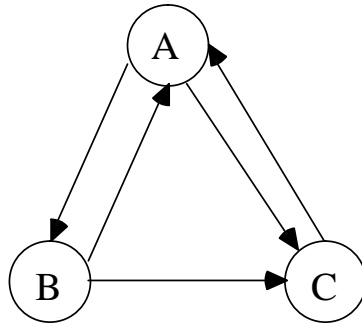


CSE 5311: Homework 3

1. It is easy to test in polynomial time if the sum of the lengths for a set of line segments \leq a given value k . This problem may be generalized to two dimensions to give an NP-complete problem. In the generalized problem, the set of line segments is replaced by a set of rectangles (with dimensions in x and y). We would like to test if the rectangles will fit (without overlap, but they may touch) within another given rectangle, but the given rectangles must remain oriented to the x and y axes, i.e. do not rotate them. Prove that this problem is NP-complete by a simple reduction.
2. In many cases, transivities may be removed from a directed graph. Instead of allowing you to remove the transivities you please until none remain, you are required to strategically remove as many as possible for that graph, i.e. removing a transitive edge may make other previously transitive edges non-transitive. As an example, consider:



If I remove edge (B,C) , no more transivities remain, but I could also remove both (B,A) and (A,C) to leave no transivities.

Prove: Testing if there are k edges that may be removed from a directed graph while still preserving all directed paths from the original graph is NP-complete.

Hint: Use an extraordinarily simple reduction from Directed Hamiltonian Circuit. You may assume that the DHC graph has a directed path between each pair of vertices.

3. 36-1
4. 37.2-1
5. 37.2-2
6. 37.2-4
7. 37.3-1
8. 37.3-2