Quiz 14A: The class P

CS 212 Nature of Computation

Habib University — Fall 2023

Total Marks: 10

Duration: 15 minutes

Date: November 22, 2023

Time: 830–845h

Student ID: _____

Student Name: _____

1. (10 points) Show that the class P is closed under union.

> **Solution:** We prove the closure by constructing a polynomial time decider for the union of two languages in P.
>
> *Proof.* Consider the languages $L_1, L_2 \in P$ and let R and S be their polynomial time deciders. Construct T to decide $L_1 \cup L_2$ as follows.
> On input w:
>
>   1. Simulate R on w.
>
>   2. If R accepts, *accept*.
>
>   3. If R rejects,
>
>   (a) Simulate S on w.
>   (b) If S accepts, *accept*; if S rejects, *reject*.
>
> Step 1 runs in polynomial time, Step 2 in constant time, and Step 3 altogether in polynomial time. Thus the total time taken is polynomial. □