

CSE 6331 – Algorithms – Spring, 2015 – Prof. Supowit

Homework 4 – Due: Wednesday, February 11

1. Let  $G$  be an undirected graph on  $n$  vertices, and let  $k$  be the number of components of  $G$ . If we add one edge to  $G$ , how many components might it have?
2. Let  $G$  be an digraph on  $n$  vertices, and let  $k$  be the number of strongly connected components (SCC's) of  $G$ . If we add one edge to  $G$ , how many SCC's might it have?
3. Recall that in our algorithm for finding the SCC's in a given digraph, the second depth-first search uses the transpose graph and processes the vertices in order of decreasing finishing time.  
Consider the following modification to this algorithm: rather than use the transpose graph in the second DFS, use the original graph and process the vertices in order of increasing finishing times. Will this alternative algorithm always give the correct answer? Prove your answer.
4. Assume that there is an algorithm that multiplies two 5-by-5 matrices with 88 scalar multiplications and 1000 additions. Consider a recursive algorithm  $A$  that extends this method to multiply two  $n$ -by- $n$  matrices for all  $n$ 's that are powers of 5.

Which is asymptotically faster, Algorithm  $A$  or Strassen's Algorithm? Justify your answer.