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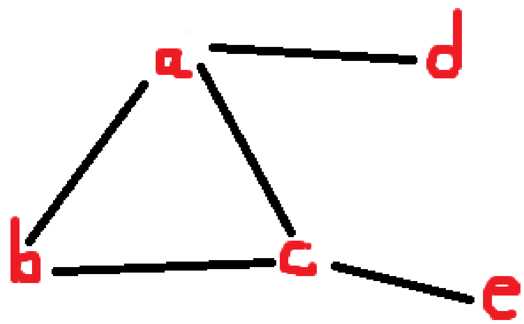
Graph Theory
Homework 2
Exercise 0.5 (a)

0.5 (a):
Let G be a connected graph. We say that G is minimally connected if the removal of any edge of G (without deleting any vertices) results in a disconnected graph.
Show that a connected, minimally connected graph has no cycles.

To form a cycle a graph needs to have at least 3 vertices of degree 2 or greater. This means that there are always at least 2 ways of getting to a given vertex within a cycle. If we remove one of those ways by removing one of the edges, the graph will still be connected on the "other side".
Consider this graph:



Even though removing edges a-d or c-e would result in a disconnected graph, removing a-b, b-c, or c-a (the edges forming the cycle) would never result in a disconnected graph.
This contradicts the statement that the removal of *any* of the edges of the graph results in a disconnected graph.
Hence a minimally connected graph cannot have any cycles.