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Written Problems

<u>Question 1</u>

```
set equivset1, equivset2
procedure equiv_states(state, n)
begin
	if size(equivset1) + size(equivset2) <= n then,
		stage_0 = transitions[state, 0]
		stage_1 = transitions[state, 1]

		if stage_0 is even then,
			if stage_0 == stage_1 then,
				add stage_0 && stage_1 into set equivset1
			else if stage_1 is even then,
				add stage_0 && stage_1 into set equivset1
			else
				add stage_0 into set equivset1
				add stage_1 into set equivset2
		else
			if stage_0 == stage_1 then,
				add stage_0 && stage_1 into set equivset2
			else if stage_1 is odd then,
				add stage_0 && stage_1 into set equivset2
			else
				add stage_0 into set equivset2
				add stage_1 into set equivset2

		equiv_states(stage_0, n)
		equiv_states(stage_1, n)
end
```

Question 2

For any undirected graph, each of the edge represent the connection between two vertices in both directions, in other words, each edge is bidirectional. Thus when we add all the edges from each node, there will be an overlap between it's connected nodes. Thus the edges are repeated twice. This leads to the overall sum of degrees of edge for any given undirected graph is twice the total number of edges in the graph. Therefore the following statement holds true

$$SUM[1..n](d_i) = 2m$$

where m is the number of edges in the graph,
n represents the total number of vertices and,
d_i represents the degree of edge for the given node.

Question 3

The in-degrees of any directed graph is going to be equal to the out-degree of the same graph. This is because of the fact that for every edge is given a specific direction. When it goes out of one vertex, it always has to go to another vertex. This means that for every outgoing edge there is a corresponding incoming edge for that specific edge. Therefore, when we calculated the total number of outgoing edges from all the vertices of a graph, it will be equal to the sum of incoming edges of all the vertices of the same graph.

Question 4

a) Adjacency matrix with arc cost

	A	B	C	D	E	F
A	∞	∞	∞	∞	∞	∞
B	3	∞	∞	3	∞	∞
C	∞	1	∞	∞	∞	∞
D	4	∞	2	∞	3	2
E	∞	∞	∞	∞	∞	∞
F	5	1	∞	∞	2	∞

b) Adjacency List

A	->	B 3	->	D 4	->	F 5
B	->	C 1	->	F 1		
C	->	D 2				

$\boxed{D}$ -> $\boxed{B \mid 3}$

$\boxed{E}$ -> $\boxed{D \mid 3}$ -> $\boxed{F \mid 2}$

$\boxed{F}$ -> $\boxed{D \mid 1}$