

Chapter 5.3 Practice

Use Rice's Theorem, if possible, to prove that the following languages are undecidable.

1. $L_1 = \{ \langle M \rangle \mid M \text{ is a TM and accepts some input} \}$
2. $L_2 = \{ \langle M \rangle \mid M \text{ is a TM and accepts all even numbers} \}$
3. $L_3 = \{ \langle M \rangle \mid M \text{ is a TM and accepts at least two strings of different lengths} \}$
4. $L_4 = \{ \langle M \rangle \mid M \text{ is a TM and accepts when given } \langle M \rangle \text{ as an input} \}$
5. $L_5 = \{ \langle M \rangle \mid \text{whenever } M \text{ is given two positive integers as input on its input tape it halts with their sum on its work tape} \}$
6. $L_1 = \{ \langle M \rangle \mid M \text{ is a TM and accepts the string } 001 \}$