Solution of HW5

4.3

Let ALL_{DFA} = {<A>|A is a DFA that recognizes ∑*}. The following TM L decides ALL_{DFA}.

L = "On input <A> where A is a DFA:

1. Construct DFA B that recognizes $\overline{L(A)}$ as described in Exercise 1.14.
2. Run TM T from Theorem 4.4 on input <B>, where T decides E_{DFA}.
3. If T accepts, *accept*. If T rejects, *reject*."

4.15

The following TM X decides A.

X = "On input <R> where R is a regular expression:

1. Construct DFA E that accepts ∑*aaa∑*.
2. Construct DFA b such that L(B) = L(R)∩ L(E).
3. Run TM T from Theorem 4.4 on input <B>, where T decides E_{DFA}.
4. If T accepts, *reject*. If T rejects, *accept*."

4.19

For any language A, let A^R= {w^R |w□ A}. Observe that if <M>□S then L(M) = $L(M)^R$.

The following TM T decides S.

T = "On input <M>, where M is a DFA:

1. Construct DFA N that recognizes $L(M)^R$ using the construction from Problem 1.31.
2. Run TM F from Theorem 4.5 on <M, N>, where F is the Turing machine deciding EQ_{DFA}.
3. If F accepts, *accept*. If F rejects, *reject*."