✓ **Congratulations! You passed!**

TO PASS 1% or higher

[Keep Learning]

GRADE
100%

Interview Questions: Reductions (ungraded)

TOTAL POINTS 3

1. **Longest path and longest cycle.** Consider the following two problems

   1 / 1 point

   - *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*.

   > Longest Path:
   > Longest Cycle:

   ✓ Correct

   Hint: add a new path (with new vertices) between s and t.

2. **3Sum and 4Sum.** Consider the following two problems:

   1 / 1 point

   - *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*.

   > three sum problem and 4 sum problem

   ✓ Correct

   Hint: define $M = 1 + \max_i |a_i|$. To solve an instance of *3Sum* with N integers, form an instance of *4Sum* with $N + 1$ integers containing only one negative value ($-3M$).

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

   1 / 1 point

   - *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*.

   > 3 linear and 3 sum problem

   ✓ Correct

   Hint: define $M = 1 + \max_i |a_i|$. To solve an instance of *3Linear* with n integers, form an instance of *3Sum* with $2n$ integers.