Name: _____

1. Time allowed: It is estimated that this portion of the exam will take no more than three hours to complete.
2. Submit your solutions as a portable document format (PDF) to Canvas before 14:00 8 November 2018.
3. In addition to this take home portion there will be a in-class portion of the exam on Canvas and a problems in a printed document.
4. Complete all sections, all questions. Do not leave any question unanswered.

Question:	I	II	III	IV	Total
Points:	15	25	35	25	100
Score:					

I. Give an $O(|V| + |E|)$-time algorithm to remove all the cycles in a directed graph $G = (V, E)$. Removing a cycle means removing an edge of the cycle. If there are k cycles in G, the algorithm should only remove $O(k)$ edges. You should try to make your algorithms as efficient as possible.

(1) (5 points) Provide a clear description of the algorithm (an English description or pseudo-code is fine)

(2) (5 points) Perform asymptotic analysis of your algorithms running time. Consider a best case, worst case, and average case input model scenario.

(3) (5 points) Provide a proof that your algorithm works correctly.

II. Chapter 5, Problem 4

(1) (10 points) Provide a clear description of the algorithm (an English description or pseudo-code is fine)

(2) (10 points) Perform asymptotic analysis of your algorithms running time. Consider a best case, worst case, and average case input model scenario.

(3) (5 points) Provide a proof that your algorithm works correctly.

III. Chapter 6, Problem 9

(1) (10 points) part a

(2) part b

i. (10 points) Provide a clear description of the algorithm (an English description or pseudo-code is fine)

ii. (10 points) Perform asymptotic analysis of your algorithms running time. Consider a best case, worst case, and average case input model scenario.

iii. (5 points) Provide a proof that your algorithm works correctly.

IV. Chapter 6, Problem 12

(1) (10 points) Provide a clear description of the algorithm (an English description or pseudo-code is fine)

(2) (10 points) Perform asymptotic analysis of your algorithms running time. Consider a best case, worst case, and average case input model scenario.

(3) (5 points) Provide a proof that your algorithm works correctly.