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**CS435**

*Prof. Emdad Khan*

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*Lab#10*

***Group 1***

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1. Problem 1
2. U = {A, B}:
3. W = {A, C, G, F}:
4. Y = {A, B, D, E}:
5. The subset X = {A, B, F} satisfies the conditions: X ⊆ V and H = G{X}.
6. The following two sets (R & S) of vertices satisfy the described conditions:

R = G[V1] = {D, E, I}, and

S = G[V2] = {A, B, F, C, G, H}.

1. Problem 2

The implementation is in the submitted folder.

1. Please check Graph.java → pathExists method.
2. Please check NumComponents.java.
3. Please check HasCycle.java.
4. Problem 3
5. The graph G contains *n* vertices and *m = n – 1* edges. It contains subsets *V1… Vk* with *n1…nk* vertices and *m1… mk* edges, where:

But since G is connected and simple (given), then we have a missing number of edges, let it be .

Also, since G is connected, then *k – 1* edges must connect *k* vertices. Each of which must belong to a different subgraph. That is, edge (i) must connect vertex from Vi to a vertex from Vi+1.

1. Consider the graph below:

It is connected, and it contains ε = 3 edges and ν = 4 vertices.

Therefore,

So, the mentioned inequality does not hold for all connected graphs.

Alternatively, it should be stated that if the mentioned inequality holds, then the checked graph is CERTAINLY connected, but not the other way around.

1. A graph with two vertices needs minimum of 1 edge to be connected.

A graph with three vertices needs minimum of 2 edge to be connected.

A graph with *n* vertices needs minimum of *n – 1* edge to be connected.

1. It is proven that if a graph G is a connected tree, then . If then it has at least one cycle.

If G is not connected, then it contains *G1, G2,… Gk* components with *m1, m2,… mk* edges and *n1, n2,… nk* vertices. If any component Gi has edges, then it contains a cycle. Consequently, graph G contains a cycle.

1. Problem 5

Let tree S have number of vertices and edges

Let tree T have number of vertices and edges

Let their union with edge (x, y) be U with number of vertices and edges

To calculate :

⸫ U is a tree.

1. Problem 6

The implementation is in the submitted folder. Please check ShortPathLength.java.

1. False.

A disconnected graph *can* be dense. Proof:

A disconnected graph G could have components g1, g2,… , gk.

Since it is possible that all components are complete graphs, then their total number of edges is: