MA565: Homework 4

Exercise 4.1. [6pts] Consider a TM M defined by

- $Q = \{q_0, q_1\}$;
- $\Sigma = \{0, 1\}$;
- q_0 is the initial state;
- q_1 is the final state;
- transition function is given by
  - $(q_0, 0) \ \to \ (q_0, 0, L)$
  - $(q_0, 1) \ \to \ (q_0, 1, R)$
  - $(q_0, \sqcup) \ \to \ (q_1, 0, L)$

(1) Is it deterministic?
(2) Does it halt on ε, '000', '001', '111', '101'?
(3) Describe the set of bit-strings on which the machine halts.

Exercise 4.2. [4pts] Consider a TM defined by

- $Q = \{q_0, q_1, q_2, q_3\}$;
- $\Sigma = \{0, 1\}$;
- q_0 is the initial state;
- q_3 is the final state;
- transition function is given by
  - $(q_0, 0) \ \to \ (q_1, 0, R)$
  - $(q_0, 1) \ \to \ (q_1, 1, R)$
  - $(q_0, \sqcup) \ \to \ (q_3, 1, R)$
  - $(q_1, 0) \ \to \ (q_2, 0, R)$
  - $(q_1, 1) \ \to \ (q_2, 1, R)$
  - $(q_1, \sqcup) \ \to \ (q_3, 0, R)$
  - $(q_2, 0) \ \to \ (q_0, 0, R)$
  - $(q_2, 1) \ \to \ (q_0, 1, R)$
  - $(q_2, \sqcup) \ \to \ (q_3, 0, R)$

(1) Describe the set of bit-strings on which the machine halts.
(2) How can we interpret the output of M on a given bit-string w? What does M compute?