Chapter 5.1 Practice Key

Using the modified TM concept of showing $A_{TM} \leq E_{TM}$ of:

- TM M_w: ”on input x:
    1. If x ≠ w, reject
    2. If x = w, run M on w:
        1. Accept if M accepts w.
        2. Reject if M rejects w.”

Use the approach above to show that the following languages are undecidable.

1. $L_1 = \{< M > | M \text{ is a TM and } 01 \in L(M)\}$

    TM M_1: “on input $x \in \{0,1\}^*$:

    a. If $x \neq 01$, reject x.
    b. Else, run M on w:
        i. Accept if M accepts w.
        ii. Reject if M rejects w.”

2. $L_2 = \{< M > | M \text{ is a TM and } 01 \cup 10\ L(M)\}$

    TM M_1: “on input $x \in \{0,1\}^*$:

    a. If $x \neq 01$ or $x \neq 10$, reject x.
    b. Else, run M on w:
        i. Accept if M accepts w.
        ii. Reject if M rejects w.”

3. $L_3 = \{< M > | M$ is a TM and $(10)^* L(M)\}$

TM M_1: "on input $x \in \{0,1\}^*$:

a. If $x \neq (10)^*$, reject x.
b. Else, run M on w:
    i. Accept if M accepts w.
    ii. Reject if M rejects w."