Computer Networks Homework 1

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Define the geodesic (short path) distance between two nodes as the minimum number of hops from one node to the other. Define the diameter of a network as the maximum geodesic distance among all the pairs of two nodes. Define the degree of a node as the number of links connected to that node.

1. If the diameter of a network with 100 nodes is 1, what is the minimum number of links in this network?

A: because the diameter is 1, which means that all nodes are directly connected to each other. As a result, we have $\frac{100\times99}{2}$ = 4950 number of links.

2. If the diameter of a network with 100 nodes is 2, what is the minimum number of links in this network?

A: Put one node to the center and all the other node connect to it. In this way, the diameter between the nodes except the center one is 2. Then we only have 100-1 = 99 number of links

3. For a network of 100 nodes, if the degree of every node is at most 2, what is the minimum diameter of that network?

A: We can make every nodes to connect like a circle, and the minimum diameter may be 100/2 = 50.

4. For a network of 100 nodes, if the degree of every node is at most 3, is it possible that the diameter of this network is not greater than 5?

A: If we let every node except the center one connect to the other two nodes, then we will have 1 + 3 + 3×2 + 3×2^2 + 3×2^3 + 3×2^4 = 1 + 3 + 6 + 12 + 24 + 48 = 94 <100 if we expand to the next root, the diameter will be 6, but in the restriction of diameter not greater than 5, we can only have 94 nodes. As a result, it is impossible for us to have this network's diameter not greater than 5.