

## Exercise 4

1. Let  $L_1 = \{\langle M, w, 1^t \rangle \mid M \text{ is a deterministic TM and } M \text{ accepts } w \text{ in at most } t \text{ steps}\}$ . (Note, in this problem  $t$  is encoded in unary.) Show that  $L_1 \in \mathbf{P}$ .
2. Let  $G = (V, E)$  be a graph, with  $|V| = n$  vertices and  $|E| = m$  edges. A *vertex cover* of  $G$  is a set of vertices  $S \subseteq V$  such that every edge in  $E$  has at least one endpoint in  $S$ . Let

$$L_2 = \{\langle G, s, t \rangle \mid G \text{ has a vertex cover of size } s \text{ and a clique of size } t\}.$$

Show that  $L_2 \in \mathbf{NP}$ .