5.20.

Each state from 1 to n is in its own set and when 2 equivalent sets are found, a union of both is taken. x(p, a) is the value stored at (p, a) in the table

The Algorithms is as proposed:

Union – Find Data Structure

Set = null

for i = 1 to N:

for j = i to N:

if isequivalent(i,j) == true

Set = Union(i, j);

isequivalent(i, j) is a recursive function

Recursive – isequivalent(i,j)

Note – a takes value in the set [0, 1]

isequivalent(int i, int j)

If i is accepting and j is not accepting

Return false

If i is not accepting and j is accepting

Return false

If i is j or (i is accepting and j is accepting) or (j is not accepting and i is not accepting)

Return true

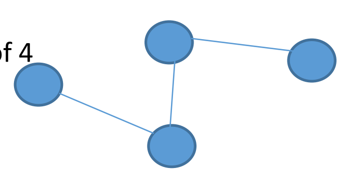
Else

isequivalent(x(i, a), x(j,a)) ← check if true for all a lying in the set a bounded by {0, 1} and lying in the table

2)

Sum of all degrees of each vertice = 2m

4 vertices and 3 edges for total degree of 4



Vertice	Degree
1	1

2	1
3	1
4	1

For all node pairs, which in this case can be represented as node i and node i+1 , an edge between the two nodes accounts for a part of the magnitude of degree (magnitude 1) at each node. In more simple words, and edge between to vertices accounts for a portion of the degree at both vertices thus, it is counted twice which is why the sum of all degrees in a graph is twice the number of edges.

3)

The number of in-degrees equals the number of out degrees because at any 2 vertices, any edge defining the directional relationship between 2 vertices is observes as both the in degree to a node as well as the out degree from the source node. Thus , for any two vertices present within a graph with an edge between each vertice, if node i has a directional relationship to node j, node i holds an out degree of magnitude 1 with respect to node j and consequently, node j holds an in degree of magnitude 1 with respect to node i. Therefore, each edge defines a relationship between any two nodes and carries the following information:

Node(I -1) – out degree of 1

Node(i) – in degree of 1

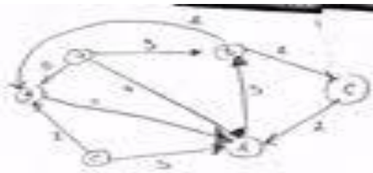
Or vice versa and

$\sum_{c=1}^{Vertices}(in_c - out_{c)} = 0$

By the above, argument, the magnitude of the in degree and out degree will always be equal.

4)

5.1)



	a	b	c	d	e	F
a	0	3	0	4	0	5
b	0	0	1	0	0	1
c	0	0	0	2	0	0
d	0	5	0	0	0	0
e	0	0	0	3	0	2
F	0	0	0	2	0	0