, c)$, $h = 4(a)$, $i = 6(a, h)$, $j = 10(a, b, c, f)$, $k = \infty$
9-consider j
$a = 0$, $b = 3(a)$, $c = 5(a, b)$, $d = 8(a, b, c)$, $e = 5(a)$, $f = 7(a, b, c)$, $g = 11(a, b, c)$, $h = 4(a)$, $i = 6(a, h)$, $j = 10(a, b, c, f)$, $k = 10(a, b, c, d)$
10-consider k
$a = 0$, $b = 3(a)$, $c = 5(a, b)$, $d = 8(a, b, c)$, $e = 5(a)$, $f = 7(a, b, c)$, $g = 11(a, b, c)$, $h = 4(a)$, $i = 6(a, h)$, $j = 10(a, b, c, f)$, $k = 10(a, b, c, d)$
11-consider g
$a = 0$, $b = 3(a)$, $c = 5(a, b)$, $d = 8(a, b, c)$, $e = 5(a)$, $f = 7(a, b, c)$, $g = 11(a, b, c)$, $h = 4(a)$, $i = 6(a, h)$, $j = 10(a, b, c, f)$, $k = 10(a, b, c, d)$

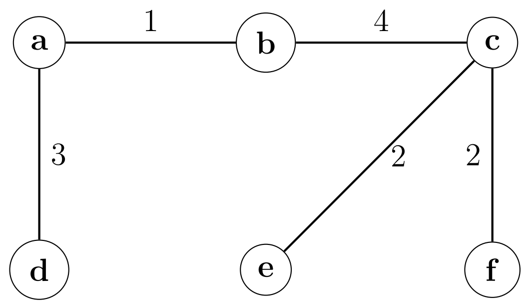
Therefore it is a, b, c, f, j with length of 10.

Answer 5

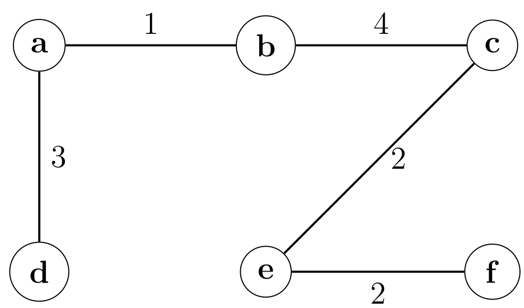
With using Kruskal's algorithm:
a) {a,b} with weight 1
{e,f} with weight 2
{c,f} with weight 2
{a,d} with weight 3
{b,c} with weight 4
b)



c) No, it is not unique, we can construct other minimum spanning trees such as:



or



Answer 6

a)the number of vertices is 13, the number of edges is 12 and the height is 4.
b)w,s,m,t,q,x,n,y,u,z,v,r,p
c)s,w,q,m,t,p,x,u,n,y,r,v,z
d)p,q,s,w,t,m,r,u,x,y,n,v,z
e)No, it is not a full binary tree, because there are nodes such as s and t which has one child.