CENG213 Assignment 2

14.12.2023

Due Date: 28.12.2023

1) (20 points) Construct a Turing machine that copies the first four nonblank symbols over the next four nonblank symbols, in reverse order.

   Example: ⊔ a b ⊔ c ⊔ d ⊔ e f ⊔ g h k ⊔ → ⊔ a b ⊔ c ⊔ d ⊔ d c ⊔ b a k ⊔

2) (20 points) Construct a standard Turing machine to decide the language **(aa)*c(bb)***

3) (20 points) Let G be the grammar (W, Σ, R, S), where

   W = {S, A, N, V, P} ∪ Σ,

   Σ = {elephant, big, mouse, small, chased},

   R = {P → N,

   P → AP,

   S → PVP,

   A → small,

   A → big,

   N → elephant,

   N → mouse,

   V → chased}.

   Draw a parse tree for the following example string: “big mouse chased small elephant”.
   Is this grammar ambiguous? Explain your reasoning.

4) (20 points) Construct a pushdown automaton for the following language:
   $\{a^i b^j c^k \mid i, j, k \geq 0, i + k = j\}$

5) (20 points) Construct a pushdown automaton for the following language:
   $\{a^i b^j c^k d^m \mid i, j, k, m \geq 0, i = k \text{ or } j = m\}$