

# Solutions for Chapter 34

Zhixiang Zhu  
zzxiang21cn@hotmail.com

May 10, 2015

## Solution to Exercise 34.1-1

The ‘if’ part: If  $\text{LONGEST-PATH} \in \text{P}$ , we can call  $\text{LONGEST-PATH}$  with  $k = |E|, |E| - 1, \dots, 0$  until  $\text{LONGEST-PATH}$  returns 1 or  $k = 0$  to get the length of a longest simple path between  $u, v$ . There’re at most  $|E|$  such calls, so  $\text{LONGEST-PATH-LENGTH} \in \text{P}$ .

The ‘only if’ part: If  $\text{LONGEST-PATH-LENGTH} \in \text{P}$ , we can call  $\text{LONGEST-PATH-LENGTH}$  in  $\text{LONGEST-PATH}$  to compare the length of a longest simple path with  $k$  to decide whether to return 0 or 1. So  $\text{LONGEST-PATH} \in \text{P}$ .

## Solution to Exercise 34.1-2

The optimization problem is defined as the relation that associates each instance of an undirected graph with a longest simple cycle in the graph. A related decision problem is defined as  $\text{LONGEST-SIMPLE-CYCLE-LENGTH} = \{ \langle G, k \rangle : G = (V, E) \text{ is an undirected graph, } k \geq 0 \text{ is an integer, and there exists a simple cycle in } G \text{ consisting of at least } k \text{ edges} \}$ .