THEORY OF COMPUTATION - HOMEWORK 4

Assigned 2019.12.03. Submission deadline 2020.01.07 (for only those who want their homework to be marked).

Problems

1. Consider the following (non-context-free) language

$$L = \{\alpha^n \beta^n \gamma^n \mid n = 0, 1, 2, \ldots\}.$$

Design a Turing machine **M** to accept/recognize L.

2. For the Turing machine **M** you designed in Problem 1, specify its 7 components Q, Σ, Γ, δ, q_0, q_a, q_r. Is the language L is Problem 1 Turing-decidable?

3. Let the alphabet be $\Sigma = \{0, 1\}$ and consider the following Turing machine **M** described in words as follows:

M = "On an input string $s \in \Sigma^*$:

(i) Scan the tape and mark the first 0 which has not been marked. If no unmarked 0 is found, go to step (iii). Otherwise, move the tape head back to the leftmost of the tape.

(ii) Scan the tape and mark the first 1 which has not been marked. If no unmarked 1 is found, *reject* s. Otherwise, move the tape head back to the leftmost of the tape, and go back to step (i).

(iii) Move the tape head back to the leftmost of the tape. Scan the tape to check if there is any more unmarked 1 left. If there is no more unmarked 1, *accept* s; otherwise, *reject* s."

What is the language L that this Turing machine accepts/recognizes?
