1. [10 points] Let \((\mathbb{N}, <)\) be the model with universe \(\mathbb{N}\) (natural numbers) and the "less than" relation. Prove that \(\text{Th}(\mathbb{N}, <)\) is decidable.

2. [10 points] Prove that the following languages are undecidable (hint: Use Rice’s theorem).
   - \(\text{EMPTY}_{TM} = \{\langle M \rangle \mid M \text{ is a TM and } L(M) = \emptyset\}\).
   - \(\text{ALL}_{TM} = \{\langle M \rangle \mid M \text{ is a TM and } L(M) = \Sigma^*\}\).

3. [10 points] Describe two different Turing Machines, \(M\), and \(N\), that, when started on any input, \(M\) outputs \(\langle N \rangle\), and \(N\) outputs \(\langle M \rangle\).

4. [10 points] Show that the set of incompressible stings is undecidable.