Data Structures and Algorithms
Homework Assignment 8

Given: March 19, 2018

Due: March 26, 2018
No Late Days Allowed

Note: The homework is due **electronically on Gradescope and Canvas** on Monday, March 26 by 11:59 pm EST. **You may NOT use any late days on this homework**, as solutions will be released on Tuesday so you can use them to study for Midterm 2.

- **A**. **Gradescope**: You must select the appropriate pages on Gradescope. Gradescope makes this easy for you: before you submit, it asks you to associate pages with the homework questions. Failing to do so will get you points off, which cannot be argued against after the fact. Gradescope may prompt you with a warning to select your cover page, please ignore this warning.

- **B**. **LATEX**: You must use the `hw121.cls` Latex template provided on the course website, or a harsh penalty will be incurred. Handwritten solutions or solutions not typeset in Latex will not be accepted.

- **C**. **Solutions**: Please write concise and clear solutions; you will get only a partial credit for correct solutions that are either unnecessarily long or not clear. Please refer to the Written Homework Guidelines for all the requirements.

- **D**. **Algorithms**: Whenever you present an algorithm, your answer must include 3 separate sections:

    1. A precise description of your algorithm in English. No pseudocode, no code.
    2. Proof of correctness of your algorithm.
    3. Analysis of the running time complexity of your algorithm.

- **E**. **Collaboration**: You are allowed to discuss **ideas** for solving homework problems in groups of up to 3 people but *you must write your solutions independently*. Also, you must write on your homework the names of the people with whom you discussed. For a clarification on the collaboration policy, please see Piazza @547.

- **F**. **Outside Resources**: Finally, you are not allowed to use *any* material outside of the class notes and the textbook. Any violation of this policy may seriously affect your grade in the class. If you're unsure if something violates our policy, please ask.

1. [10pts - Nugget-Fry Headquarters]   After her wild monetary success creating/selling nugget-fry art, Jess has accrued enough money to create her own city devoted to McDonald's.

In this city, there are n buildings and one-way roads connecting some pairs of buildings. All roads are one-way, however, a pair of buildings A and B may have two one-way roads between them, one going from A to B and the other going from B to A. Let us denote the total number of such one-way roads as m.

Jess wants to turn one of these buildings into the Nugget-Fry Headquarters, however, wants to ensure that she can reach all the other buildings in the city from these headquarters – can you return Jess a set of possible buildings that could be the Nugget-Fry Headquarters in $O(m + n)$ time?