Northern Michigan University (Marquette Co, MI)
CS 522-01-25W: Principles Of Programming Languages

Assignment 6
Due: Wednesday 23 May 2025 11:00 A.M. EDT

Create a directory called “HW6” at the top level of your CS522-01-25W folder on PHILOS. You should solve this problem in either a text file (.txt) or an MS Word file (.docx). Place this file inside your HW6 folder along with an empty file or folder named DONE .

1. Prove that NP and co-NP are both contained in Δ_2^p.

2. Prove that Σ_k^p and Π_k^p are both contained in Δ_{k+1}^p.

3. Prove that NP is contained within PSPACE. In other words, suppose a problem is in NP. This means there is one thread through the NTM that can solve the problem in polynomial time. Show that a regular TM can emulate that NTM using polynomial space EVEN THOUGH you probably can't do it in polynomial time?

4. Show that any problem in Σ_1^p can be solved in polynomial time by an ATM starting in an existential state and switching between existential and universal states no more than once.