Student Information

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Answer 1

a) (3+3+3+2+3) = 14
b)

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

Non zero entries: 14

c) It has 7 edges so we can form this matrix:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Non zero entries: 21

d) It does not contain that subgraph.
e) No, because it has cycles of odd length
f) 2^7 since any edge can have one of two possible directions.
g) The longest simple path has length 4 since it contains 5 unique vertices. $(a- > b- > c- > d- > e)$
h) This graph has one single interconnected subgraph so it has one connected component.
i) No,it has multiple vertices with odd degrees.
j) No, graph has 4 nodes that have degree 3 (odd)
k)Yes, becasue there is a cycle in G that uses every vertex once such as $b- > a- > e- > d- > c- > b$
l) If we remove a single edge from the cycle it turns into path such as $b- > a- > e- > d- > c$

Answer 2

Isomorphism between the two graphs must exist such that if an edge connects two vertices in one graph, the corresponding vertices in the other graph must also be connected by an edge. So by this definition we can see that the graphs are isomorphic because, for example , a-b in the first graph is connected in the second graph a’ and b’ are connected aswell. Since this is true for all vertices we can say they are isomorphic.

Answer 3

The algorithm to find is:
The starting node's distance is 0
Unvisited nodes' distance is infinity.
When we visit the nodes we update the distances.
Starting from s, s-u = 4, s-v = 5, s-w = 3 , we choose w as the closest node.
Finding the second closest, we check from s and from s-w, s-u = 4, s-w-u = 4, s-v = 5, s-w-v= 6, s-w-x = 11, s-w-z = 15
Now we check from s or s-w or s-u, s-u-w = 5,s-v = 5, s-w-v = 6, s-w-x = 11, s-u-v = 12 , s-u-y = 15, s-w-z = 15
Now we check from s,s-u,s-v,s-w, s-v-x = 7, s-v-y = 11, s-w-x = 11, s-w-z = 15, s-u-y = 15,
Now,s-v-x-y = 8, s-v-y = 11, s-v-x-z = 13, s-w-z = 15, s-u-y = 15
Then, s-v-x-y-z = 12, s-v-x-z = 13, s-w-z = 15, s-v-x-y-t = 17
Lastly, s-v-x-y-z-t = 15, s-v-x-y-t = 17
So shortest path length is 15 : $s- > v- > x- > y- > z- > t$

Answer 4

I will use Prim's algorithm. Firstly we choose a random vertex, say a. Then we will choose and add the closest vertex to our tree until the tree spans the whole graph.

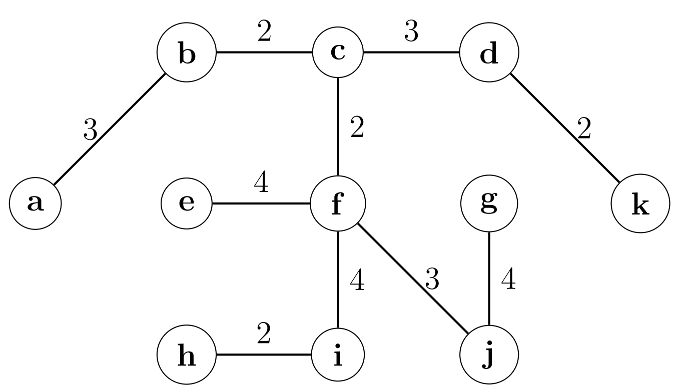

Figure 1: Minimum spanning tree of graph G

a)The the order in which the edges are added to the tree:
1) a-b
2) b-c
3) c-f
4) c-d
5) d-k
6) f-j
7) f-i
8) i-h
9) f-e
10) j-g

b) Given above

c) The minimum spanning tree is not unique since the algorithm includes arbitrary choices