

Exercise 1

Prove that the following problems are in NL:

- (1) *Given an undirected graph G , does G contain at most 2010 strongly connected components?*
- (2) *Given an undirected graph G , does G contain at least 2010 strongly connected components?*
- (3) *Given an undirected graph G , does G contain exactly 2010 strongly connected components?*

Exercise 2

Given an undirected graph with n vertices recall that

$$\text{diam}(G) = \max_{u,v \in V(G)} \{d(u,v)\}.$$

Is the problem of deciding whether the diameter of G is at most $\frac{n}{4}$ in NPC or in NL? Prove your answer.

Exercise 3

Let L be a language of all graphs on n vertices with diameter $\log(n)$. Prove that $L \in \text{Space}(\log(n) \cdot \log(\log(n)))$.

GOOD LUCK