Interview Questions: Reductions

The **hard deadline** for this homework is **Wed 12 Jun 2013 8:59 PM PDT (UTC -0700)**.

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Question 1

Longest path and longest cycle. Consider the following two problems

- *LongestPath*: Given an undirected graph G and two distinct vertices s and t, find a simple path (no repeated vertices) between s and t with the most edges.
- *LongestCycle*: Given an undirected graph G', find a simple cycle (no repeated vertices or edges except the first and last vertex) with the most edges.

Show that *LongestPath* linear-time reduces to *LongestCycle*.

Question 2

3Sum and 4Sum. Consider the following two problems:

- *3Sum*: Given an integer array a, are there three distinct indices i, j, and k such that $a_i + a_j + a_k = 0$?
- *4Sum*: Given an integer array b, are there four distinct integers i, j, k, and ℓ such that $b_i + b_j + b_k + b_\ell = 0$?

Show that *3Sum* linear-time reduces to *4Sum*.

Question 3

3Sum and 3Linear. Consider the following two problems:

- *3Linear*: Given an integer array a, are there three indices (not necessarily distinct)i, j, and k such that $a_i + a_j = 8 \, a_k$?
- *3Sum*: Given an integer array b, are there three indices (not necessarily distinct) i, j, and k such that $b_i + b_j + b_k = 0$?

Show that *3Linear* linear-time reduces to *3Sum*.

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