Solution 3-10

Ex 3.10: Cat bridges [4]

Consider a network, where all the links are directed and can only be walked in the respective direction (i.e. they are one-way roads). Suppose that the network is at least weakly connected. Under what conditions does an eulerian circuit exist?

Solution

If a node has an out-degree that is smaller than its in-degree, we will eventually get stuck there. If a node has an out-degree that is greater than its in-degree some other node must have an out-degree that is smaller than its in-degree (in every network, the sum over all in-degrees equals the sum over all out degrees), so we will get stuck in that other node. Hence an eulerian circuit exists only if for each node the in-degree is identical to the out-degree. (It's that simple)

(This question becomes much more difficult if a network has both directed and bidirectional links.)